Geweniger · Bohlander

Pilates – A Teachers' Manual

Exercises with Mats and Equipment for Prevention and Rehabilitation

Springer

Pilates – A Teachers' Manual

V. Geweniger
A. Bohlander

Pilates – A Teachers' Manual

Exercises with Mats and Equipment for Prevention and Rehabilitation

With 781 figures and 24 tables

Springer

Verena Geweniger
Deutscher Pilates-Verband
Mühltal/Trautheim, Germany

Alexander Bohlander
POLESTAR Europe
Köln, Germany

Das Werk erschien 2012 in deutscher Sprache mit dem Titel „Das Pilates-Lehrbuch" im Springer-Verlag Berlin Heidelberg.

Library of Congress Control Number: 2013920134

ISBN 978-3-642-38113-3   ISBN 978-3-642-38114-0 (eBook)
DOI 10.1007/978-3-642-38114-0

Springer Medizin

Editor: Barbara Lengricht, Berlin
Project Management: Birgit Wucher, Heidelberg
Translation: Joanna Mountifield, Berlin
Copyediting: Isabella Athanassiou, Bonn
Project Coordination: Michael Barton, Heidelberg
Photography: Roger Richter, Mainz-Kastel
Cover Design: deblik Berlin
Cover Illustration: © Roger Richter
Production: le-tex publishing services GmbH

Printed on acid-free paper.

Springer is part of Springer Science+Business Media (www.springer.com)

Foreword

During the late nineteenth century and until the beginning of World War I, “La Belle Époque” – the “Beautiful Era” – was spreading over Europe. This period was characterized by optimism and new technological and medical discoveries. Only in retrospect was it named La Belle Époque and considered a “Golden Age” when compared with the horrors of World War I. A profound cultural revolution in health and wellbeing developed during this period, amongst an exceptional group of people in Europe and especially in Germany. Influenced by Friedrich Jahn, a philosopher, historian, and theologian, and Per Henrik Ling in Sweden, a revision of ancient Greek gymnastics was in the making. Complementing and balancing this new approach, individuals such as Leo Kofler, Elsa Gindler, Rudolf Laban, Hede Kallmeyer, Bess Mensendieck, and Joe Pilates worked on new ethics and principles for body movement. They especially focused on the science of self-awareness through exercise.

Joe Pilates was one of many Europeans intertwining physical practice and mental discipline. Trainers and dancers started to explore the relationship between mind, body, and brain. In common with Alexander, Cohen, Bartenieff, and later Feldenkrais, they shared an urgent desire to educate their clients about internal awareness and sensitivity. This was combined with a focus on moving consciously, to improve control.

The emergence of this movement from the Belle Époque could very well have been a new conceptualization of human individuality, a realization that as individuals we have a unique responsibility and potential. Ultimately, these concepts of self-awareness were imaginative steps toward increased awareness of the body, and the acceptance of personal responsibility for one’s own deeds and actions (Hanna 1986).

This inspiring movement of mindful bodywork would not only have a big influence in Europe and Germany. The tide of transformation washed around the world, reaching as far as North America. In the 1960 s, the revolution in human and cultural change and taking responsibility for one’s individuality was identified exclusively as a typically American phenomenon. However, the roots of this movement lay in Europe, and particularly in Germany.

The work of Joe Pilates and his partner Clara centered on teaching awareness, proper breathing, and alignment of the spine and strengthening of the torso muscles. After the couple moved to New York, they gained followers from the local performing arts and dance community almost immediately, experiencing this new wave of change. George Balanchine and Martha Graham were early supporters, and later many influential disciples followed. Under the guidance of Pilates and his wife, a somatic conception of “one’s self” emerged. Joe Pilates was a devoted reader of philosophical texts, and repeated the mantra of Friedrich von Schiller: “It is the mind itself which shapes the body.” This emergent process of integrating movement with awareness and consciousness may have been captured best by the words of psychologist Roger Sperry, when he accepted the Nobel Prize in 1981:

» The events of inner experience, as emergent properties of brain processes, become themselves explanatory causal constructs in their own right, interacting at their own level with their own laws and dynamics. Learning to recognize an internal proprioceptive pattern is not essentially different from learning to recognize the visual outlines of a map.

» The whole world of inner experience, long rejected by twentieth century scientific materialism, thus becomes recognized and included with the domain of science.
(According to Hanna 1986).

Finally, in the late twentieth century, science picked up and incorporated ideas about motor control, feed-forward and feed-back mechanisms, and the significance for exercise and training of patients.

Blending the wisdom of the past, and particularly the Pilates method, with new insights and present-day research in one book is not simple. Contemporary research now expresses clear interest in human motor behavior and what distinguishes the behavior of a healthy person from a chronic patient. At the heart of this research is the realization that dissimilar motor tasks lead to other patterns of motor behavior. High load tasks combined with a high level of unpredictability seem to favor a stiffening response from the motor system, to guarantee sufficient strength and stability. Low load tasks, with higher predictability, induce a more controlled strategy. The latter strategy is characterized by sharing the load, guarding and steering unilateral movement, as far as possible, from the same side as well as from the inside outward. By contrast, a rigid strategy often creates stiffening and cramping of musculo-fascial systems, leading to bilateral muscle activity. These dual motor pattern mechanisms are not necessarily distinguished in black and white; in fact, there is a large gray zone. Under normal circumstances, the dual pattern is a splendid reaction for executing different tasks successfully. The literature, however, shows that chronic patients often tend to adopt a continuous rigid strategy even when executing low-load and high-predictability tasks. Many patients alter normal motor patterning in such a manner that the sensory and motor cortex of the brain rewrites the neurosystem. The consequence is that the neurosystem uses its qualities of plasticity to create a maladaptive compensatory pattern. The new pattern becomes habituated, and we have learned from new studies that even ligaments and fascial structures adapt very quickly to this new situation. These structural, muscular, and fascial changes could hamper a quick recovery.

Of course, many people with modest complaints who are still functioning rather well show signs of altered motor patterns, especially as a result of our present day lifestyle. Emotional processes also play a big part in this scenario. Fear of movement, for instance, opens up existing preprogrammed motor patterns in the brain, particularly in the periaqueductal gray (PAG) matter in the brain stem. Fear can also be the result of receiving sometimes (very) confusing information about your body from therapists, trainers, and doctors: "Yes you clearly have defined arthrosis of your spine and our test reveals that you are highly unstable in your pelvis and you have some ruptured ligaments and the scan shows … etc." Such messages unfortunately create great fear and consequently change motor patterns. Words are very powerful. We should therefore be careful how we relay information to our clients and patients about their condition.

It seems clear what Joe Pilates wanted to achieve: a valid training method to bring patients and clients back to their own inner and outer strength and confidence. For many centuries there has been a strict separation of mind and body. The Pilates method promotes awareness of movement from an inner perspective, and promotes movement from the inside out. This methodology is indeed confirmed and verified by recent data. Like Pilates, many years later Thomas Hanna promoted self-awareness as the main key of analyzing your own body. Hanna pointed out that we have two irreducible viewpoints for observing our clients and patients. There is external observation, analyzing clients "bodies" from the outside, from a "third person's" point of view. In contrast, the first person viewpoint derives from inner awareness and the perception of what the client feels and registers about him/herself. Using this insight, we should work and focus on input/awareness training simultaneously, but also promote inner awareness of clients so as to achieve what Hanna called "first person regulation" of the body!

Pilates encouraged the execution of effective movement patterns from the inside outward, which is at the heart of present-day discussions about core control. Indeed, how can we use the legs and spine effectively as levers from the pelvis, when at that moment the pelvis is not sufficiently externally stabilized on the hips and internally self-braced by locking the sacrum into the iliac ring? This is of course a discussion of anticipatory feed-forward reactions (see the work of Paul Hodges, Jaap van Dieen and Jaceck Cholewicki).

Self-bracing and force closure of the pelvis and lower spine are preconditions for using the legs and spine effectively. When forces increase under more challenging conditions, we have to adapt the level of self-bracing for the different components of the kinematic chain. How can we use levers such as the arms or legs during throwing and walking? By starting with optimal conditions, to force-close the system from inward (center) to outward. If this is the case, should it not be a necessity to recognize that the arm, spine, and leg musculature and fascia are not in fact separate, but actually work together?

Here you may notice again that topographic anatomy is very helpful, and a necessary tool for understanding the body. Unfortunately, it does not explain how the body works as a functional unit. Fortuitously, a logical functional approach was already at the center of what Joe Pilates considered effective training.

Foreword

The present book on the Pilates method clearly illustrates concepts that help us to understand these enigmas. In particular, it represents the wisdom of many practitioners, trainers, and dancers from the past who have built up a tremendous body of intelligent models. The book clearly explains how Joe Pilates developed his methodology by focusing on whole body movements, breathing, concentration, centering, precision, and balanced muscle-fascia development.

Recently, mind-body researcher Herbert Benson from Harvard University underpinned these insights, by showing that slow, deep, diaphragmatic breathing is central to most mind-body techniques. Proper breathing is an effective antidote to stress, restoring rigid strategies to controlled strategies. Alice Domar, a colleague of Benson, shows that mind-body techniques, combined with proper breathing, can significantly reduce symptoms of severe PMS as well as anxiety.

I am delighted to recommend this book to all practitioners, dancers, therapists, and of course Pilates trainers. The authors of this book have put a lot of energy and determination into blending new information for the benefit of their readers. They have woven many contemporary insights into their text, creating a modern interpretation of the Pilates methodology. It is also nice to see a German book honoring the enormous wealth of intelligent ideas from the past, particularly the work of Joe Pilates

Prof. Dr. Andry Vleeming
Medical faculty of New England
Department of Anatomy
Maine, USA

Medical Faculty
Department of Rehabilitation and Kinesiotherapy
University of Ghent
Belgium

Foreword

Pilates is a wonderful way to bring body and mind into harmony. I have personally benefited from Pilates training for years. Because of its diversity and complexity, an appropriate program can be created for any age or fitness level. As an orthopedic surgeon, I recommend Pilates to my patients, because stability and mobility can be achieved without promoting tension.

Christine Becker
Orthopedic Specialist
Klinik am Ring
Cologne

Preface

This “manual” for physiotherapists, physical education teachers, and trainers is the first textbook of its kind, and provides an ideal foundation and guide to accompany certification in modern Pilates. We have brought together the documents and descriptions that form the traditional basis of the Pilates method as well as modern concepts in sports science and movement studies.

From daily practice to daily activity – clearly explained and easy to apply – the fundamental methodology of training, analysis, and didactics is linked to the exercises themselves.

The most important mat exercises are clearly presented, together with their theoretical background and implementation on the Pilates equipment.

Our intention has been to consciously transcend barriers, dogmatic thinking, and the restrictive definitions that inhibit the vital development of the method. This book seeks to define a common vocabulary, thereby facilitating communication between teachers and the exchange of ideas with specialists in related fields.

The positive effects and impact of Pilates training, for decades taught successfully to millions of people, leaving them free of symptoms, happier, and more balanced, should be more accessible as a result of this clarification of the fundamental, underlying principles.

When asked, “Why does one do Pilates?” a student of Joseph Pilates once replied, “To master the challenges of life and to enjoy life!” In this sense, we hope to contribute to making the lives of Pilates trainers and their clients more interesting and comfortable, by helping them to become free of symptoms.

Joseph Hubert Pilates had a comprehensive, unified understanding of his method and the exercises he developed, as well as great dedication. We hope that this book does justice to his legacy, but also reflects the extent of his vision. We consider it essential to present not only exercises on the mat, but also on the Pilates equipment. It is only in a synthesis of all the elements of the Pilates training concept that the exercises can unfold to their full effect.

The Authors
Mühltal and Cologne, Spring 2014

Acknowledgments

We would like to thank everyone who has supported our project with advice and assistance.

- Thanks to Springer-Verlag Heidelberg for the initiative on this book's creation. During implementation, we have come to appreciate the expert and professional advice of the publisher, especially of Mrs. M. Botsch.
- During the research and development, we have received support from staff and dear colleagues.
- Big thanks are due to Elizabeth Anderson and the Pilates Method Alliance (PMA) for kindly providing the historical images, as well as to Deborah Lesson and Stacey Redfield for historical information.
- Thanks to the Sissel/NovaCare company for providing the Pilates equipment shown in the exercise photos.
- Our thanks also goes to Joanna Mountifield for the committed and competent translation.
- Finally, thanks to our families, who have encouraged and supported us!
- A very special thanks to Joseph Hubert Pilates and his partner Clara Zeuner, for their life's work. They have enriched and changed our lives.

The Authors
Mühltal and Cologne, Spring 2014

The authors

Alexander Bohlander

Alexander Bohlander, born in 1964, is a distinguished expert in Pilates training both in Europe and beyond. Having begun his career as a physiotherapist in 1991, Alexander qualified as an alternative health practitioner in 1995, and graduated in the study of osteopathy in 2005. He was cofounder of the first German medical practice to integrate Pilates training into treatment and rehabilitation, when he opened his practice in Dormagen in 1998, incorporating a small Pilates studio. In 2000, he established the Polestar teacher training company in Germany, and soon became a leading figure in Pilates throughout Europe, offering training courses taught by visiting lecturers from the USA. In 2002 Alexander opened the SPRINGS health center in Cologne, which offers the full spectrum of Pilates training as well as a range of holistic therapy. In 2009 and 2013 expanded with two new locations in Cologne. Today Alexander Bohlander travels worldwide as a lecturer, and his holistic approach has significantly shaped the development of Pilates training in therapy and prevention.

Verena Geweniger

Verena Geweniger was born in 1951, and following her graduation in sports studies, taught in German schools for foreigners in South America. It was here during the 1980 s that she discovered and learned to love the Pilates exercises, taught at a ballet studio and known simply as "floorwork." After returning to Germany, she opened 1987 a functional gymnastics studio near Darmstadt. Through Ken Endelman (California), the manufacturer of the Balanced Body Pilates equipment, she met Alexander Bohlander in 1997 and went on to take part in the first Pilates teacher training course he offered in Cologne, taught by Elizabeth Larkam and Brent Anderson. In the following years, Verena deepened her already extensive knowledge of the Pilates exercise repertoire, staying with Alan Herdman in London, with representatives of "classical" Pilates in New York, and at the Polestar Education Center in Miami. In 2001, she took part in the founding of the Pilates Method Alliance (PMA) and taught her Pilates floor program for the PMA. Verena has been instrumental in establishing and developing Pilates in Germany, and her work has appeared in numerous publications. Her initiative led to the founding of the German Pilates Association in 2006, and to this day, she remains the dedicated president of the organization.

Contents

Introduction

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_1,

1.1 Why Pilates as Preventative Exercise?

Promoting a Healthy Lifestyle

Political and societal interest in the topic of **prevention** (prevention rather than cure) has never been greater than at present. At a time of exploding health care costs, coupled with the restriction of medical services to the individual, it is increasingly important to encourage healthy living and avoid unhealthy habits.

In addition to regular cardiovascular exercise, the WHO (World Health Organization) recommends **strength training** for the major muscle groups, at least twice a week (WHO 2011).

The comprehensive full-body training program developed by Joseph Pilates – particularly the modern form which reflects the more recent findings of sports science and medicine – provides an ideal foundation for modern preventative exercise.

The aim is to awaken a sense of **personal responsibility** – something Joseph Pilates emphasized in his original writing (Pilates 1934, 1945, in Gallagher and Kryzanowska 2000):

- The **mat program** can be performed by anyone, at any time, without much inconvenience!
- The **equipment program** developed by Pilates represents an efficient and innovative method of therapeutic exercise for either prevention or rehabilitation.

The words of the Roman poet and philosopher von Juvenal (around 60–140 A.D.), much quoted by Joseph Pilates – **the mind builds its body** – can, as we now know, be reversed to state that: **the body also builds its mind!**

» Whoever trains his muscles, virtually floods his brain with fresh nutrients and growth substances. Thus grow new neurons. (Blech 2007, p 6)

Natural Movement

Sport and health are not inherently positively associated however. The sports identified with modern civilization (fitness training, competitive sports, and others) do not necessarily replace **natural, regular movement** but on the contrary, frequently cause weaknesses and issues resulting from unbalanced or one-sided movement patterns. "More" is not always "better."

"Movement is life" (said Andrew Taylor Still, the founder of osteopathy), and it is commonly accepted that "to move yourself, brings blessings." However, integrating this knowledge in a society and environment which increasingly limits opportunities for movement becomes ever more challenging. The **appreciation of movement** is closely linked with awareness of a healthy lifestyle in general. Joseph Pilates echoed this awareness, and the tradition of the reform movement, in 1930 when he **recommended** that one should:

- Eat healthily
- Enjoy the sun and fresh air
- Sleep enough
- Move regularly
- Shape one's body through sports

The Social Significance of Movement

Many of the assertions dating from this period retain their validity and topicality today. In 2010, the **Research Institute of the AOK** (WIdO) published the following:

- Muscle and skeletal disorders are the dominant health issue. Almost half (47 %) of the population suffer from back pain. Alarmingly, this finding also applies to a third of respondents aged 20 years or younger.
- In 2009, **back pain** was the most common course of incapacity to work, and was second only to respiratory diseases as the most common cause of work days lost (absenteeism Report 2010, http://www.wido.de).

In 2007, Blech cited two million deaths annually resulting from **physical inactivity** (WHO report, see Blech 2007, p 237). By 2011, this had already increased to 3.2 million deaths, of which over 670,000 occurred prior to 60 years of age. Approximately 30 % of all cases in the categories of diabetes and cardiovascular diseases can be associated with physical inactivity (http://www.who.int).

Joseph Pilates outlined the social significance of these factors in "Return to Life". Individual responsibility for living a healthy lifestyle represents potential for change both at a personal and environmental level. Viewed from this perspective, Pilates exercise in the field of prevention potentially offers a valuable contribution to health, performance and success as a whole.

1.2 Why Use Pilates in the Therapeutic Field?

Pilates and Chronic Disease

Health is more than just the absence of disease. Man is more than just the sum of his (physical) parts. According to the concepts of Salutogenesis, which have gained increasing significance in the therapeutic field, the person with health issues is no longer perceived simply in terms of his disease. **Physical symptoms urge** us to pay closer attention to the body. **Pain** can provide a warning for us, to actively pursue a healthier lifestyle. Doctors, therapists and patients are called upon to act mindfully and with increased awareness.

Characteristic of this approach is the perception of the **person as a whole.** Both structurally and functionally, the human body is an entirety, with complex interrelated systems in health as well as in a diseased condition. In addition to this, the processes of perception and interpretation, and the influence of psychological phenomena, are decisive in terms of physical well-being.

In its methodological approach, Pilates training emphasizes the interconnectedness of the body's resources. Precisely for this reason, it can be used effectively to intervene in the vicious circle which often characterizes chronic diseases of the musculoskeletal system.

Pilates and Acute Disease

For a number of years, the Pilates Method has been successfully integrated into the physical therapy and rehabilitation of **acute diseases, although this has gained limited recognition in Europe to date.**

The term **"Early Functional Treatment"** can embrace Pilates training, and is an important concept in the field of therapy and rehabilitation. Above all, the **training principles** are crucial: they facilitate a holistic rehabilitation process with tremendous long-term effectiveness, in a way that almost no other training can.

The **smooth transition** from the therapeutic environment to the physical demands of the daily routine and the emphasis on preventative exercise and avoidance of injury are central to Pilates training. Having experienced the physical competence and ability gained by training, countless former patients have stated, that they might never have suffered the symptoms that they did, had they discovered the Pilates Method earlier.

Bearing this in in mind, Pilates training represents a real development in expanding the range of services physical therapists and other professionals in the field of rehabilitation are able to offer their clients.

References

Blech J (2007) Bewegung, die Kraft, die Krankheiten besiegt und das Leben verlängert. Fischer, Frankfurt/Main

Gallagher S, Kryzanowska R (2000) The complete writings of Joseph H. Pilates: Your HEALTH 1934 – Return to life through contrology 1945, The authorized editions. Bainbridge Books, Philadelphia (PA)

WHO (2011) Global Recommendations on Physical Activity for Health. http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/index.html. Cited 21 May 2011

History

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_2, © Springer Berlin Heidelberg 2014

2.1 Who Was Joseph Pilates?

Based on what we know today, Joseph Pilates (Fig. 2.1) lived an exciting and – at least for the first 40 years – highly diverse life. Since the training concept he developed can be better understood in the light of its historical context, a brief overview of Pilates's life is presented in this chapter.

Synopsis of Pilates's Life

9.12.1883	Hubertus Joseph Pilates. Mother: Helena, born Hahn (1860–1901), Father: Heinrich Friedrich (Fritz) Pilates (1859–?), occupation: locksmith
1900	Brewer in Engelbeck
1905	Birth of daughter Helene (Leni) Friedrich on 30.11. in Gelsenkirchen, mother: 1. By his first wife Maria Friedrich (deceased 1913)
1912	Pilates lives and works in England
1913	Sister Anna Helena (*1886) and brother Clemens Friedrich (*1890) emigrate to the USA
1914	Detained on the Isle of Man
1919	Returns to Germany/Hamburg. Second Marriage: Elfriede (1879–1931)
1924	Registers a patent for the equipment known as "Universal Reformer" in Berlin
1925	First trip to the U.S. travelling first class, carrying $800 in cash, occupation: teacher, age: 41 years old
1926	Second trip to the U.S. in second class carrying $500 in cash. Meets his future lifelong companion on board the ship: Anna Clara Zeuner (6.2.1883–1976)
1929	Opening of Studio. His birth date on his business card is changed to 1880
1934	Published his book *Your Health* ("Deine Gesundheit")
1935	Naturalization of J. Pilates. Occupation: "Director of Physical Culture." "Not married"
1937	Naturalization of Clara Zeuner. Occupation: "Assistant Director of Physical Culture" "Not married", registered as living in the same apartment as Pilates
1938	Trip to Cuba
1939–1951	Pilates teaches regularly at summer camps for dancers at Jacob's Pillow, Berkshire Mountains. He and Clara own a house there
1940	A Canadian newspaper calls his studio a "high-class exercise salon" due to the fees of $10 per training (Redfield 2011)
1942	Pilates's entries in the US army draft papers during WWII: 1. "Person who will always know your address": Clara. 2. Indicates that he lost his right eye at age 5.
1945	Publishes his book *Return to Life Through Contrology* ("Rückkehr zum Leben durch Contrology"). He demonstrates his mat exercises in a series of photographs – although approximately 62 years old
1967	Pilates dies on 9 October in a hospital in New York. Clara leads the Studio until 1972 (PMA Pilates Study Guide 2005)
1976	Clara Zeuner dies
1977	Romana Kryzanowska continues to lead the Studio

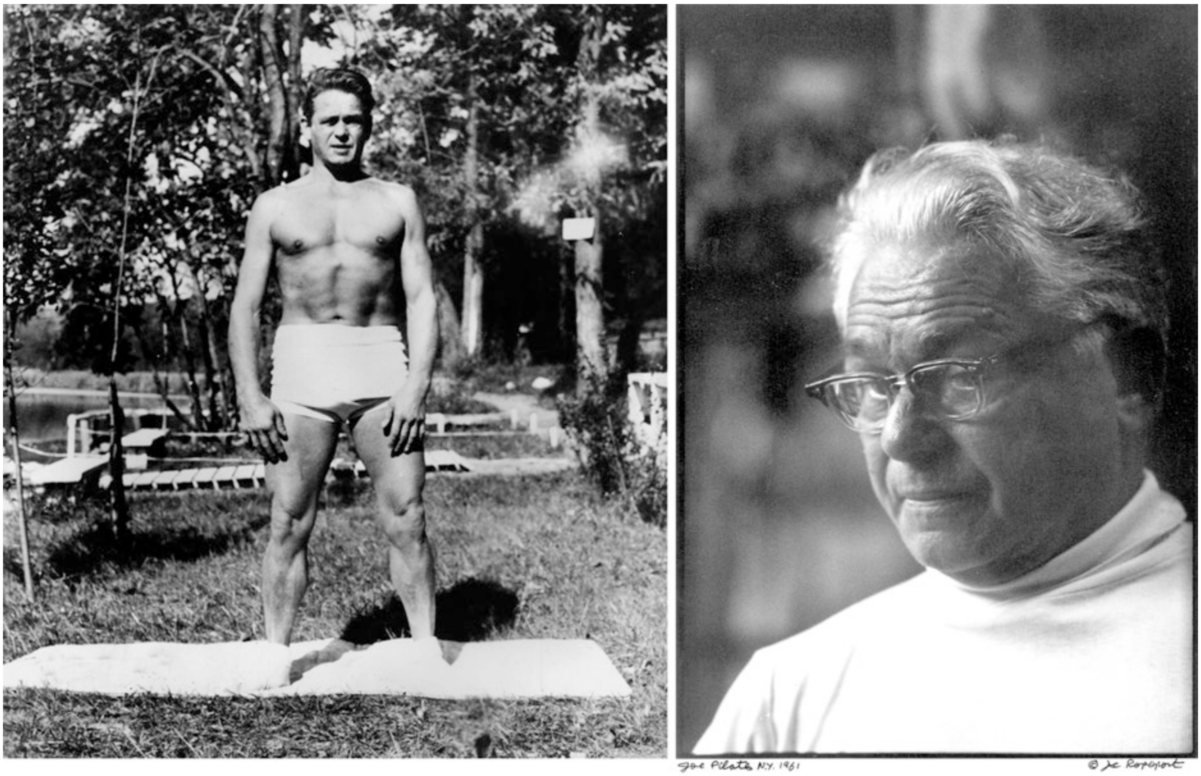
Facts and Legends

Following extensive research with the assistance of the Mönchengladbach City Archive, the German Pilates Association established the following findings in early 2007:

- Hubertus Joseph Pilates was born on **9 December 1883**, at 0:30 a.m. in a house that no longer stands at 20 Waldhausener Street, Mönchengladbach. He was the second of nine children for Helena and Heinrich Friedrich Pilates.
- Pilates's business card from 1929 lists **1880** as his **year of birth** (information provided per post by Stacey Redfield, March 2011), which is 3 years older than in actuality. The intention behind this is no longer known. Although contradicting official documents, the date was published in the press and adopted in literature. Only after the German Pilates Association published Pilates's birth certificate in 2007 was the correct date of birth made public.
- At the convention of the Pilates Method Alliance (PMA) in 2007, even his longtime friend and attorney John Steel was unable to provide an answer regarding this **inconsistency about Pilates's date of birth**. He recalled that as Pilates's attorney he was always busy, as "Joe was the kind of person, who did not have a will, did not pay taxes or have a driver's license" (PMA Manual 2007).

Numerous **stories** have been told about Pilates:

- As a **child,** he was weak and sick (asthma, rickets, rheumatic fever and tuberculosis were mentioned). In the 1920 s, however, the "fitness industry" was already booming and had become a "Billion Dollar Industry." Many advertised their systems as a recipe for overcoming personal suffering of all kinds. The possibility that Pilates claimed to have steeled his ailing body through his method purely as a "publicity stunt" cannot be ruled out (Redfield 2011a, Part II).
- At **age 14**, he is said to have been the model for anatomical cards. His father may have provided a role model; a well-trained Fritz Pilates can also be seen in a photo taken during a meeting of the P.E. and sports teachers of the District of Dusseldorf (thanks to the city archives of Mönchengladbach).
- Pilates strengthened his body with bodybuilding, boxing, gymnastics and kung fu.
- From **1912**, he worked in England as a boxer, self-defense trainer and as a "living Greek statue" in a circus (PMA Pilates Study Guide 2005).
- During his internment (1914) in England, he experimented with bedsprings and conceived his first ideas for training equipment. The first piece of equipment patented, the "Reformer" had no springs for resistance, however, and instead used weighted plates.



a b

Fig. 2.1a,b Joseph Pilates

- **After the war**, he worked as a self-defense coach for the Hamburg Police, and was in contact with Max Schmeling, Rudolf von Laban and Mary Wigman (PMA Pilates Study Guide 2005).
- On his second trip to the USA, he met Anna Clara Zeuner from Chemnitz, who was either a nurse or kindergarten teacher. There is no evidence that they were ever married. According to Clara's certificate of naturalization in 1937, they were registered as living in the same apartment, but "not married" (thanks to the city archives of Mönchengladbach).
- In **1926,** he worked in a "Boxing Gym."
- He loved thick cigars, whisky, beer and women (Grant and Fletcher 2001). That did not stop him preaching the benefits of a healthy lifestyle in his writing: moving in the fresh air, taking cold showers, brushing with a massage sponge, wearing scanty clothing in winter to harden the body, and exposing the body to sunlight in the summer ("Return to Life" 1945, in Gallagher and Kryzanowska 2000, pp 38, 59).
- His two nieces, Mary Pilates and Irene Zeuner-Zelonka, assisted him in the studio and were his favorite pupils (PMA Pilates Study Guide 2005).
- Clara's niece, Irene Zeuner-Zelonka, reported that during the last 5 years of life he barely visited the studio (information provided per post by Stacey Redfield, March 2011)
- Pilates student Mary Bowen adds that **since 1966**, he had been suffering from emphysema and was clearly ill.
- Pilates died shortly before his **84th birthday**, on 9 October 1967. On the day of his death he was apparently very angry, and they had placed a guard outside his room to prevent him running away (information provided per post by Mary Bowen, 2007).

Fig. 2.2 shows Clara Zeuner and Joseph Pilates as a couple.

Following Pilates's Death

A number of **first-generation students** of Joseph Pilates opened their own studios in the United States. The **most significant** of these are listed below:

- **Carola Trier**
  Dancer and acrobat, student from 1940 onward, opened a studio in 1950 with Pilates's assistance. She died in 2001. Famous student: Deborah Lesson, who continues her teachings.
- **Eve Gentry**
  Dancer, student from 1938 to 1968 and teaching since 1960, first at the University of NY, then in Santa Fe.

Fig. 2.2 Clara Zeuner and Joseph Pilates

- **Bob Seed**
  Hockey player and Pilates student, according to John Steel he was driven out when threatened with violence by Pilates, as he attempted to open his own rival studio across the street.
- **Ron Fletcher**
  Graham dancer; opened a studio in Hollywood in 1970.
- **Romana Kryzanowska**
  Dancer; ran Pilates's studio from 1977 onward following Clara's death.
- **Kathy Grant**
  Dancer; has been teaching her own classes since 1972.
- **Lolita San Miguel**
  Dancer; teaches in Puerto Rico.
- **Bruce King**
  Dancer with the Merce Cunningham Company; opened his own studio in New York in the mid-1970 s.
- **Mary Bowen**
  Jungian analyst, student from the mid-1960 s onward; teaching in her own studio in Massachusetts since 1975.
- **Robert Fitzgerald**
  Opened a Studio in approx. 1960; he and Carola Trier were the teachers of Alan Herdman, who brought Pilates to England in the 1970 s.

Recent Developments

1995	The term "Pilates" is so well known that it is listed in Webster's dictionary
1996–2000	Legal disputes: the attempt by a New York studio to register "Pilates" as a trademark was rejected. Pilates is designated a general term for a method of training that cannot be owned by a single person
2001	Founding of the Pilates Method Alliance (PMA) in the USA, with the aim of preserving the tradition of the Pilates Method
2006	Founding of the German Pilates Association (DPV e. V.)
2007	According to the PMA, over 12 million people worldwide exercise using the Pilates method (http://www.pilates.com)
2009	Founding of the Swiss Pilates Association
2011	Founding of the Austrian Pilates Association

2.2 How Was Pilates Integrated into Therapy?

Joseph Pilates developed a concept for the process of functional rehabilitation early on. Working with **the injured** in an adjoining room, he adapted his exercises to their needs and did not follow a set exercise program (as told by Kathy Grant, information received per post from Deborah Lesson 2011).

Training with Pilates must have been effective; at the founding meeting of the Pilates Method Alliance, professional dancers Ron Fletcher and Kathy Grant recalled that in spite of their injuries, they danced better following their work with Joseph Pilates's than before, and recovered faster (Grant and Fletcher 2001).

Dr. Henry Jordan, an **orthopedist** at Lennox Hill Hospital in New York City, was not only a good friend but also a supporter of Pilates's method, and sent him both patients and students. These included **Carola Trier**, who had suffered a knee injury during a show at the Radio City Music Hall in 1940. She eventually worked closely with both men. Trier continued her education in the medical field with Jordan, and Pilates gave her a second career – she was able to open her own studio in the late 1950 s.

In 1960, the **Journal of the Lennox Hill Hospital** described in detail how a "former dancer led an unusual Rehabilitation Center." Jordan would often send patients with orthopedic issues to work with Trier, where they would complete a "program with heavy resistance" on equipment developed by Joseph Pilates, to build "muscular strength" and "functional skills."

If Jordan planned to send a patient to Carola Trier for rehabilitation, he allowed her to observe the surgery, so that she was precisely aware of the affected structures. This can be considered the origin of the integration of Pilates's concepts in therapeutic treatment.

The real breakthrough of Pilates's method into the therapeutic field was achieved by the first clinic for Dance Medicine, at St. Francis Hospital in San Francisco. The clinic was founded in around 1983 by **Dr. James Garrick** a surgeon who allowed the staff to be trained by Pilates teacher Ron Fletcher in Los Angeles (http://www.fletcherpilates.com).

Orthopedist Dr. Henry Jordan was the first person to integrate Pilates concepts into therapy. However, the breakthrough for Pilates training was achieved by Dr. James Garrick, the founder of the first clinic for Dance Medicine.

2.3 Where Is Pilates Today – In Europe and Worldwide?

In the early 1990 s, Romana Kryzanowska was the first to design a **certification process following the traditional methods.** Since then many of Pilates's other followers have established training institutions, contributing their own methodologies based on Pilates's original method. Some of the most well-known names today are dancer Moira Merrithew and chiropractor Howard Sichel (both students of Romana's), Feldenkrais teacher Elizabeth Larkam, physiotherapist Dr. Brent Anderson, Julie Lobdell and Rael Isacowitz.

Thanks in part to those above the Pilates method has grown over time, and underpinned by the **latest scientific principles** is now accepted worldwide as a system not only suitable for prevention, but also for use in rehabilitation.

The ingenuity of Pilates's concepts has meant that today, the Pilates Method is a fundamental component of the health and fitness industry. Not only is the method **known worldwide**, teacher training is also available throughout the world.

Ken Endelman, proprietor of the world's leading manufacturer of Pilates equipment, Balanced Body, has been another driving force in the development and dissemination of the method. Thanks to his initiative in 1999, the rights to the Pilates name were released by court order and use of the term "Pilates" made available to all.

Today, more than 12 million people exercise with the Pilates Method (http://www.pilates.com). Yet all too often, the teaching is distorted or diluted to the extent that it no longer accurately reflects the original philosophy. In the absence of **in-depth knowledge,** Pilates becomes another "fitness trend", merely an additional "legs, bums, and tums" program for many fitness studios.

References

Grant K, Fletcher R (2001) Oral communication. Founding meeting of the PMA, Miami 2001, Miami 2001

Redfield S (2011a) Whisper down Pilates Part I & II. http://www.physicalmethods.com. Cited 20 March 2011

Redfield S (2011b) Chasing Joe Pilates. http://www.physicalmethods.com. Cited 20 March 2011

Pilates Method Alliance (2005) The PMA Pilates Certification Exam Study Guide. Pilates Method Alliance Inc., Miami (FL)

Pilates Method Alliance (2007) Handbuch der PMA-Tagung "Pilates for everybody" 2007. Pilates Method Alliance Inc., Miami (FL)

Pilates Method Alliance (2007) The PMA Pilates Certification Exam Study Guide. Pilates Method Alliance Inc., Miami (FL)

The Pilates Concept

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_3,

3

3.1 The Philosophy

Pilates's training is not merely a collection of exercises, but is based on his philosophical ideas and **vision of health and wellbeing**. In his books, *Your Health* (1934) and *Return to Life Through Contrology – The Basic Fundamentals of a Natural Physical Education* (1945), Pilates outlines the context and theoretical foundation of his method (Gallagher and Kryzanowska 2000). In their handbook (PMA Pilates Study Guide 2005, p 18), the Pilates Method Alliance summarized **three fundamental principles** of the Pilates philosophy, based on these texts.

The three fundamental principles of Pilates's philosophy are:
- **Whole Body Health**
- **Whole Body Commitment**
- **Breath**

Whole Body Health:
(Based on quotations from Pilates's *Return to Life*, 1945, in Gallagher and Kryzanowska 2000)

The prerequisites for performing our many daily tasks with pleasure and joy are physical fitness, an evenly trained body, and full control over our mental faculties. Body, mind and spirit must be in equilibrium. The **desired balance** is achieved through:
- Physical exercise
- Appropriate nutrition
- Personal care and hygiene
- Balanced sleeping habits
- Plenty of movement in the fresh air and sunshine
- A balance between work, recreation and relaxation (today: "Work-Life Balance")

Whole Body Commitment: To Devote Oneself Fully to Something
(Based on quotations from Pilates's *Return to Life*, 1945, in Gallagher and Kryzanowska 2000)

We can only achieve the best from our physical and mental capabilities through discipline, if we strive throughout our lives to reach our **natural limits**. Our entire life should be focused in this way. By conscientiously performing the **Contrology exercises** 4 times a week over a period of 3 months, new levels of mental strength and spiritual wellbeing will be experienced.

Breathing:
For Pilates, breathing could be compared with an "internal shower", and **learning to breathe correctly was** the foremost aim of his method, preceding all other objectives. Consistent and regulated inhalation and particularly exhalation, facilitates:
- The optimal functioning of the body
- Leads to fundamental physical changes
- Cleanses the body
- Rejuvenates, strengthens and invigorates

3.2 The Traditional Movement Principles

Pilates's Philosophical Reflections
Like many other "physical educators", Pilates drew inspiration from the movement patterns of animals. Calling his method **Contrology**, he was powerfully influenced by the exercise traditions of earlier cultures and Asian martial arts. Pilates was convinced that the straight spine of a newborn baby exhibited the least deformation and could therefore be considered the ideal (*Return to Life*, 1945, in Gallagher and Kryzanowska 2000, p 59). The **spine** reflects the true age of a human being:

If your spine is inflexibly stiff at 30, you are old. If it is completely flexible at 60, you are young! (*Return to Life*, 1945, in Gallagher and Kryzanowska 2000, p 58)

During this particular period, gymnastic programs, exercise in general and bodybuilding were no longer something out of the ordinary, particularly in Europe where they had become common.

As the beginning of the twentieth century was marked by the Reform Movement and increasing industrialization, numerous publications and pamphlets hailed the benefits of more **natural movement**. Dancing and walking in the fresh air, preferably without clothes, may initially have been purely romanticized concepts, but no later than the 1940 s and 1950 s and particularly in the urban environment of New York City, new so-called **lifestyle diseases** were establishing themselves. The increasing lack of natural, primal movement gave rise then, just as now, to familiar musculoskeletal complaints.

The program of exercises utilizing the **equipment Pilates designed himself** follows the form of his floor exercises for the most part. The particular construction of his apparatus permits a diverse range of **training objectives**:
- Increased strength through resistance training
- Improved mobility through assisted movements
- Improved coordination through complex exercises utilizing unstable surfaces

Through consistent, precisely guided practice, the exerciser can achieve a substantial improvement in his faulty movement habits. The discipline demanded by Pilates, combined with **daily repetition of the exercises,** succeeded in establishing new motor patterns and movement skills, enabling natural and primal movement to be regained.

The key lies in providing a successful, **pain-free movement experience** that counteracts the mechanisms of pain avoidance, preventing the long-term postural faults which in turn create further issues.

This methodical approach and the connection between the mat and equipment exercises make the Pilates exercise concept unique even today, when modern equipment and materials make numerous other options available to us.

The Evolution of Training Principles

The generation which succeeded Pilates and the teachers who were partially trained by him, distilled the diverse and wide ranging fundamentals of his work. A concise set of traditional **Pilates principles** was devised (PMA Pilates Study Guide 2005, p 19), to form the foundation of every lesson (▶ **Overview 3.1**).

Overview 3.1 Pilates Movement Principles

- Whole Body Movement
- Breathing
- Balanced Muscle Development
- Concentration
- Control
- Centering
- Precision
- Rhythm

To apply the **Pilates Method** therefore means:

- To perform full-body exercises
- To promote natural movement through conscious breathing
- To load joints efficiently and biomechanically, through balanced development of muscle strength and flexibility
- To apply constant mental concentration
- To use only as much muscle strength as is necessary for each exercise, through controlled movement, i. e., use energy efficiently
- To begin all movement of the body from a strong center
- To perform precise, defined movements as accurately as possible,
- To channel the natural rhythm of movement and stimulate muscle engagement through the breath
- (PMA Pilates Study Guide 2005, p 19)

3.3 The Traditional Series of Exercises

Exercises are referred to as **traditional** if they are taught as Pilates himself taught them, this distinction being based on the notes of his students, historical documents, film or teaching passed down by word of mouth. Even here there is divergence, as Pilates modified his exercises over the years, or adapted them for specific students (interview with Kathy Grant and Ron Fletcher, 2001). As a consequence, any debate about "classical versus nonclassical", "pure or not" becomes complicated and ultimately unnecessary. A comparison of *Return to Life* with later texts or with the training guidelines of his successors simply reveals contradictory statements.

Whether on the mat or the equipment, the exercises are performed in a pre-**defined order**. Often interlinked by transitional poses, there is a **flow of movement** and seamless merging of one exercise into the next. A fixed sequence of exercises makes instruction easier for the teacher, and allows clients to memorize the exercises more rapidly; "muscle memory" is activated when the pre-determined sequence is consistently adhered to (Ungaro 2002, p 22). This results in flow of movement.

The Pilates Method Alliance recorded the exercises and their sequence in ▶ **Overviews 3.2–3.4** (PMA Pilates Study Guide 2005, pp 66–71).

Overview 3.2 The Beginner Series

1. Hundred
2. Roll Up
3. Single Leg Circles
4. Rolling Like a Ball
5. Single Leg Stretch
6. Double Leg Stretch
7. Spine Stretch
8. Side Kicks
9. Seal

Overview 3.3 The Intermediate Series

1. Hundred
2. Roll Up
3. Single Leg Circles
4. Rolling Like a Ball
5. Single Leg Stretch
6. Double Leg Stretch
7. Single Straight Leg
8. Double Straight Leg
9. Criss-Cross
10. Spine Stretch
11. Open Leg Rocker
12. Saw
13. Single Leg Kick
14. Neck Pull
15. Spine Twist
16. Side Kicks

17. Teaser
18. Swimming
19. Seal

3

Overview 3.4 The Advanced Series

1. Hundred
2. Roll Up
3. Roll Over
4. Single Leg Circles
5. Rolling Like a Ball
6. Single Leg Stretch
7. Double Leg Stretch
8. Single Straight Leg Stretch
9. Double Straight Leg Stretch
10. Criss-Cross
11. Spine Stretch
12. Open Leg Rocker
13. Corkscrew
14. Saw
15. Swan Dive
16. Single Leg Kick
17. Double Leg Kick
18. Neck Pull
19. Scissors
20. Bicycle
21. Shoulder Bridge
22. Spine Twist
23. Jackknife
24. Side Kick Series
25. Teaser
26. Hip Circles
27. Swimming
28. Leg Pull Front
29. Leg Pull
30. Kneeling Side Kick
31. Side Bend
32. Boomerang
33. Seal
34. Crab
35. Rocking on Stomach
36. Control Balance
37. Push Up

Joseph Pilates demonstrates a selection of classic exercises from the Advanced Series. (Fig. 3.1).

3.4 The Traditional Didactics and Methodology

Didactics

Joseph Pilates's teaching style, particularly his **harsh corrections,** may have been appropriate at the time, but would be unthinkable today (DVD documentary by Mary Bowen and Power Pilates). After his death, his original didactic precepts were adapted according to personality; the interpretations of Pilates's method were as varied as the numerous personalities that taught his exercises, sometimes with and sometimes without his authorization.

Methodology

Certain **concepts** were characteristic of traditional Pilates training, and are described below. Some of them retain their validity to this day, and can be implemented during exercise series on the mat and equipment.

Pilates Breathing

For Joseph Pilates, correct breathing is the elixir of life! Intensive breathing purifies the blood, rejuvenates and revitalizes. A complete exhalation enables the subsequent deep inhalation to flood the body with the maximum amount of oxygen. Traditionally:

- Inhalation through the nose preceded the movement and
- Exhalation through the nose occurred during the movement (Gallagher and Kryzanowska 1999, pp 13, 32 ff).

Some authors cite Romana Kryzanowska, and recommend inhaling during the exertion, and exhaling whilst relaxing on completion of the movement (Friedman and Eisen 2005, p 17).

Pilates Stance: Foot Position/Standing Position

External rotation of the legs from the hip produces the typical, V-shaped Pilates Stance, with the heels and inner side of the legs pressed firmly together. During Pilates's lifetime, this was typical of **military posture,** in addition to being the preferred starting position for his gymnastic exercises (Gallagher and Kryzanowska 1999, p 27).

Flat Back/Spine to Mat/Imprint

According to Pilates's notions of biomechanics, the spine should remain as flat as a newborn baby's during the execution of his exercises, and the term **flat back** was coined. It refers to the action of pressing the back into the floor whilst supine (*Return to Life*, 1945, in Gallagher and Kryzanowska 2000, p 59). The instructions **spine to mat** and **imprint** have a similar goal: by means of a forced posterior pelvic

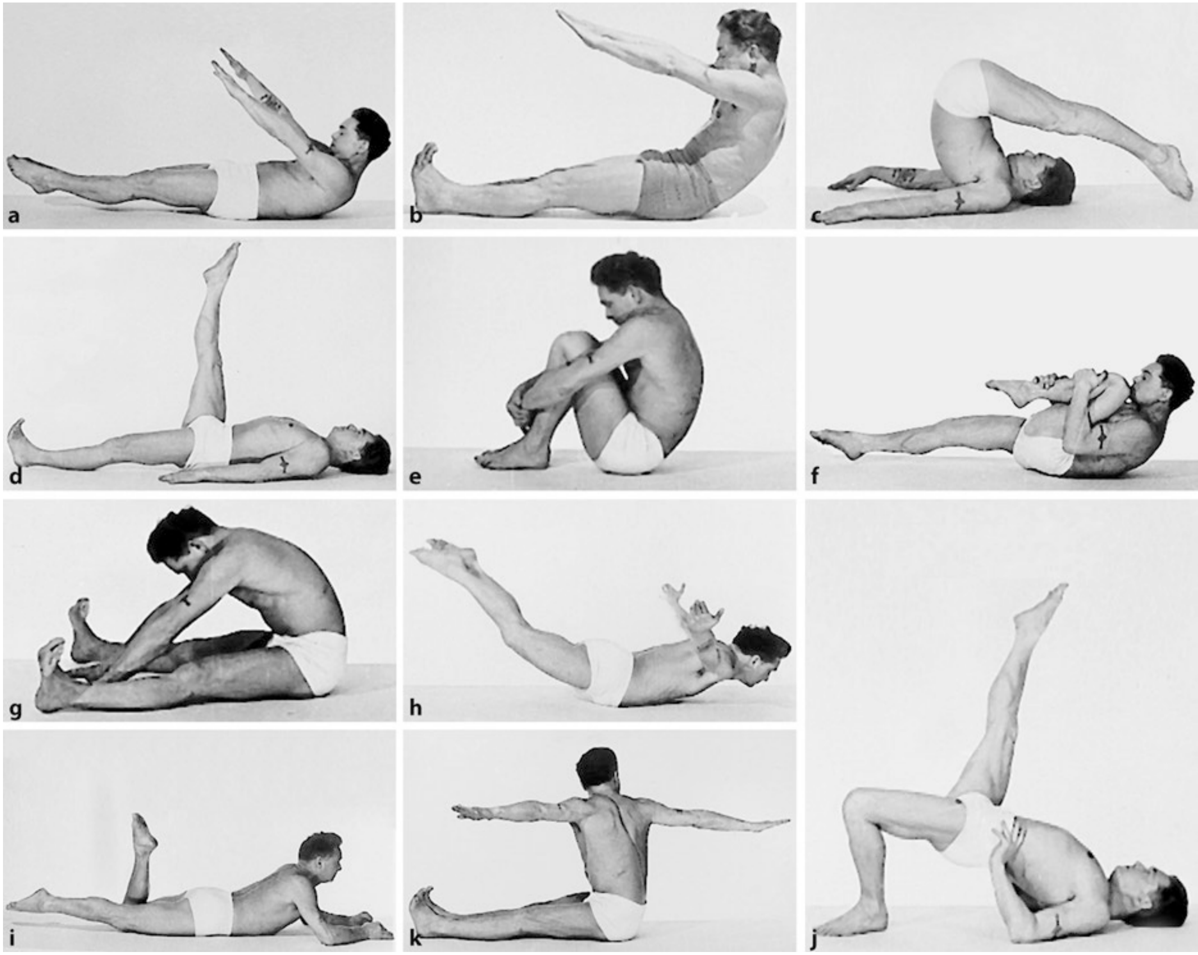


Fig. 3.1a–k Exercises from the Advanced Series. **a** Hundred, **b** Roll Up, **c** Roll Over, **d** Single Leg Circles, **e** Rolling Like a Ball, **f** Single Leg Stretch, **g** Spine Stretch, **h** Swan Dive, **i** Single Leg Kick, **j** Shoulder Bridge, **k** Spine Twist

tilt, all lumbar vertebra should have contact with the mat, creating the ideal, stable foundation for certain exercises.

Navel to Spine/Scoop: "Hollow the Abdominals"

These exercise instructions are often combined with the instruction "Spine to mat." The abdominal muscles are engaged to keep the distance between the navel and spine as narrow as possible. Pilates referred to this flattened core – the area between the ribs and hips – as the **Powerhouse** or **Girdle of Strength** (Gallagher and Kryzanowska 1999, p 27). Activating this central girdle of power is the basis of every exercise.

Pinch/Squeeze: "Squeeze the Buttocks"

"Whenever you're standing, sitting or lying, just imagine a coin between your buttocks. Tighten the muscle of the buttocks so that they squeeze the imaginary coin. Continue to press and train these muscles …" (Gallagher and Kryzanowska 1999, p 14).

Chin to Chest

The Pilates repertoire features a number of rolling movements, designed to keep the spine young and flexible and to clean the lungs. In order to roll "one vertebra at a time" (segment by segment), the head is curled forward, keeping the neck long; the chin should either try to touch the sternum (Friedman and Eisen 2005, p 31) or be held parallel to the breastbone (Ungaro, 2002, p 15). This neck posture should protect the neck, facilitate centering during rolling movements, and help anchor the spine to the mat during supine exercises.

Pits to Hips

Keeping the shoulders blades down should allow the neck to elongate and release any tension in the neck and shoulder area. Here, the **shoulder blades** are drawn down **toward the spine** and "pressed" lower than their normal position (Ungaro 2002, pp 16).

3

3.4.1 The Traditional Structure of a Class

- Equipment and mat exercises were combined in a form of "circuit" during each session.
- Pilates developed special, particularly **thick mats for his exercises**, with loops for the feet or a wooden rod integrated at the head end, to facilitate rolling movements for example.
- The **dedicated mat program** as a complete choreography was probably developed during the 1940 s, for the regularly scheduled dance camp at Jacob's Pillow (information provided per post by Stacey Redfield, May 2011).

! The goal of training was a body "as flexible as a cat, and not as muscular as a brewery horse" (*Return to Life*, 1945, in Gallagher and Kryzanowska 2000, p 57).

- Pilates demanded that students attend training **3 times per week**.
- All participants started with a **beginner program**.
- **No exercise** was repeated **more than 10 times**: "favorite exercises" were not to be repeated more frequently, or other less popular exercises neglected.
- There was **little talk** during class, particularly not from students, and there were **no breaks**, "no drinking water."
- After training, a **cold shower** and a whole body massage with a brush were recommended (description of teaching by John Steel, 2007).
- **The first 5–9 mat exercises at least** were to be practiced **at home** for a minimum of 10 minutes, preferably daily

! In total, training and showering should take a maximum of 45 minutes (CD: Ungaro 2000)

References

Friedman P, Eisen G (2005) The Pilates method of physical and mental conditioning. Penguin Books, London

Gallagher S, Kryzanowska R (1999) The Pilates method of body conditioning. Bainbridge Books, Philadelphia (PA)

Gallagher S, Kryzanowska R (2000) The complete writings of Joseph H. Pilates: Your HEALTH 1934 – Return to life through contrology 1945, The authorized editions. Bainbridge Books, Philadelphia (PA)

Pilates Method Alliance (2005) The PMA Pilates Certification Exam Study Guide. Pilates Method Alliance Inc., Miami (FL)

Ungaro A (2000) Portable Pilates Mat Class at the Pilates Center of New York. Tribeca Bodyworks, New York

Ungaro A (2002) Pilates. Dorling Kindersley Verlag, Starnberg

Pilates as Preventative Exercise: Foundations

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_4, © Springer Berlin Heidelberg 2014

4

4.1 Methodological Definition

The goals of Pilates training can best be met through detailed analysis and structured communication.
- Firstly, its effectiveness can only be gauged through an understanding of the body's physical responses.
- Secondly, each session requires a clear and methodical structure, independent of the specific requirements of each client/patient, to optimize the training experience.

The following themes can provide a foundation for competent, structured action.

Principles of Methodological Action

To correctly perform a Pilates exercise, certain **fundamental principles** must be observed. The United States-based organization the Pilates Method Alliance (PMA) outlines the following movement principles in its manual for Pilates teachers:
- **Whole Body Movement:** In contrast to other methods which focus on isolating muscles, usually with specific equipment, the Pilates method engages the entire body. In terms of motor control, the rule is "as little as possible, as much as is necessary."
- **Breathing:** "Above all, learn how to breathe correctly", wrote Pilates (*Your Health* 1934, in Gallagher and Kryzanowska 2000, p 36). Conscious breathing, particularly complete exhalation, facilitates natural movement and floods each cell in the body with revitalizing oxygen. Controlled breathing is compared to an "internal shower", rejuvenating and refreshing physically and mentally (*Your Health,* 1934, in Gallagher and Kryzanowska 2000, p 55).
- **Balanced Muscle Development:** Whole body movements are performed on the mat or the Pilates apparatus. The training facilitates balanced development of muscle strength and flexibility. Joints are appropriately loaded, with attention to correct biomechanics. Limited repetition assures that no one area of the body becomes overdeveloped in relation to another.
- **Concentration:** Continuous concentration is necessary, in order to train effectively. The mind cannot wander and the daily routine must be forgotten. The necessity of maintaining awareness of the movement and its effect on the body prevents injury, and promotes a state of mental relaxation following training.
- **Control:** Control is a central tenet of the Method. Pilates titled his system "Contrology" to reflect the demand for **strict discipline over body and mind.** Only regular exercise and a healthy lifestyle can re-establish the ideal state of health and fitness, the basis of a happy life. This holistic approach requires that every movement be performed with full control. Controlled movement ensures that the appropriate amount of muscle force is generated. Muscle strength and energy are applied efficiently, with corresponding benefits for activities of daily living.
- **Centering:** Every movement begins with engagement of the core or midsection muscles, and control of the core is maintained as one movement flows into another, to produce an entire choreography. Pilates sought to tone and strengthen the entire midsection, simultaneously lengthening and enhancing mobility, to leave the body "rejuvenated."
- **Precision:** Precision is the partner of control! To perform precisely defined and targeted movements as efficiently as possible, places the highest demands upon concentration and physical discipline and maximizes the effectivity of every exercise. By approaching specific physical goals via a number of interconnected exercises, Pilates avoided countless repetitions of any one movement. This fine-tuning of the musculature creates flowing and elegant patterns of movement – outside the studio and within.
- **Rhythm:** A natural rhythm of movement is created by conscious use of breath, and smooth transitions linking individual exercises. This whole body activity facilitates both mental and physical flow, honing motor skills for everyday life.

4.1.1 Movement Categories

When designing a balanced Pilates session, **structured** around the Pilates Principles outlined above, movements can be grouped into several categories. Every session should include exercises from each movement category, as well as reflecting the individual requirements of students. The **sequence of exercises** is not predetermined, but dependent on:
- The existing fitness level of students
- The focus or theme of the class
- The need to employ harmonious movement transitions

The movement experience is most effective if the exercise **choreography** remains more or less constant over a period of approximately 10 weeks. Flowing transitions play an even more vital role when performing exercises on the mat, than on the Pilates apparatus. For example, stretches may be introduced as and when required, to better prepare the body for the exercises which follow in the sequence.

! Within each session, the exercises should be selected to allow movement to flow, and facilitate harmonious transitions from one exercise to the next.

Overview 4.1. Movement Categories
1. Supine:
   - Core Integration
   - Abdominal Strengthening
2. Side-lying:
   - Stabilization
3. Seated:
   - Upright posture
4. Prone:
   - Strengthening of the trunk
5. Weight-bearing through the upper extremities:
   - Supporting strength
6. Full body integration:
   - Complex coordination
7. Overhead organization:
   - Inverted position
8. Standing

1. Supine
- **Core integration:** controlling the center of the body and movement of the extremities in the supine position calls for engagement of the stabilizing muscles. The breathing pattern selected supports this activity. The resulting **active starting position** incorporates **axial elongation or dynamic tension.**
- **Abdominal training:** articulation of the spine (thoracic and cervical) trains the abdominal muscles both concentrically and eccentrically. Targeted use of breath supports good organization of the head, neck and shoulders, whilst facilitating axial elongation during movement of the trunk.

2. Side-Lying
- **Stabilization:** reducing the base of support and controlling the length of lever (through movement of the upper or lower extremities) develops stability and maintains axial elongation. The supporting arm is functionally integrated onto the trunk.

3. Seated
- **Upright posture:** optimal alignment of spinal segments allows for effortless seated posture, supported by specific breathing patterns. Activating core strength perpendicularly by means of dynamic tension, facilitates control and dynamic stability during trunk motion. The cervical/shoulder area should be organized functionally.

4. Prone Position
- **Strengthening the trunk:** this movement category focuses on maintaining axial elongation during spinal motion in the direction of extension. The torso is strengthened with an emphasis on the posterior musculature. The limbs function as a lever to increase intensity.

5. Weight-Bearing Through the Upper Extremities
- **Supporting strength:** the alignment of the arms in relation to the trunk, as well as the active integration of the trunk onto the arms, creates a stable connection. The head and neck must be actively stabilized and carried, the supporting arm muscles are strengthened. The alignment of the arms beneath the body, as well as the active connection of the trunk to the arms, forms a stable link. The head and neck must be actively stabilized and held in space, and the supporting arm muscles are strengthened.

6. Full Body Integration
- **Complex coordination:** selective movement of individual body parts challenges coordination, motor control and stability. The linking of motion with breath facilitates harmonious patterns of movement.

7. Overhead Organization (Inverted Position)
- This category emphasizes the efficient execution of movements in the **inverted position,** and places high demands on both flexibility and dynamic strength.

8. Standing
- An upright stance with good alignment through the axis of the lower limbs is fundamental for locomotion. A well-organized core, with activation of opposing forces to create **elongation through dynamic tension**, offers stability and reduces impact on joints.

Application of Movement Categories
Exercises from the first category are normally performed at the **beginning** of the session (the first 10–15 minutes), and therefore can be critical for the progression of the whole class. The client should "arrive", switch off from everyday concerns, focus on his body and move consciously. Cueing should be as concise yet precise as possible – too much instruction disturbs concentration and distracts from one's own movement.

According to the focus of a particular session, exercises from the remaining 4 categories can be selected for emphasis during the remaining **25–35 minutes** of the class. The sequence in which these 4 categories have previously been presented need not be followed. The goal is to prepare for more complex movements, selected from the remaining 3 categories. Full body integration, overhead organization and standing exercises comprise the **last 15–20 minutes** of teaching. These require that the body be well prepared and an understanding of safe, correct movement established in advance, and are therefore practiced toward the end of the class.

At beginner level, the selection of exercises from categories 7 and 8 should be limited. Simpler exercises for full body integration can be incorporated earlier in the choreography; however, overhead exercises should be introduced gradually.

Upright alignment of the body, standing balancing exercises and finally, eye contact between participants and trainer, make **excellent conclusions** to each session, irrespective of the level of the participants.

During an hour of intelligent movement, clients have become aware of their bodies, physically experienced the meaning of "good posture", and are increasingly able to integrate this experience into their everyday movements.

4.1.2 Functional Groups (Fig. 4.1)

Due to its holistic approach to movement, it is **difficult to subdivide the Pilates method** into exercises for specific regions of the body. Historically, exercise sequences were structured and taught according to levels of difficulty, ranging from "easy" to "hard." The emphasis was on learning the method in its entirety, rather than on training each individual according to their specific needs. Our focus lies in identifying those **functional links or relationships**, which enable the method to meet modern scientific standards. The Pilates exercises are therefore placed in a methodological context and linked to functional groups:

- Firstly, they are effective locally
- Secondly, they are interrelated

And they can be completely adapted to the individual requirements of clients.

The functional groups of the human body are summarized in ▶ **Overview 4.2** (Fig. 4.1a).

Overview 4.2 Functional Groups
- Cervical spine, head, and shoulder
- Thoracic spine and shoulder/arm region
- Core, pelvis, and leg
- Upper extremity
- Lower extremity

Cervical Spine, Head, and Shoulder (Fig. 4.1b)

Functionally and **biomechanically,** these three areas of the body are closely linked. The positioning and orientation of the sense organs (eyes, ears and vestibular system) requires a high degree of mobility. For **taking nourishment** and even **smelling and tasting**, trouble free, integrated movement of the head, tongue, and jaw mechanism must be assured.

» The human looks where the attention goes, the eyes, the spine and the entire body follow. (Feldenkrais 1981, 1985)

The importance of this functional group is reflected by the widely differentiated and complex interlinked **motor control systems** in the area of the neck and shoulder. Neurophysiological response patterns trigger **postural reflexes** of the head and sensory organs, a reflection of the healthy condition of the nervous system. Due to neurological, circulatory, muscle and fascial connections, the shoulder itself is a pivotal point for many body functions.

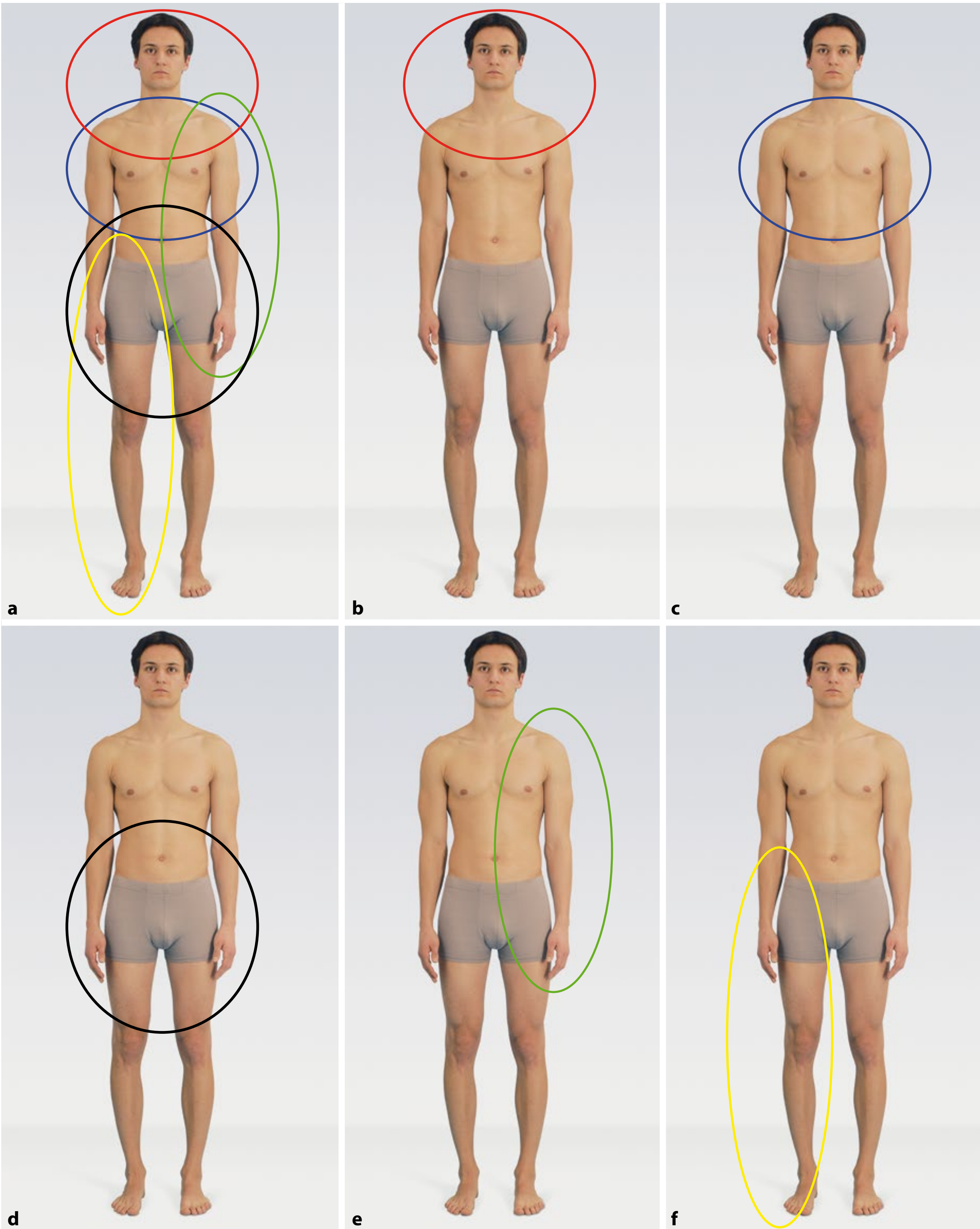
Thoracic Spine and Shoulder/Arm Region (Fig. 4.1c)

These two areas are inseparably linked during the transfer of forces and movement. Overhead movement of **both upper limbs simultaneously** demands mobility of the thoracic spine in the direction of extension; **single arm** movements require a combination of extension and rotational thoracic motion. The **movements of the shoulder blades** are directly linked to movements of the ribs and thoracic wall. Deficits in strength or connection in this area immediately affect function and may contribute to a variety of symptoms.

Core, Pelvis, and Leg (Fig. 4.1d)

Muscular, neural and bony connections link these three areas of the body directly and indirectly. Extensive multi-joint muscle systems and fascial slings transfer the forces from kinetic movement chains upward (cranially) and downward (caudally). Even small deviations in the alignment of this functional group can cause major problems and injury. The coordinated systems of global and local stabilizers, together with the moving muscle parts, provide **functional stability and motion control** (motor control). The superficial and deep muscles of the abdominal wall stabilize the core, whereby the connections to the diaphragm and pelvic floor play a crucial role. This motor control is achieved by a neurophysiologically correct trigger mechanism (**Feed-forward**, ▶ Glossary: see Hodges 1999).

The lower lumbar spine is of central significance during Pilates training, due to its key role in loading and the transfer of forces.



■ **Fig. 4.1a–f** Functional groups of the human body. **a** Full body view. **b** Neck, head, and shoulder. **c** Thoracic spine and shoulder/arm region. **d** Center of the body, pelvis, and leg. **e** Upper extremities. **f** Lower extremities

Upper Extremity (Fig. 4.1e)

With its delicate, highly sensitive range of fine motor control, the upper extremity is highly dependent, both actively and passively, on undisturbed functioning. The elbow, wrist, and particularly the thumb joint with its highly specialized gripping action, allow everyday activities to be completed without hindrance. The spiral arrangement of muscle systems permits **complex fine and gross motor control movement chains** to be generated. In terms of physiological evolution, the significance of the upper limbs in weight-bearing has been lost. Generally, the transmission of forces operates through an **open kinetic chain** (▶ Sect. 8.4.1).

Lower Extremity (Fig. 4.1f)

The lower limb provides the point of contact with the ground. **Locomotion** – walking, running, jumping, dancing, sports, etc. – is only possible through use of the legs. The gait pattern can be an expression of individual personality; running can be a life-saving activity or, in certain situations, be critical in achieving a goal. The evolutionary development of an upright stance and gait provided human kind with crucial advantages, and problem free and fluid locomotion remain important goals for Pilates training. The transmission of forces to bony structures takes place via spirally arranged muscle systems, primarily in a **closed kinetic chain** (▶ Sect. 8.4.2).

4.1.3 Functional Anatomy

Connective Tissue

Connective tissue provides the central **matrix** for all systems within the body, performing multiple functions. Van Wingerden (1998) identified the following **types of musculoskeletal tissue:**

- Normal connective tissue (tendons, ligaments, joint capsules, skin)
- Connective tissue with specific functions (adipose, elastic, mucous, lymphatic)
- Cartilage (hyaline, elastic, fibrous)
- Bone

Three types of fibers form connective tissue:

- Collagen fibers (e.g., tensile strength of joint capsules, ligaments, muscle fibers)
- Reticular fibers (network of smooth muscles/organs)
- Elastic fibers (age-dependent, rehabilitation-specific)

The genetic framework, as well as physiological adaptations, is decisive in terms of the precise combination of fiber types. An understanding of these processes can assist during Pilates training, allowing an emphasis on supportive stimuli and avoiding disruptive factors.

Noncontractile Structures

Structures such as **fascia, ligaments and joints** are the focus of particular attention. Indirectly, the attributes of these structures function as regulating variables for the efficiency of all actions. During Pilates training, these inert (nonactive) structures are loaded or unloaded through the conscious positioning of the body and specific postural instructions during movements.

Bony Structures

Attention should be paid to bony structures during Pilates training for several reasons:

- Bone is a **reactive changing tissue** that alters specifically in response to loading. Therefore, consideration needs to be given to the specific distribution of load during an active program of exercise. These physiological and pathophysiological issues necessitate a differentiation between Pilates mat and equipment training. The compressive forces which are required by long bones and the vertebrae, in order to increase bone density, are more easily attained using the Pilates equipment (e.g., reformer and chair) than on the mat.
- Variations in alignment and length of levers occur as a result of differences in **physical type**. Traditionally designed exercises for an average body size (up to 1.70 m), or extremities which vary substantially from the average in terms of length, may significantly alter the character of an exercise or its feasibility.

Tendons and Ligaments

Ligaments are the connecting and force-transference structures which link bone to bone. **Tendons** connect bones with muscles. Both structures fulfill a powerful **proprioceptive function**, serving as sensors allowing the body to respond appropriately to stress.

Fascia

The form-providing component of connective tissue, fascia surrounds all muscles and organs and interconnects them; until recently it was considered to play a purely passive role. However, it was known, that damage to the fascia (e.g., resulting from surgery or extensive burns) could strongly affect the mobility, circulation and function of related structures. This disruptive effect on fascial connections can be transmitted across **greater distances**, e.g., a retraction of the fascia of the foot could disturb the flow of movement throughout the body, to the extent that symptoms become apparent in the shoulder and neck area.

More recent research results have shown that fascia plays an extensive role in pain transmission. By virtue of its capacity to alter its tension, it can be designated **active tissue** (see Schleip 2009).

Some alterations in noncontractile structures are provided as examples.

Example

Possible Changes of Noncontractile Structures

- **Leg axis:** in an optimally adjusted leg axis, the center of the hip joint, the center of the patella and the 2nd metatarsal are aligned.
- **Valgus/varus position:** deviations from the optimal position of the legs are the valgus (knock-knee) or varus positions, which amongst other things may be caused by a physiologically immature anteversion of the femoral head or a tibial torsion of the lower leg.
- **Scoliosis:** is a misalignment of the spine, usually with a strong rotational component, triggered by an unclear etiology. The results are movement losses at all levels.
- **Anatomical leg length inequality:** disturbed growth may cause a discrepancy in leg length, which cannot be altered.

A **physical assessment** of the client, leading to a specific, adapted **program of exercises,** can facilitate meeting desired training goals. Additional measures (manual therapy, stretching, etc.) to improve the quality of the noncontractile structures may also facilitate improved results from Pilates training.

Contractile Structures

Due to their function of **dynamic-active stabilization** during all movements, muscles play a pivotal role in any form of exercise, including Pilates.

Core Stabilizing Muscles

The **core stabilizing muscles are of great significance** in the **traditional,** established concept of the active organization of the human musculature:

- The abdominal muscles (vertical and oblique) are grouped around the center of the body
- In synergy with the **back muscles** (directly and indirectly)
- The horizontal systems of the pelvic floor and diaphragm participate in active stabilization

! Combined action of the abdominal, back, pelvic and diaphragm muscles is referred to as the power cylinder (formerly: Powerhouse) (Table 4.1). This center of power provides the foundation for the organization of movements at the periphery (extremities).

Hierarchy of Muscular Activation

The **hierarchy of muscular activation** is biomechanically significant, and substantiated by various authors (Hodges 1999; Vleeming et al. 2007).

Table 4.1 Power cylinder vs. powerhouse

Powerhouse (former definition)	Power cylinder (expanded definition)
M. transversus abdominis	M. transversus abdominis
Mm. obliquus internus/externus	Mm. obliquus internus/externus
M. erector spinae, M. multifidus	M. erector spinae, M. multifidus
	Diaphragm
	Pelvic floor

! Muscles located close to the axis of rotation should be activated as local stabilizers, before the global stabilizers are engaged (and therefore require an appropriate performance capacity).
→ Core stability is primarily a matter of timing and not of force!

From the perspective of the Pilates method, contractile structures are typically considered within a whole body context. Traditionally, the focus lies on **anatomically significant relationships**, e.g.:

- Upper body and core muscles as a unit supporting the upper extremities
- Trunk, pelvis and leg muscles supporting the lower extremities

The **pelvis** plays a central role in the transmission of forces.

The findings of Feldenkrais (1981, 1985), Vleeming et al. (2007), Hodges (1999), Larsen (1997), Myers (2004) confirm the preferred perspective of "functional anatomy" over the last 25 years (as opposed to purely "topographical anatomy") and provide a sound scientific starting point for training.

Muscle Slings According to Vleeming (2007)

! Axial elongation during a movement refers to the spatially optimally organized range of motion, accessible by means of muscle slings.

Larger muscle groups and their fascial connections work together as **force couples**. No muscle works in isolation: the optimal interaction of myofascial systems allows for functional, coordinated movement and ensures the stability and protection of joints.

According to Vleeming (2007), the muscle sling network is comprised of **four systems** (Fig. 4.2).

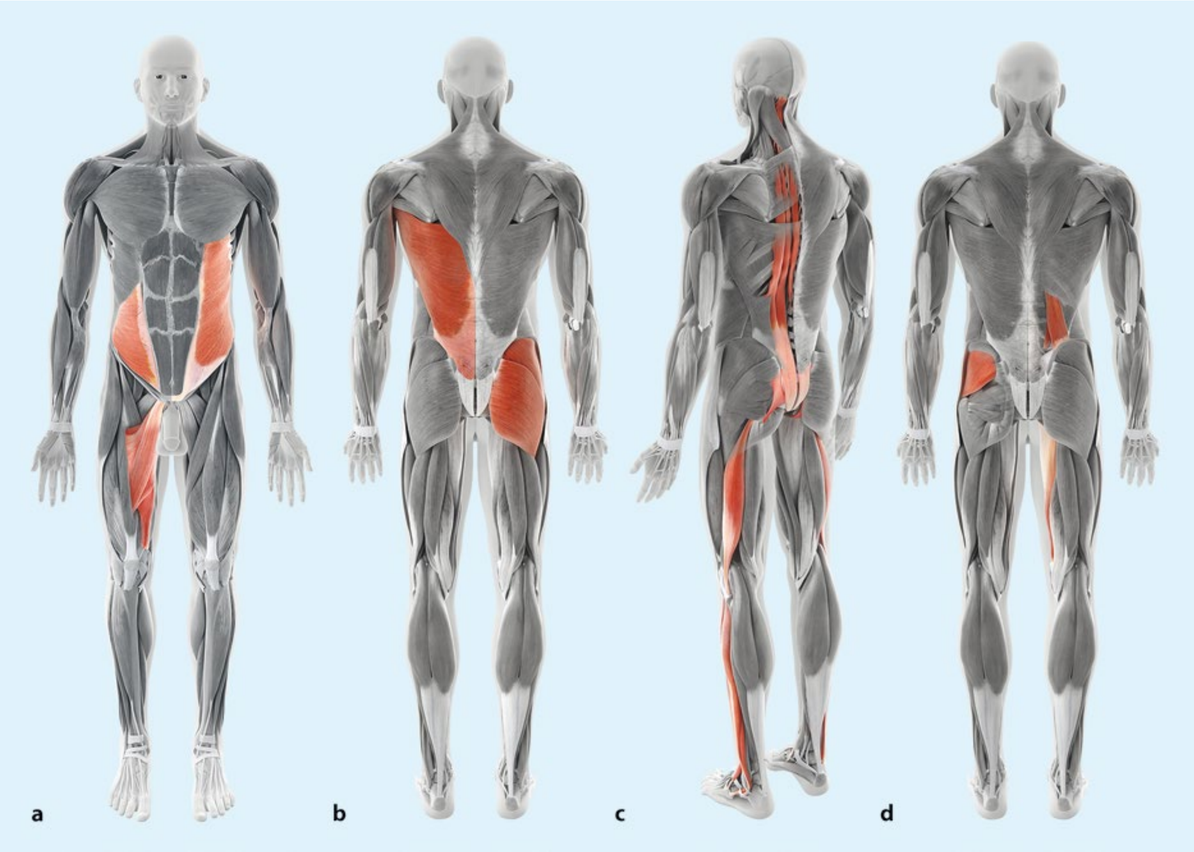


Fig. 4.2a–d Muscle slings. **a** Anterior Oblique System, **b** Posterior Oblique System (POS), **c** Deep Longitudinal System (DLS), **d** Lateral System (LS) (by Vleeming et al. 2007).

Anterior Oblique System (AOS, Fig. 4.2a)

- External oblique muscle (M. obliquus externus abdominis)
- Contralateral internal oblique muscle (M. obliquus internus abdominis)
- Contralateral adductors

Function: The **AOS** contributes significantly to force closure of the symphysis pubis and sacroiliac joints.

Posterior Oblique System (POS, Fig. 4.2b)

- M. latissimus dorsi
- Thoracolumbar fascia
- Contralateral M. gluteus maximus

Function: The **POS** contributes to closure of the sacroiliac joint and the transfer of forces to the pelvic girdle during rotational movements and walking.

Deep Longitudinal System (DLS, Fig. 4.2c)

- M. erector spinae
- M. multifidus
- Sacrotuberous ligament
- M. biceps femoris
- M. peroneus longus
- M. tibialis anterior

Function: The **DLS** is involved at every step during walking, and in the transfer of kinetic energy to the upper torso; the M. Biceps Femoris functions as a link between the lower extremities and the pelvis.

Lateral System (LS, Fig. 4.2d)

- Mm. gluteus medius and minimus
- Contralateral adductors
- Contralateral M. quadratus lumborum

Function: The muscles of the **LS** ensure functional stability of the pelvis while walking and standing.

Physiological Muscle Behavior: Active and Passive Muscle Insufficiency

If a muscle actively moves a joint component to the end of movement range (e.g., knee flexion), the Z-lines within the muscle are forcefully pressed against each other to the extent that no further active motion is available. We refer here to an **active insufficiency** (weakness) of the muscle. This phenomenon can arise during more complex Pilates exercises. The perceived weakness may be interpreted by the subject as a spasm.

Passive insufficiency is caused by lengthening of the muscles, combined with a passively triggered movement inhibition. Biomechanically, the neuromuscular inhibition plays a more significant role than the connective tissue shortening.

These two principles should be considered during positioning and execution of Pilates exercises.

Muscle Conditioning

Considering the increasingly complex, holistically significant nature of these muscle systems enhances the spectrum of Pilates exercises and lends them broader significance. Nevertheless, widely **accepted, general principles** of muscle training and development can be discussed at this point, and should be considered when setting training goals to be met by means of Pilates exercise (Digression ► “General Training Principles”).

Overview 4.3 Basic Considerations at the Beginning of a Training Session

1. Assessment and examination of the affected structures
2. Phase of wound healing
3. Factors influencing wound healing
4. Identification of sport-specific attributes
5. Determination of performance level
   Points 1–3 are applicable to rehabilitation, points 4 and 5 to preventative exercise and sports for health.

Overview 4.4 The Top Ten Principles of Training Planning

1. Length of training: the time available in days, weeks, months
2. Intensity: resistance/amount of loading
3. Repetitions: the number of repetitions, dependent on weight and speed
4. Series: number of sets, dependent on training objectives
5. Overload: an effective load stimulus must exceed the normal, everyday demands
6. Frequency: the number of training sessions per day/week
7. Transferability: the task set should reflect the specific goal of training
8. Specificity: the selection of exercises should reflect sport-specific factors
9. Exercises: the selection of exercises should be based on functionality, i. e., have relevance to activities of daily living
10. (Micro-)Periodization: may include allowing for the scheduling of recovery periods, amongst other factors (Van Wingerden 1988, p 307)

Pilates Training

Effective training for strength, in accordance with the fundamentals of current training theory, is also possible using the Pilates method. Abandoning the prevalent view of Pilates as “a gentle wellness concept” allows for a broader perspective on both the Pilates mat and equipment exercises.

However, it cannot be assumed that the complex exercises presented here will achieve an adequate training effect in cases of major dysfunction. **Targeted, isolated,** and particularly **daily exercise** over extended periods may be necessary, in order to compensate for deficits. In the following two ► discourses, Pilates training protocols are presented for functional disorders of the pelvic floor, and for the activation of the transversus abdominis.

Example

Pelvic Floor Training

Goal of treatment

Reestablish timing and coordinated activation of the pelvic floor muscles (functional co-contraction of the muscles of the cylinder).

Exercise instructions

- Three times per day, contract the pelvic floor muscles approximately 10 times, for 10 seconds per time, increasing the contraction gradually to around 50 % (training for muscular endurance).
- Practice contraction initially during exhalation, later in combination with inhalation.
- Practice contraction during spinal extension.
- Practice contraction during spinal flexion.
- Pay attention to upright posture during daily activities, particularly when coughing or sneezing.
- Combine pelvic floor activation with training for the M. transversus abdominis.

Example

Transversus Abdominis Training

Goal of treatment

Re-establish timing and coordinated activation of the transversus abdominis muscle (functional interaction of the cylinder muscles).

4

Digression

General Training Principles

The following rules apply to training during rehabilitation and general sports for health, as well as to competitive sports.
Training target
The **training target** dictates:

- Intensity
- Duration
- Frequency of exercise

In order to enhance motor abilities such as strength, endurance, flexibility, agility and coordination, the body must be subjected to sufficiently large stimuli. "Challenging the body, without overwhelming it, and perhaps provoking (new) injuries" (Van Wingerden 1998, p 293).
The higher the starting level, the greater the challenge provided must be, in order to achieve the desired improvement (adaptation). "The term training refers generally to all processes that generate development. … Training effects occur in humans through the processing of stimuli" (http://www.wikipedia.org/training).

Training Plan

Assuming the presence of an injury, Van Wingerden (1998, p 298) begins with 5 fundamental considerations to be clarified when beginning a training session (▶ **Overview 4.3**).
After appropriate examinations and tests, training can proceed, with the assistance of the **top ten of training design** (Van Wingerden 1988, p 303) (▶ **Overview 4.4**).

Strength Building

Whether in the field of preventative exercise or of rehabilitation, strength is a primary component of a complete training program and represents the dominant, performance dictating factor (van Wingerden 1988, p 312).
We can distinguish between **two aspects** of strength:

- General (nonsport related) strength
- Specific (sport specific) strength

Strength capacity (Fig. 4.3) is manifested as

- Maximum strength
- Speed strength
- Reactive strength
- Endurance

Strength is always a combination of the above (Weineck 2010, p 371).

Maximum Strength

"Maximum strength represents the amount of power that the nerve-muscle system is able to generate, through maximum voluntary contraction" (Weineck 2010, p 371).
Strength is measured as **maximum load**, F_{max}, or in 1 RM (1 repetition maximum) (Gottlob 2001, p 71). Weineck does not consider measurements based on 1 RM useful, considering them inaccurate due to their dependence on a variety of additional factors (Weineck 2010, p 403).
Maximum strength can be subdivided into:

- Static maximum strength
- Dynamic maximum strength

Maximum strength is dependent on the following **components**:

- The physiological muscle profile
- Inter-muscular coordination (coordination between the muscles that work together during a movement)
- Intra-muscular coordination (coordination within the muscle) (Weineck 2010, p 373)

Speed Strength

We refer to speed strength when the body or limbs (arms, legs) propel objects (ball, ball, spear, etc.) at maximum speed (Weineck 2010, p 374). "Speed strength is heavily dependent on sport- or training-specific factors" (Weineck 2010, p 376).
The determining factor for performance will be the proportion of:

- **FT fibers** (type-II or white fibers): fast-twitch fibers, trained using maximal strength training with low reps and explosive movements, in relation to
- **SL fibers** (type-I or red fibers): slow-twitch fibers, trained using mid-range resistance, high repetitions and during endurance sports.

The proportion of muscle fiber types is genetically predetermined.
By selective training of fast-twitch fibers and increasing the cross section of a muscle, "a certain shift of its fiber percentage composition can be achieved" (Gottlob 2001, p 75) and the speed or explosive strength of a talented athlete increased (Weineck 2010, p 375).

Reactive Strength

Reactive strength is defined as "muscle action which generates an increased output of force, within a stretch-shortening cycle (SSC)" (Weineck 2010, p 378). All **jumps** and **sprints belong to this category.**
Training for reactive strength is achieved through dynamic maximal strength conditioning, and demands a high level of coordinative ability. Physiologically, SSC is dependent on the elasticity of tendon tissue (Weineck 2010, p 379).

Endurance

Strength endurance is determined by the factors of **strength** and endurance/**stamina**, "and can be defined as maximum strength dependent, ability to resist fatigue when subjected to prolonged, repeated loading during static or dynamic muscle work" (Ehlenz et al. 2003).
The training guidelines and methods are very different (Weineck 2010, p 379) and consequently, require adaptation to the specific sport. Training for endurance is achieved most effectively by utilizing:

- Higher resistance
- Frequent repetition of the training stimuli
- Muscle work closely approximating or conforming to the sport specific pattern of motion

The Interdependence of Strength and Other Main Motor Skills

- **Strength and speed**: speed and quickness are highly dependent on strength.
- **Strength and mobility: only extreme forms of muscle growth (weightlifting) are likely to lead to restricted** movement. Otherwise, there is no significant alteration in levels of mobility as a direct result of increasing or decreasing strength.
- **Strength and coordination skills:** coordination is not negatively affected by increasing strength. However, impairment of fine motor control is a possibility, directly following weight training.
- **Strength and long-term endurance:** the exchange and removal of metabolic waste is affected by an enlarged cross-section muscle (conditions for diffusion are impaired), leading to decreased levels of endurance.

However, higher maximum strength is advantageous for strength endurance (when overcoming resistances of 50 % F_{max} and higher; Weineck 2010, p 385).

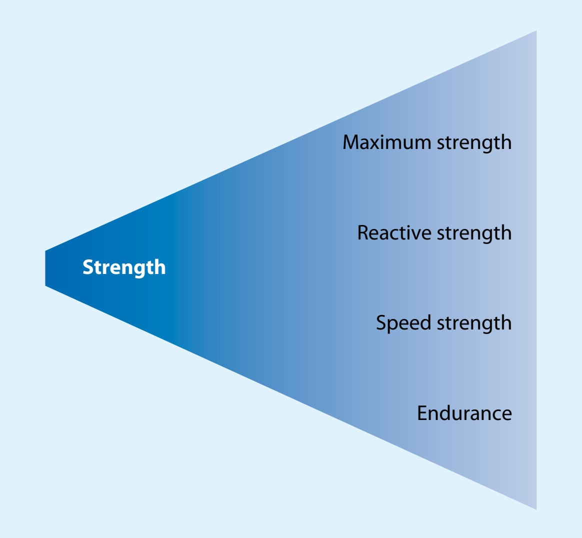


Fig. 4.3 Strength and strength performance

Digression

Patients with Pelvic Floor Dysfunction

- It cannot be assumed that students will have appropriate awareness or control of the pelvic floor.
- Pre-contraction of the pelvic floor muscles prior to coughing and sneezing is frequently absent in women with pelvic floor dysfunction.
- Patients with dysfunction do not experience reflex contraction of the pelvic floor musculature during general exercise (Junginger 2009a,b). On the **contrary**, abdominal training (specifically exercises with flexion and raised upper body) may place stress on the pelvic floor in patients with existing dysfunction (Keller et al. 2007.)
- Patients with pelvic floor dysfunction frequently exhibit SIJ issues and an inability to engage the **transversus abdominis** muscle.
- Patients with SIJ problems are prone to incontinence (Hamilton 2009).

The themes of pelvic floor weakness or incontinence, and a possible relationship to back pain, should be addressed briefly at the **beginning of a training session**. Newcomers / beginners may be reluctant to raise the issue themselves. An offer to answer questions privately after a group session, or to provide relevant information or specific exercise literature is often gratefully received (▶ Example of pelvic floor training: goal and exercise instruction).
Daily training is recommended, in order to regain motor control and pre-contraction of the pelvic floor (integration into everyday life).

Digression

Targeted activation and engagement of the transversus abdominis muscle

The transversus abdominis (TrA) exhibits an involuntary anticipatory pre-contraction, independent of the direction of, and fractions of a second prior to, movement (feed-forward mechanism ▶ Glossary). Together with the muscles of the pelvic floor and the deep fibers of the multifidi, it contributes to stabilization of the lumbar region (power cylinder). Studies by Hodges et al. (1999) show that the pre-contraction of TrA is "inhibited" in patients with chronic back pain, and others,
Daily training for the TrA is recommended, to reestablish motor control and pre-contractive capability.
The deepest portions of the multifidus also form part of the power cylinder. To target and activate these portions selectively, Hamilton (2009) advises the instruction "Attempt to make a hollow back, but don't make one!" and to maintain this activation, as described below. This targeted activation has proven equally as effective for issues in the cervical area, as in the lumbar region (▶ Example of transversus abdominis training goal and exercise instruction).

Exercise instructions
- Exercise in prone, supine and quadruped positions.
- Three times per day, draw the navel inward 10 times for approx. 10 seconds each, gradually increasing contraction to around 50 % (training for muscular endurance). Keep breathing!
- Next, practice contraction during exhalation, later coordinated with inhalation.
- "Carefully separate an inner muscle corset from the outer layer of the skin."
- "Imagine a silken thread between navel and vertebrae, drawing them together."
- Avoid coactivation of the global superficial muscles (Mm. obliques, rectus abdominis – the ribs should remain mobile when breathing; avoid the common Pilates cue to "close your ribs")
- Combine the above with pelvic floor exercises.

Physiological Training Stimuli

Depending on **tissue structure** and **type**, differing stimuli lead to adaptation, and corresponding healing and strengthening of the tissues.

Muscle Tissue

This highly vascularized muscle tissue responds to **dynamic movement stimuli** with alignment and growth. Crosslinks (▶ Glossary) caused by injury can be reorganized into sound structures.

4

Table 4.2 Physiological training stimuli

Structure	Training stimuli
Muscle	Active movement
Bone	Axial compression
Tendons	Movement with a stretching component
Ligaments	Movement of the joint (without stretching) with muscular stabilization
Nerves	Movement and learning stimuli

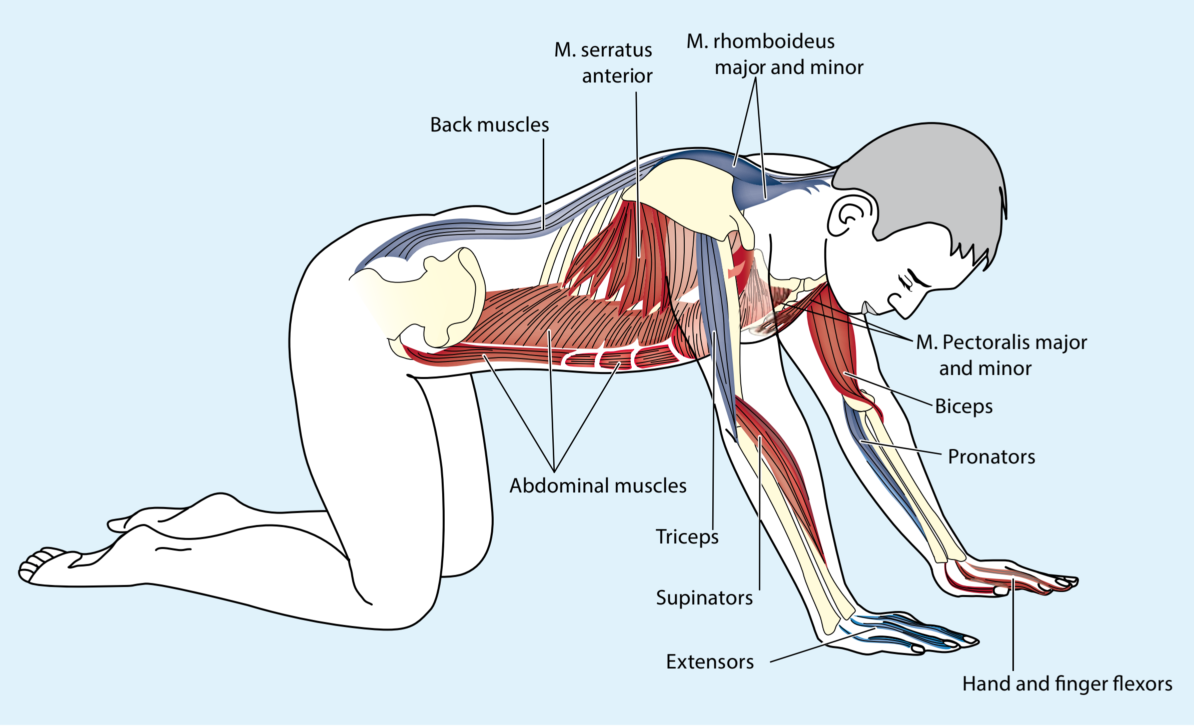


Fig. 4.4 Engagement of the muscle systems of the shoulder girdle: quadruped. Internal (*red*) and external (*blue*) muscle systems.

Bone Tissue

Also highly vascularized, the alignment and consistency of bone cells is enhanced when bone tissue is subjected to targeted pressure. Bone requires **axial loading, in order** to regenerate its structure normally.

Tendon Tissue

The more weakly vascularized tissue connecting muscles with bones is realigned and strengthened, when subjected to moderate traction. Movements with a stretching component offer an ideal functional stimulus.

Ligaments

Ligament tissue is poorly vascularized, and will hardly alter in either quality or quantity, in response to active movement impulses. Rather, a damaged ligament requires **protection** from further damage and premature stress, which can be achieved by stabilization of the surrounding structures.

Nerve Tissue

The peripheral and central neural structures and their stimuli must be differentiated here. It is thought that **peripheral movement stimuli** affect the peripheral nerves (skeleton), which respond with an effect, **known as budding or sprouting**. In contrast, central nervous structures and tissues (brain / spinal cord) can probably not be re-formed. The function is effectively learned anew, by previously unused tissues. Therefore, the stimulus can best be described as a **physiological learning stimulus** (Table 4.2).

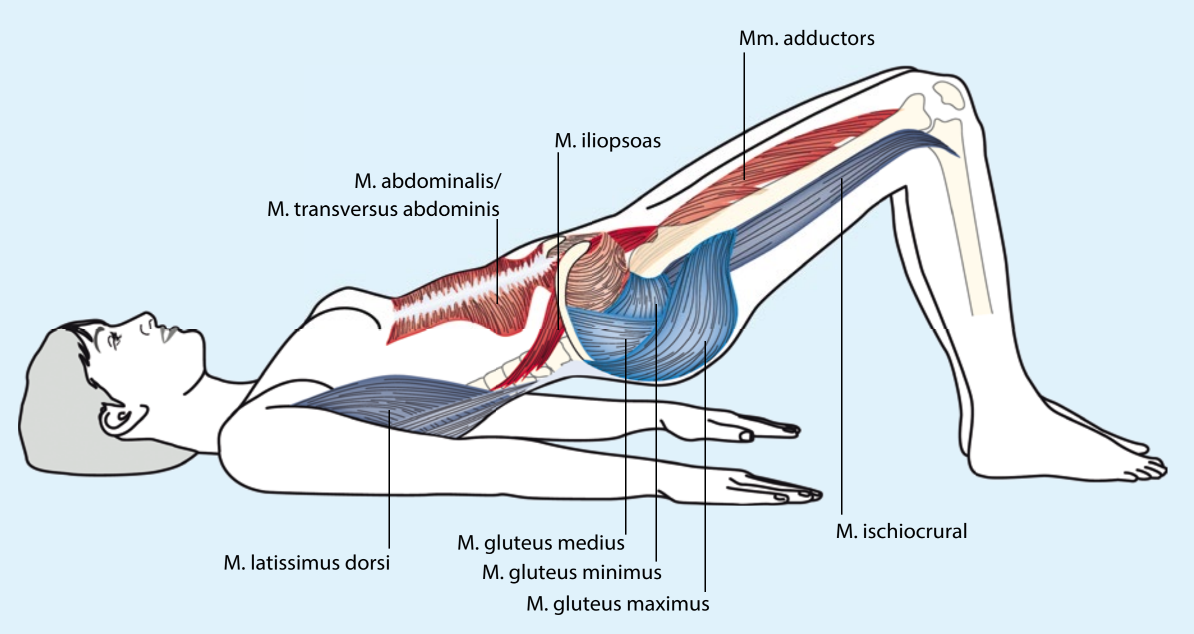


Fig. 4.5 Engagement of the muscle systems of the pelvic girdle: bridging. Inner (*red*) and outer (*blue*) muscle systems

4.1.4 Functional Biomechanics

The following section defines important and functionally significant systems, to facilitate and clarify their application during Pilates exercise.

Inner and Outer Muscle Systems of the Shoulder Girdle (Fig. 4.4)

The term muscle systems of the shoulder girdle, refers to the synergistically linked, muscle groups of the thoracic cage, torso and arm.

The major muscles of the two systems are:

- **Inner muscle system:** Mm. pectoralis major and minor, abdominals, M. biceps brachii, forearm pronators, flexors of the hand.
- **Outer muscle system:** M. serratus anterior, Mm. rhomboidei, the back muscles, M. triceps brachii, supinator muscles of the forearm, extensor muscles of the hand.

Inner and Outer Muscle Systems of the Pelvic Girdle (Fig. 4.5)

The term muscle systems of the pelvic girdle refers to the activated musculature surrounding the ilium, the sacroiliac joint, lumbosacral junction and the hip joint.

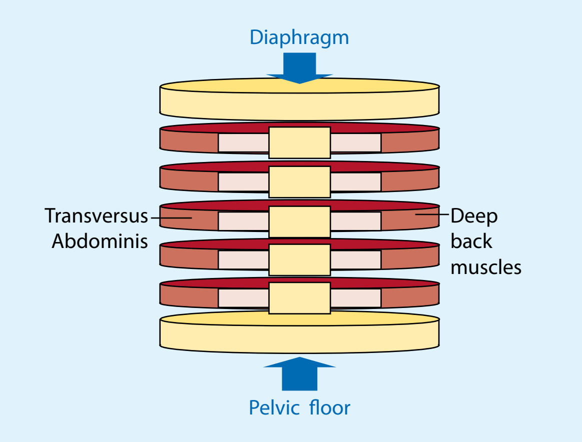


Fig. 4.6 Breathing: Biomechanics

The major muscles of the two pelvic systems are:

- **Inner muscle system:** M. transversus abdominis, the pelvic floor muscles, M. iliopsoas, adductors.
- **Outer muscle system:** Mm. gluteus maximus, minimus and medius, M. latissimus dorsi, M. longissimus (thoracolumbar fascia) and the pelvic floor muscles.

Respiratory Muscles (Fig. 4.6)

During basal respiration, the diaphragm is in synergy with the indirect resonance of the pelvic floor, and the core muscles responsible for the power of breath. The force generated by the lowering and rising motion of the diaphragm

4

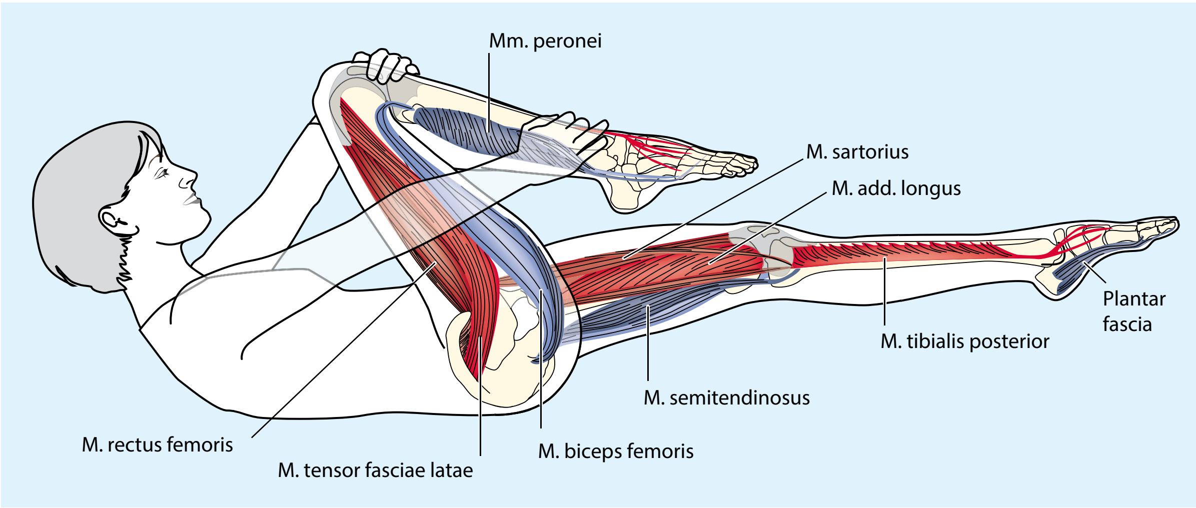


Fig. 4.7 Muscle systems of the lower extremity: Single Leg Stretch

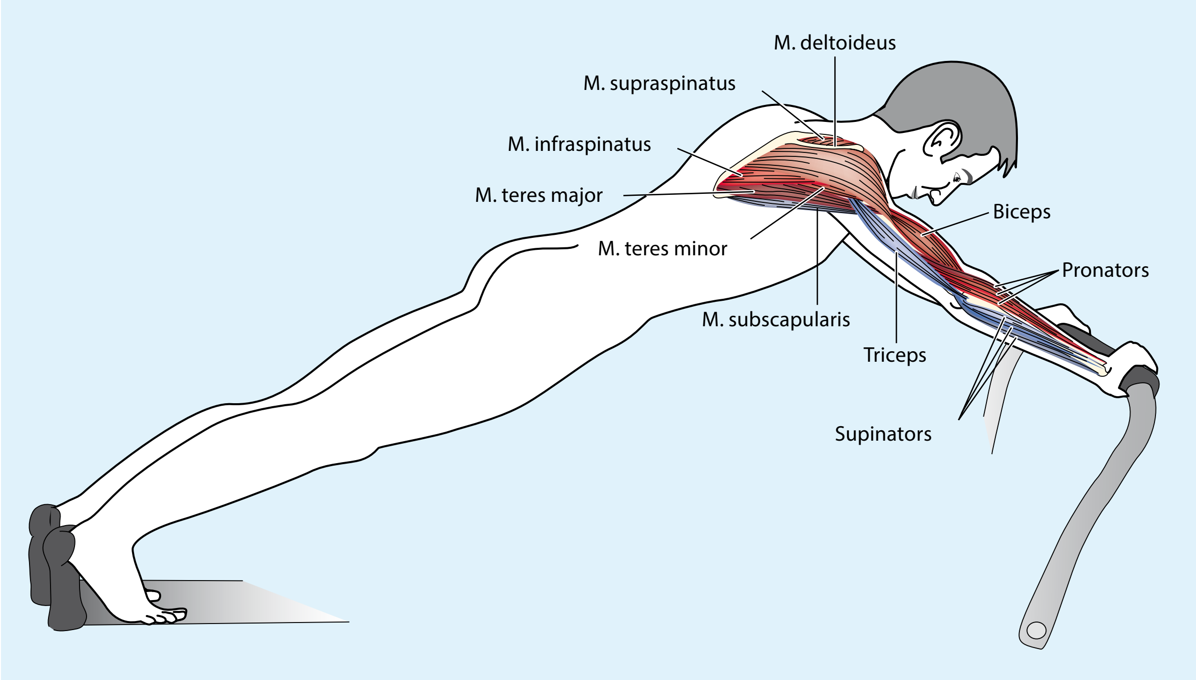


Fig. 4.8 Muscle systems of the upper extremity: Long Stretch

is therefore dependent on the interaction of both active and passive trunk structures. During **forced breathing**, additional muscles are recruited:

- **Inhalation**: muscles that expand the thoracic space – Mm. external intercostals, M. trapezius, M. levator scapulae, M. sternocleidomastoideus and Mm. scaleni
- **Expiration:** abdominal muscles, Mm. internal intercostals, M. latissimus dorsi
  Respiratory movement is three-dimensional.

Lower Extremity (Fig. 4.7)

The lower extremity is actively grounded through the **big toe when standing**, and engaged through abduction/flexion and via the connection to the long toe flexors. The **arch of the foot** is actively maintained by means of the functional stirrup of the tibialis posterior and peroneus muscles.

Alignment of the **knee axis** is maintained diagonally through the active connections of the abductors and adductors, and the anterior (quadriceps, sartorius) and posterior (hamstrings, gastrocnemius) muscle chains.

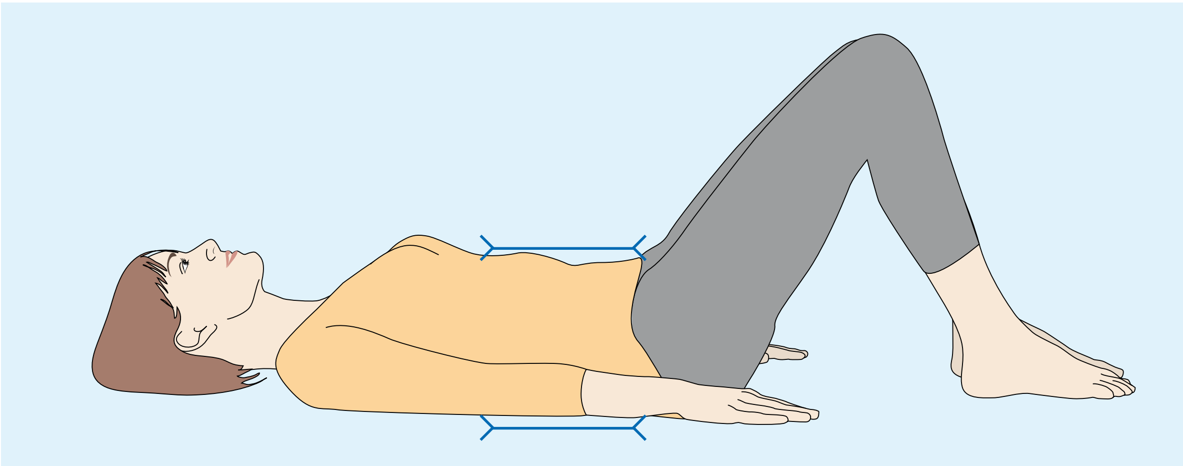


Fig. 4.9 Neutral spine position: bridging, starting position (supine, legs bent)

Upper Extremity (Fig. 4.8)

Congruence of the articulating surfaces of the humerus and the glenoid fossa at the shoulder joint is maintained by the rotator cuff muscles (Mm. infraspinatus and supraspinatus, M. subscapularis, and M. teres minor), the M. deltoideus, Mm. biceps and triceps brachii. The **rotational alignment** of the arm is determined by the pronators and supinators of the forearm, as well as the anterior (M. biceps) and posterior arm stabilizers (M. triceps brachii, M. anconeus). The delicate, multifunctional finger and hand muscles determine the alignment of thumb and fingers.

The various muscle systems are activated to differing degrees depending on function, but always as part of a **synergistic co-contraction**. Therefore weakness or contraction of individual muscles or muscle groups may cause wide reaching destabilization of entire functional groups.

4.1.5 Pilates-Specific Terminology

A number of important and functionally significant stances and body positions will be clearly defined In the following section, and their relevance and applications for Pilates exercise clarified. The **exercise instruction** given both consciously and unconsciously during Pilates training is based on current principles of biomechanics. Specific principles which facilitate a deeper understanding of the movements will be considered in more detail.

Neutral Spine Position (Fig. 4.9)

The organization of the core or center of the body is fundamental to the Pilates method, therefore particular emphasis must be given to this area. Pilates himself instructed a position of flattened **lumbar lordosis** (Flat back/Imprint) for many exercises. Based on his assumption that the typical alignment of the spine during early childhood represented the initial and most natural alignment, Pilates recommended a straight spine for general posture and during standing exercises.

In contradiction of this original assertion, an alignment which respects the **physiological curvatures of the spine** was recommended in subsequent years. However, maintaining this position of static stability during exercises of a dynamic nature, created issues of clarity for both instructor and client/participant.

The common goal of these differing approaches remained, to ensure stable, functional relationships between the various components of the spine.

The correct definition of a neutral spine position is the positioning of contractile and noncontractile structures at the midpoint between the respective, available ranges of motion.

The neutral position, results in equal distribution of forces through all spinal segments.

Warning
Terminal range positions should be avoided, as they increase the risk of overloading and injury.

It is necessary to determine the most functional position for each individual and exercise specifically.

Example
Cueing Starting Position: Prone and Supine

- **Supine position**: rest the sacrum and the lower ribs flat on the mat, under dynamic tension ("active supine starting position").
- **Prone position:** using the cue to "roll the tailbone slightly inward", tension is established from the sitting bone toward the heel, the pelvis is stabilized and the

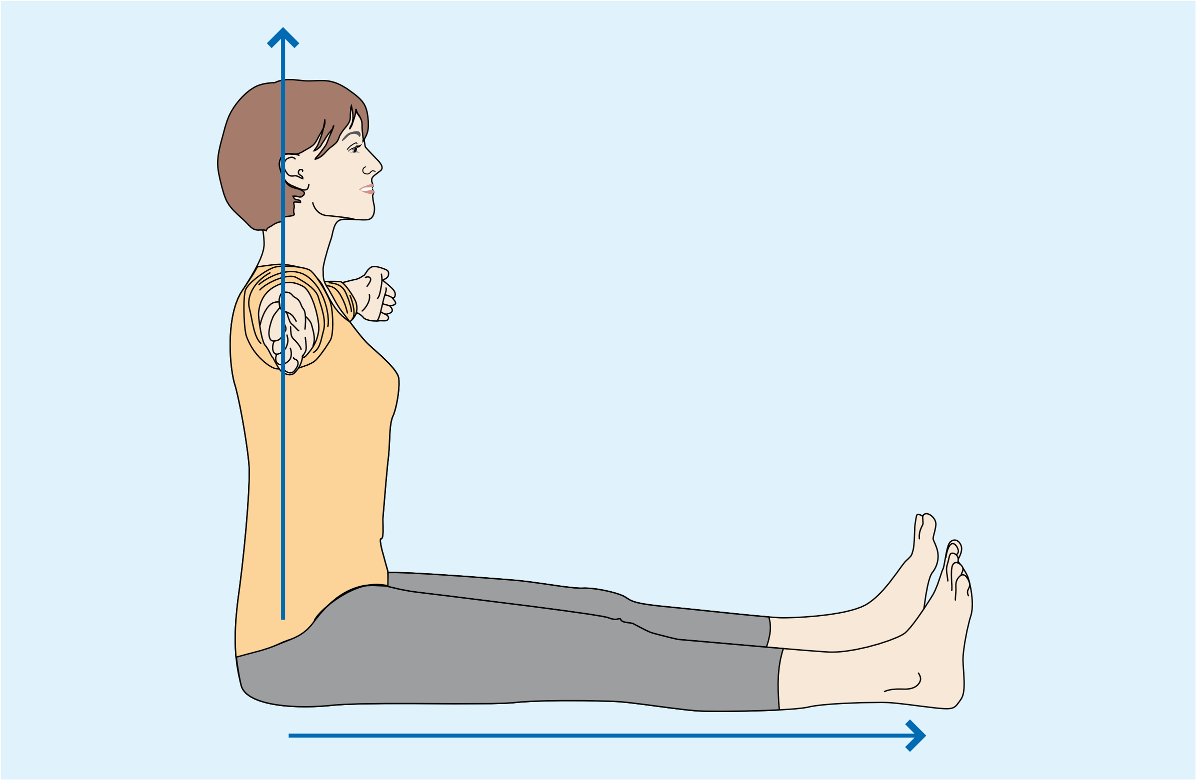


Fig. 4.10 Axial Elongation: Spine Twist seated, starting position

lumbopelvic and hip region engaged ("active prone starting position").

The meaning of an active starting position is: to create axial elongation through dynamic tension.

Axial Elongation (Fig. 4.10)

The term refers to an organization of the body, which allows compression to be minimized, and passive / active **congruence** to be optimized. Different patterns of engagement, and positioning of both the trunk and extremities, may be required, depending on the orientation to gravity.

Finally axial elongation creates space for **movement** within the joints, simultaneously reducing destructive friction and compression, and increasing **Tensegrity** (▶ Glossary) through dynamic tension.

The Connection of Ribs and Pelvis (Fig. 4.11)

Organizing the midsection of the body as described, through engagement of the contractile structures, provides a solid foundation for Pilates exercise. Within the momentum of a dynamic exercise, however, a characterization of the relationship between two moving components is more useful than a description of a static position. For this reason, the connection between the upper (**ribs / chest**) and lower (**pelvis**) sections of the body during Pilates training, is emphasized.

Example

The Connection of Ribs and Pelvis

In the resting position (neutral position), e.g., supine, the lower ribs should rest on the ground, and all three points of the sacrum should also maintain contact with the floor or mat.

Even (Segmental) Articulation (Fig. 4.12)

Spinal movements should be executed sequentially, to allow for the even **distribution of forces**.

» Distribution of movement equals distribution of force. (Anderson 2004)

» You must press something down, to lift something up. (Lesson 2011)

A model that can be applied to all movement planes has been selected to illustrate this principle. Two oppositional movements occur simultaneously, the **convex** (lengthening) and **concave movement** (shortening). The ratio of the two movement ranges to each other remains relatively constant.

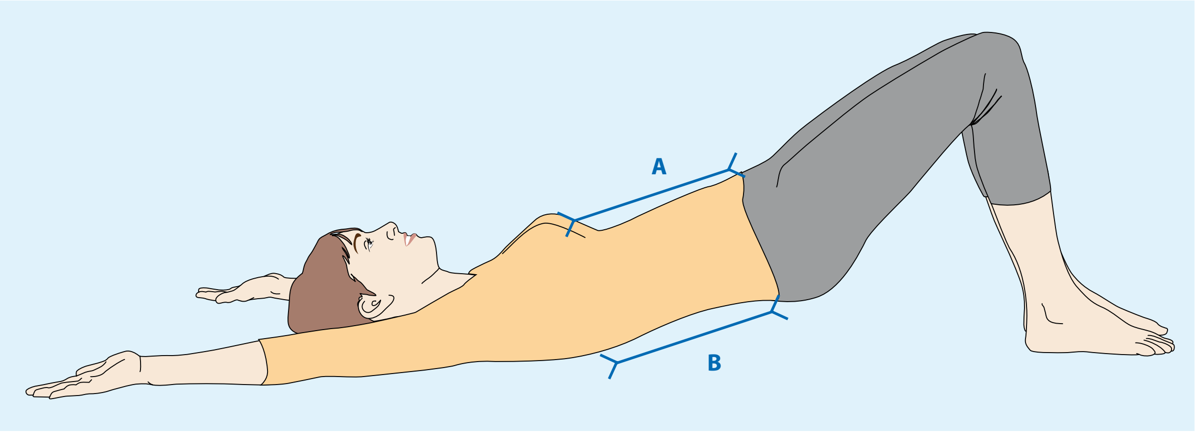


Fig. 4.11 Connection of ribs and pelvis: Bridging, end position

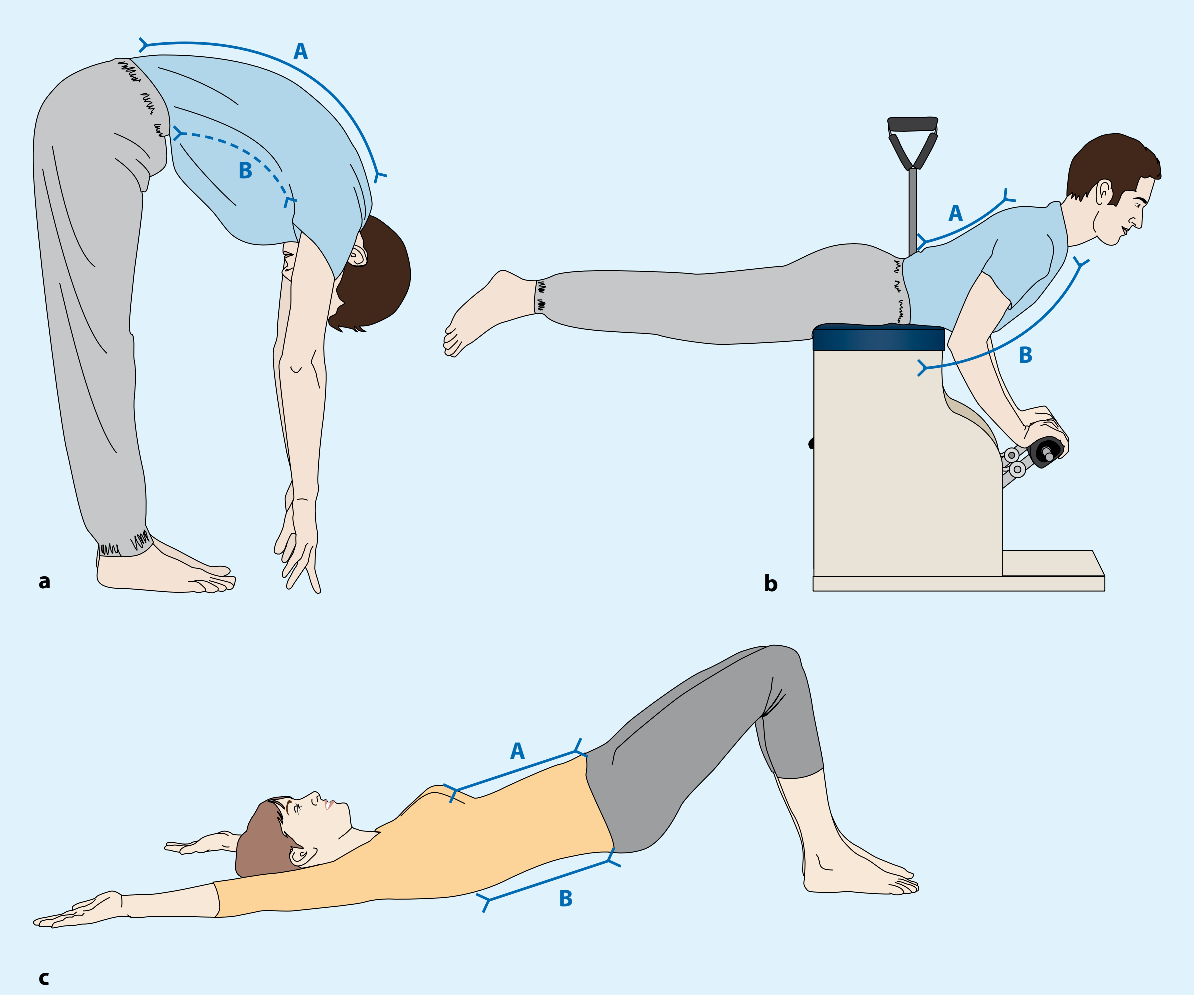


Fig. 4.12a–e Even (segmental) articulation. **a** Flexion: Half Roll Down, **b** Extension: Swan, **c** Neutral position: Bridging, end position, **d** Lateral flexion: Mermaid, **e** Rotation: Spine Twist, end position

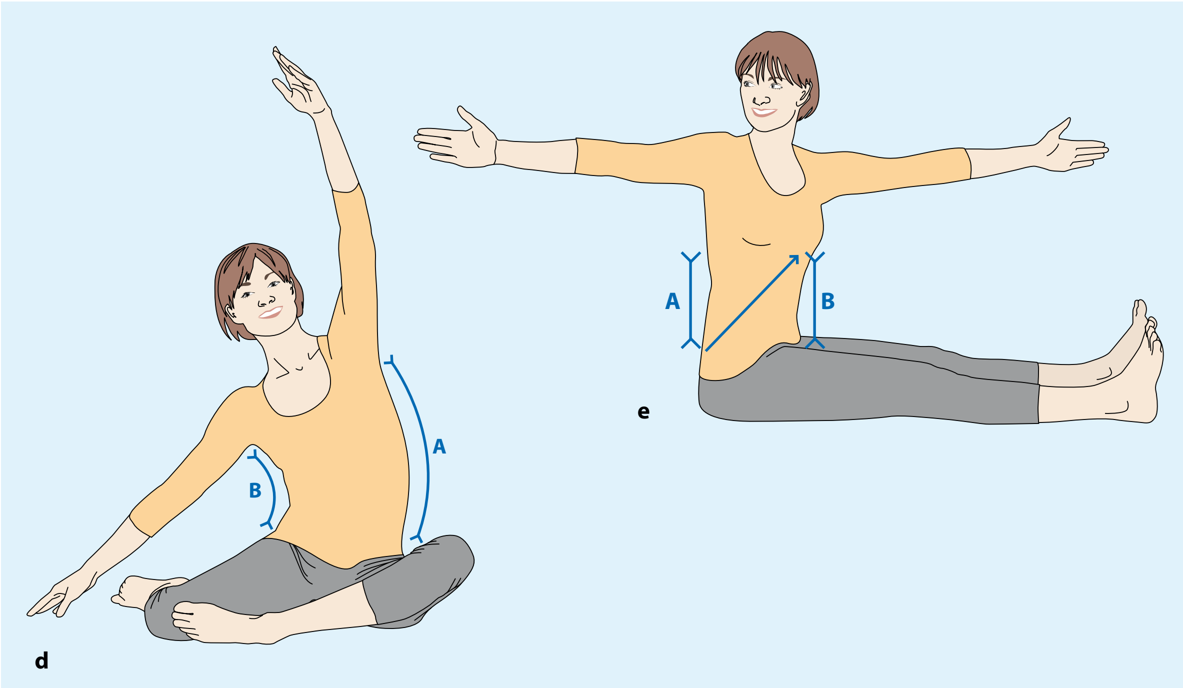


Fig. 4.12a–e (*continued*) Even (segmental) articulation. **a** Flexion: Half Roll Down, **b** Extension: Swan, **c** Neutral position: Bridging, end position, **d** Lateral flexion: Mermaid, **e** Rotation: Spine Twist, end position

- **Flexion of the spine: during flexion of** the trunk, the desired movement pattern is a minimal reduction of the space between ribs and pelvis anteriorly, with a simultaneous increase in the space between ribs and pelvis posteriorly. Waist length remains unchanged.
- **Extension of the spine:** during spinal extension, the desired movement pattern is a minimal reduction of the space between ribs and pelvis posteriorly, with a simultaneous increase in the space between ribs and pelvis anteriorly.
- **Neutral position:** with the spine positioned neutrally, there is no alteration to the connection between ribs and pelvis.
- **Lateral flexion:** during side bending, a slight decrease in length on one side of the body will occur, with a corresponding lengthening of the pelvis to rib connection on the opposing side.
- **Rotational movement during spinal rotation**, a stable connection between ribs and pelvis is maintained. Only in combination with movement in other planes, is an alteration in the diagonal length of the rib to pelvis connection generated.

Push and Pull Activation (Dynamic Stability) (Fig. 4.13)

The principle of dynamic stability guides all Pilates exercises. The instruction that one lever pulls as the opposing lever simultaneously pushes can be given during an exercise. Agonists and antagonists are evenly engaged, resulting in dynamic stabilization of the movement path (▶ Sect. 7.5, neutral zone). This creates a demonstrably smoother flow of movement, enhances accuracy (precision) and increases axial elongation. Traditionally, this process is referred to as “work in opposition”.

Dynamic Tension (Fig. 4.14)

This term is used to describe a similar phenomenon.

It can be assumed that any position can be stabilized within all three planes of the body, through **pulling action**. The principle is usually applied to the core structure of the body, and the **active support of the spine** in order to maintain optimal distance between the opposing poles of head and pelvis. However, the term dynamic tension can also be applied to the extremities, also referring to elongation through the axis. Furthermore, the term **tensegrity** can be used to understand the **immense stability of highly complex interconnected structures,** which can be achieved through the interaction of both active and passive components (Fig. 4.15). The human body illustrates this principle on multiple levels.

Neutral Position (Fig. 4.16)

This term is used to describe the position which should be taken, in order to perform an exercise correctly. On closer analysis, a description of a position held in space is of lim-

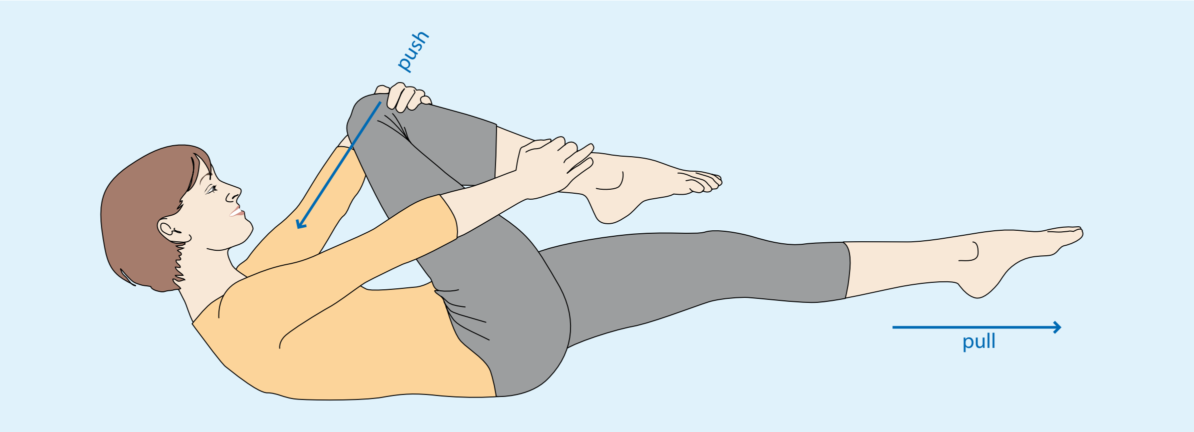


Fig. 4.13 Push and pull activation: Single Leg Stretch

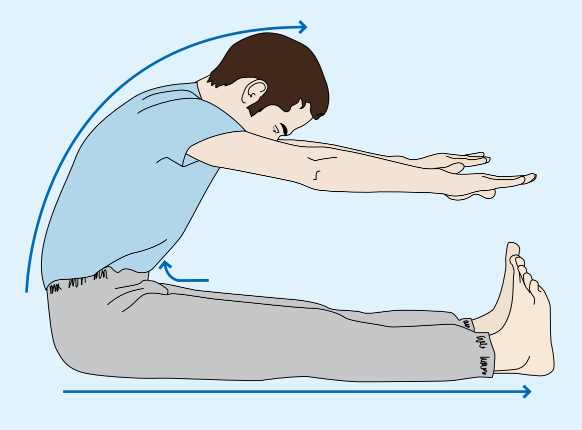


Fig. 4.14 Dynamic Tension: Spine Stretch II

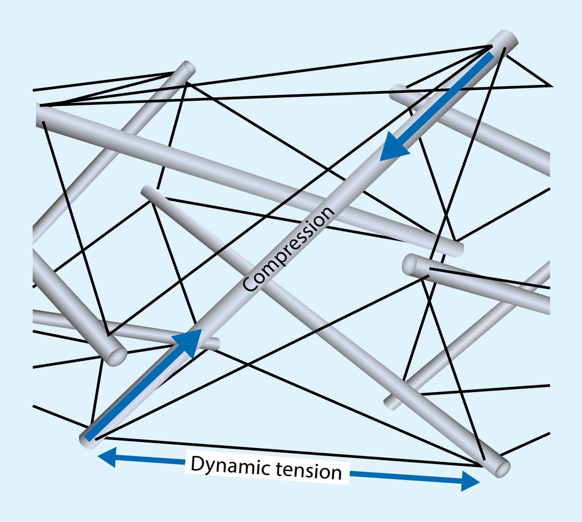


Fig. 4.15 Tensegrity

ited use. **Functionally activated relationships** between the component parts of the movement (either joints or body parts) should be facilitated by appropriate instructions. Following this approach, "**neutral**" is understood to mean that the acting forces in a position or movement can be neutralized (Fig. 4.17). The ability to achieve this is not primarily dependent on given anatomical conditions, but on a qualitative physical response to the demands of an exercise. Therefore, if the abdominal muscles are able to exert a neutralizing effect on lumbar extension (during the exercise "Swan Dive"), for example, the lower back is in a neutral position. If strength or dynamic stability is insufficient, this results is a position with compression.

4.1.6 Common Clinical Disorders and Contraindications

Pilates, as an exercise system, must consider both general and specific factors that may lead to limited or entirely inappropriate execution of the exercises.

Inflammation

In addition to tissue inflammation caused by viruses or bacteria, which are usually accompanied by fever and vital function disorders, local, mechanically induced inflammation can play a significant role.

Signs of inflammation indicate that movement or stress at the site of the inflammation may be harmful. (▶ **Overview 4.5**):

- **Acute** inflammation (traumatic, infectious) is normally indicated by the presence of all the signs below.
- **Chronic** inflammation may exhibit only some of these signs.

Overview 4.5 Classic Signs of Inflammation

- Swelling (tumor)
- Heat (calor)

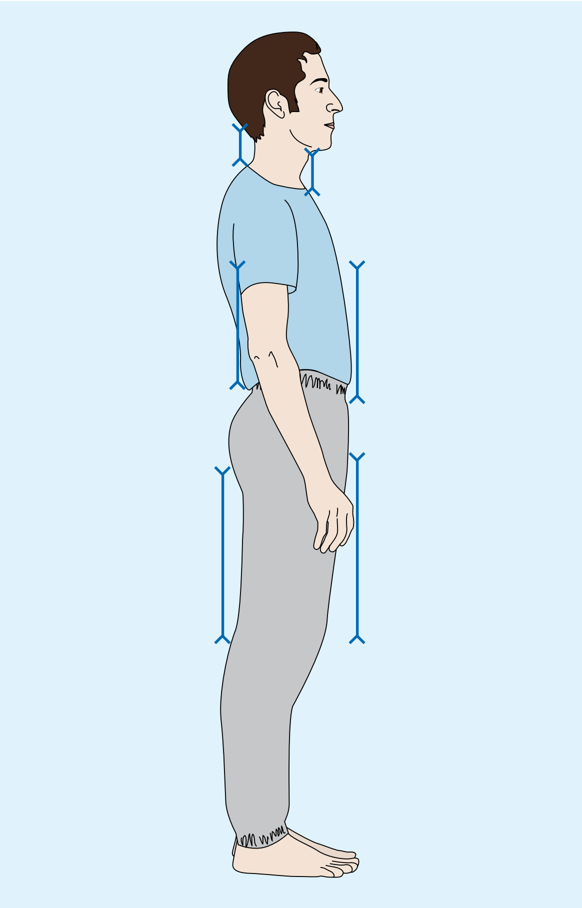


Fig. 4.16 Neutral position: standing

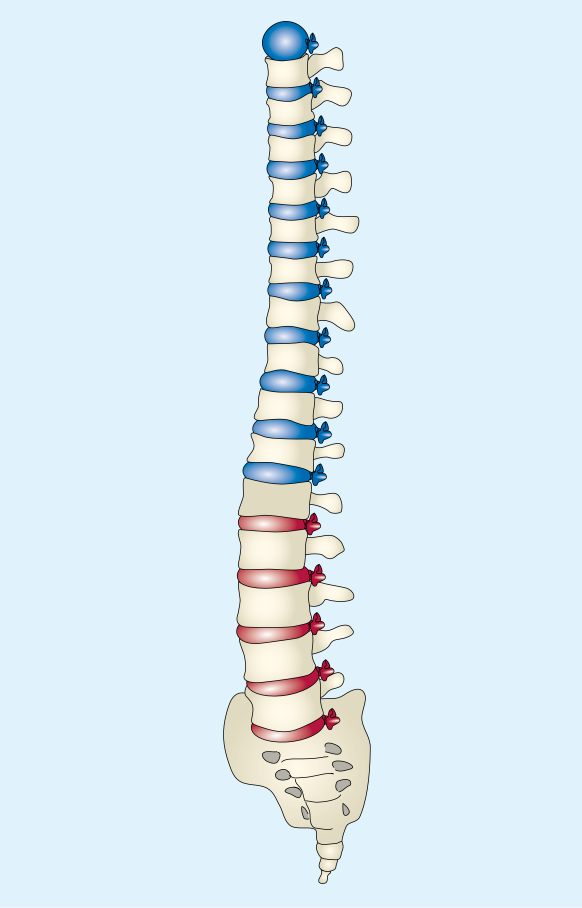


Fig. 4.17 Neutralization of acting forces

- Functional disability (functio laesa)
- Pain (dolor)
- Redness (rubor)

Warning

In cases of acute inflammation, training at the site of inflammation is fundamentally contraindicated. In cases of chronic inflammation, the movement veto can be qualified.

Both during and following training there should be no increase in inflammation, and particularly no increase in pain.

Osteoarthritis (Degenerative Joint Disease)

All joint surfaces within the body are covered with a fine layer of cartilage, to optimize the sliding of joint surfaces and reduce friction during movement. In the case of osteoarthritis, cartilage surfaces are damaged; in advanced osteoarthritis, the bony parts of the joint are also affected. Osteoarthritis is classified in levels (I–IV), which supply information as to the morphological extent of damage. The **clinical signs** of arthritis are:

- Crepitus (noise during motion)
- Pain
- Deformation of the joint
- Capsular pattern (joint-specific movement inhibition due to joint capsule contraction)
- "Giving way" (signs of disrupted movement due to instability)

Protrusion, Prolapse (Damaged Disc)

The intervertebral discs function as shock absorbers, distributing pressure three-dimensionally during movement of the body through space. The fluid core of the intervertebral disc (nucleus pulposus) and the fibrous ring (annulus fibrosus) form a stable yet dynamic connection between two vertebrae. This unit (vertebra-disc-vertebra) is referred to as a **motion segment**. A variety of factors can lead to **disc degeneration**:

- Faulty posture
- Mechanical overload
- Muscle imbalance

- Adverse sleeping position
- Poor nutrition

Initially we see dehydration of the nucleus pulposus, followed by loss of height, damage to the fibrous ring, leakage of disc tissue, either into the spinal canal or into the intervertebral space.

In addition to back pain, **symptoms** may radiate to the surrounding nerve area. The more extensive the damage, the farther the referred symptoms may extend toward the periphery of the body.

Alterations to the skin area supplied by the nerve (dermatome) corresponding to a particular motion segment, or muscle weakness in the muscle supplied by the nerve (myotome) are **warning signs** which should be investigated urgently by a doctor.

Warning
In case of numbness or loss of power → visit the doctor!

Spinal Stenosis

The term Stenosis refers to the narrowing of the intervertebral spaces or spinal canal. The **causes** are seldom congenital; stenosis is often a result of wear and tear to the bony parts of the spine. Pain radiating along the nerve pathway is a more typical symptom than back pain, usually exacerbated in an upright position, in swayback posture, or in body positions which increase narrowing of these spaces, such as lying prone.

Spondylolisthesis (Slipping Vertebrae)

Spinal segments are stabilized by means of passive and active structures. When vertebrae slip or slide, there is a lack of **passive stability**. The **cause** is usually a bony defect of the vertebral arch. These bony defects are most commonly congenital; less frequently, they may be sustained through extreme, long term stress (such as gymnastics, tennis etc.).

In addition to back pain, **symptoms** may include pain radiating into both legs or the inner thigh area, accompanied by a feeling of instability ("of breaking or snapping").

Warning
Pilates exercises that encourage slipping should be avoided. In most cases, vertebral slipping occurs ventrally, therefore extension movements are primarily to be avoided. Less frequently, flexion movements should be avoided (when slipping occurs dorsally).

Hallux Valgus

A symptom of misalignment of the metatarsophalangeal joint, the causes of Hallux Valgus may be genetic or acquired. Impaired motion in the forefoot causes painful inflammation and arthritis in the big toe joint. At a later stage, **hallux rigidus** may cause stiffening of the joint. Before beginning Pilates training, other disturbances or misalignment of the movement chain should be investigated. The goal of training is **pain-free axial weight-bearing**.

Osteoporosis

A decrease in bone density (osteopenia) is the precursor for osteoporosis, which is characterized by decreased resilience and a high risk of fractures. The situation becomes critical in areas of trabecular or cancellous bone structure (long bones, vertebrae). **Initial signs** include pain at the site of osteoporosis during loading, which may also arise when resting, as the disease progresses. In cases of heavy bone density loss (more than 20 % compared to age group) compression can cause **sudden disintegration of the affected area.** For this reason, compressive forces acting on the vertebral bodies (which arise during loaded flexion and lateral flexion movements) should be strongly avoided during Pilates exercise, if osteoporosis is known to be an issue.

The development of osteoporosis has been linked to:
- Hormonal fluctuations (menopause)
- Training and movement
- Nutrition
- Other general disorders (kidney problems, cancer)

Warning
Avoid loaded flexion or bending movements that create compression.

Endoprosthesis

Joint replacement technology (total endoprosthesis, TEP) has improved massively in the past three decades; 70 % of all endoprostheses are total hip endoprostheses, 20 % knee replacements, and fewer shoulder, elbow or ankle joint prostheses. TEP offers a functionally stable, pain-free alternative to a joint destroyed by trauma or wear.

Warning
Dependent on the surgical procedure and mechanical properties of the implanted prosthesis, certain movements and loads should be avoided:
- **THR: inward rotation, adduction and forced flexion over 90°.**
- **TKR: end-range extension, forced flexion and rotation of the lower leg.**

The endoprosthesis itself cannot cause pain, therefore these movements must be avoided even if no direct pain occurs. The symptoms of overloading often appear at a later date, and can eventually lead to premature loosening of the endoprosthesis. For this reason, **vibrations** or shocks (jumping etc.) should be avoided.

Table 4.3 Contraindications

Symptom	Contraindication
Inflammation	Stress at the site of inflammation
Arthritis	Friction and pressure within joints, uncontrolled movements
Disc protrusion/herniation	Pressure, reinforcement of referred symptoms
Stenosis	Narrowing movements
Slipping vertebrae (spondylolisthesis)	Hyperextension, movements with momentum
Hallux valgus	Shearing movements, poor alignment of the lower extremities
Osteoporosis	Flexion and lateral flexion, particularly under compression, impact to affected areas (e.g., jumping)
Endoprosthesis	Adduction, inner rotation and flexion above 90° under pressure
Cardiovascular problems	Overloading, excessive fatigue, inverted positions
Increase intraocular pressure	Inverted positions
Hernia	Pressure on weakened tissue, e.g., long levers, heavy loads
Fibromyalgia	Pressure in pain-sensitive areas, fatigue
Compression syndrome	Pressure to vulnerable structures
Pregnancy	Prolonged supine position, intensive stretches, heavy loading

Heart and Blood Pressure Problems

In cases of limited capacity of the cardiovascular system to cope with pressure, close consultation with attending physicians is advised, in order to modify the program of Pilates exercise appropriately. In general, a Pilates workout should not place great stress on the cardiovascular system, as it does not have a high cardiovascular demand. However, **longer periods of exercise** in the supine position (particularly in inverted positions) may lead to cardiovascular stress in cases of high blood pressure.

Glaucoma (Increased Intraocular Pressure)

In cases of raised intraocular pressure, inverted body positions should be avoided; the pressure gradient from the elevated body to the head below may cause increased **pressure in the eyes**.

Warning
Avoid inverted body positions!

Hernia (Tissue Rupture)

Hernias are most common at the site of the inguinal ligament. The **cause** is usually a generic tissue weakness, combined with mechanical stress. **Rectus diastasis** (separation of the abdominal septum) may occur during or after pregnancy, or in cases of overweight coupled with a lack of supporting abdominal strength. Ruptures of the **diaphragm** are rare; these are often located at the esophageal hiatus (the passage of the esophagus through the diaphragm).

Warning
Due to the reduced load-bearing capacity of the tissue, it must be ensured that no additional local stress occurs during exercise.
Movements with long levers, as well as exercises with emphasis on the rectus abdominis muscles and pressing, should be avoided!

Fibromyalgia

Sometimes referred to as soft tissue rheumatism, Fibromyalgia is a complex of symptoms, with **pain localization in the muscles and connective tissue.** Trigger points (reflex muscle knots) may be found in a variety of areas, and touch and pressure sensitivity is greatly increased. Pain and overloading must be avoided during training. Exercise should focus on improving quality of movement and circulation.

Warning
Avoid fatigue and pain!

Compression Syndromes

Mechanical or circulatory compression occurs at functionally constricted sites in the body (primarily upper body / shoulder region). **Symptoms** may include:
- Impingement syndrome (periarthritis humeroscapularis, PHS)
- Carpal tunnel syndrome (CTS)
- Thoracic outlet syndrome (TOS)

All of the above arise due to structural or functional disorder. The symptoms can be addressed through Pilates training, with a focus on exercise to **open and stabilize**.

Pregnancy

During pregnancy, specific physical changes demand certain **precautions**:

- **In the early stages of pregnancy** (1st–3rd month), intense dynamic exercises for the abdominal and pelvic floor muscles should be avoided.
- In the **2nd–3rd trimester,** long periods (more than 5 min) in the supine position should be avoided, due to the risk of vena cava-deficiency syndrome.
- Pilates training during the first 4–6 weeks following the birth should take place under the supervision of a postpartum specialist. If the abdominal wall is normal (no rectus diastasis present) and the abdominal and pelvic areas pain free, exercise intensity can be increased gradually, with particular emphasis on the obliques and deep abdominal muscles.

Summary

The contraindications for the conditions/disorders discussed are summarized in ◘ Table 4.3

4.2 Parameters for Progression and Regression

By modifying the original Pilates exercises by **altering individual components,** it is possible to create useful variations, which do not completely alter the original nature of the exercises.

These adaptations serve to optimize the **learning process**. A beginner need not be overwhelmed, advanced students should not feel unchallenged. Didactically, this approach makes an effective, pain free movement experience possible, one which frequently exceeds the expectations of the participant/client. Other Pilates exercises can then be added to the program, at a later stage.

Each Pilates exercise can be modified to fit the needs of the client, by means of:

- **Regression (simplification)**
- **Progression (intensification)**

The tools for modifying Pilates exercises are summarized in ► **Overview 4.6**.

Overview 4.6 Exercise Progression and Regression

- Lever length
- Speed
- Resistance
- Base of support
- Range of motion
- Movement planes and axes
- Instruction

Lever Length

The length of lever acting on the center of movement determines the **workload.** Both anatomical factors, as well as alterations to the form of the exercise, can be significant. Clients with long legs or arms, in proportion to the upper body, will experience a different level of intensity than clients with shorter limbs. The position of the upper body in relation to the axis point of an exercise, or the raising of one or more limbs, immediately changes the degree of difficulty of any Pilates exercise.

Speed

Depending on choice of exercise, the speed of execution will make it easier or harder. Pilates exercises should generally be performed with an **even rate of movement** (so-called flow). But there are **exceptions**, such as the initiation of a dynamic phase of movement or the control of a challenging part of an exercise (end of movement range, utilizing a long lever). In general, slowing movement down increases exercise difficulty, as it demands greater accuracy and better integration.

Resistance

The **Pilates equipment** is **particularly** useful for adding resistance to movement. Dynamic resistance is created by means of springs placed under tension. This resistance is rarely used to directly increase concentric muscle exertion. In most cases, the resistance is applied during both the concentric and eccentric phases of movement, indirectly challenging stability of the movement center (trunk / center of the body). Even a **small increase in resistance** increases the difficulty of execution during certain exercises, due to the limited potential for anchoring distally. Adding resistance through the use of small apparatus (resistance band, stick, ball, etc.) may also intensify the effect of an exercise.

Base of Support

A reduction in the base of support increases exercise difficulty. This may be achieved by utilizing an **unstable surface** (foam roller, balance pad, mat) or by modifying the contact points of the body with the floor or equipment.

Fig. 4.18a–c Goal Post. **a** Starting position, **b** correct execution, **c** faulty execution

Range of Motion

Different movements of the joints demand different stabilizing actions. Furthermore, the functional movement of multiple, related joints can be trained by initially isolating and stabilizing one part of the movement chain. Isolating one range of motion simplifies a Pilates exercise, simultaneously demanding control in combined ranges of motion increases difficulty.

Planes and Axes of Movement

Our body has three degrees of freedom, with corresponding movement planes and axes. If an exercise takes place in one movement plane, the muscles are challenged to stabilize the movement axis in this one plane. By including multiple movement **planes,** complex multidimensional connections are activated. Not only the muscles are involved, but also the **proprioceptive system**, which provides feedback on joint positioning via the organs of proprioceptive sensibility. In order to achieve the greatest functional benefit, awareness of healthy, effective axial loading during Pilates exercise should be instructed.

Cueing

The instruction style or method of a Pilates trainer/therapist is a vital factor in regression and progression. Each exercise represents a complex learning process, on mental, somatic and cognitive levels. Therefore, placing **emphasis on specific aspects of the exercise** may increase or decrease the difficulty of that exercise. The more challenging the progression, the more specific or differentiated the instruction and correction become, and the more competence is demanded from the client/participant themselves.

4.3 Assessment Techniques

This section provides useful, practical techniques for assessing clients and designating appropriate training goals. A **test or assessment:**

- Eases the initial approach to clients
- Increases compliance between client and trainer/therapist
- Creates opportunities to determine starting level and subsequently, to assess progress

The tests presented should be conducted either before joining a group, or as part of a personal training session. The test exercises are consciously modeled on the Pilates exercise repertoire.

Fig. 4.19a–c Half Squat. **a** Starting position, **b** correct execution, **c** faulty execution

Polestar Pilates Fitness Screening®

These 15 tests (▶ **Overview 4.7**) enable the precise determination of specific and general strength, flexibility and coordination, directly related to Pilates exercise. They also facilitate an evaluation of whether particular Pilates exercises are achievable at the time of assessment.

Overview 4.7 Fitness Screening Tests

1. Goal post
2. Half squat
3. Full squat
4. Heel raise
5. Push up
6. Side lift
7. Superman
8. Prone shoulder flexion
9. Prone knee bend
10. Prone press up (swan)
11. Hundred / abdominals
12. Roll up
13. Long sitting
14. Seated hip abduction
15. Z-Sitting

Exercise performance will be evaluated using specific criteria, and a mark of between 3 and 0 points given. To determine **fitness level**, the total amount of points should be divided by the number of exercises, and graded according to the following **scoring key** :

- 3 points: Advanced
- 2 points: Intermediate level
- 1 point: Beginner

1. Goal Post on the Wall (Fig. 4.18)

Test Components

- Posture control and alignment of the spine
- Abduction and external rotation of the shoulder joint

Execution

- Stand one foot away from the wall
- Lean against the wall: pelvis, thoracic spine, shoulders, back of the head and arms form a U shape in contact with the wall
- Slowly stretch the arms diagonally upward without losing contact with the wall

Assessment Criteria

- Can maintain position of the spine
- Wall contact (sacrum/thoracic spine) can be maintained even with full extension of the arms (abduction)

Scoring Key

- **3 points:** all of the above mentioned evaluation criteria are met and the position can be maintained
- **2 points:** position of the spine can be maintained, arms are less than 50 % extended
- **1 point:** position of the spine cannot be maintained or the arms do not remain in contact with the wall
- **0 points:** unable to accomplish / not attempted / pain

2. Half Squat (Fig. 4.19)

Test Components

- Strength, flexibility and alignment of the legs
- Ability to isolate movement of the hips, pelvis and lumbar spine
- Ability to keep the spine upright and still

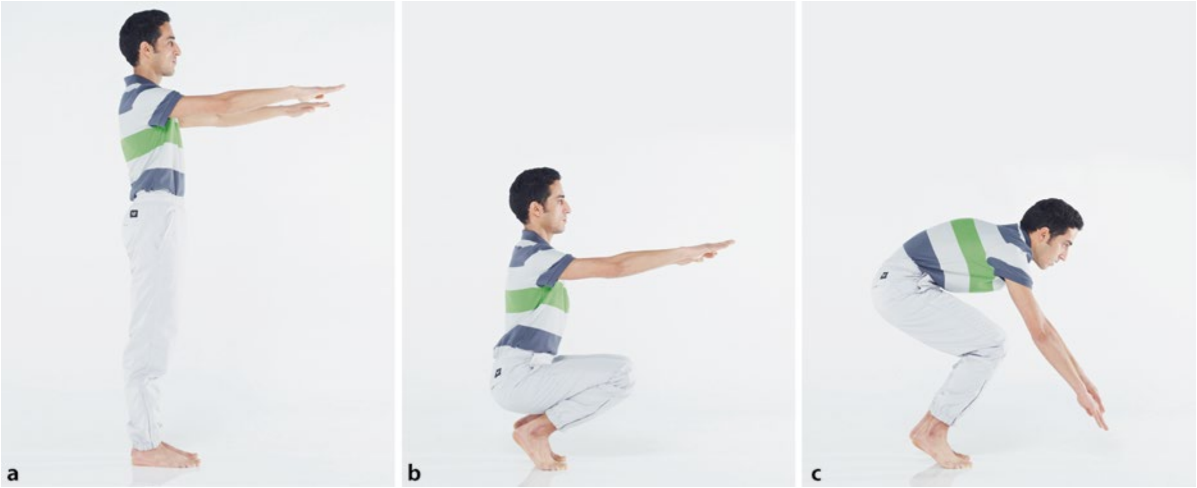


Fig. 4.20a–c Full Squat. **a** Starting position, **b** correct execution, **c** faulty execution

Execution
- Stand: feet hip width apart and parallel
- Bend knees 45°, keep heels on the floor
- Arms at shoulder level parallel to the floor
- Spine straight
- Hips, knee and ankles are aligned

Assessment Criteria
- Knees can be bent to 45°, and heels remain on the ground
- Arms can be kept parallel to the ground, shoulders remain down and relaxed
- Spine can be kept straight as the legs bend
- Hips, knees and ankles remain aligned

Scoring Keys
- **3 points:** fulfills all of the above criteria, and can hold the position for 30 seconds
- **2 points:** does not fulfill one of the above criteria
- **1 point:** does not fulfill two of the above criteria
- **0 points:** unable to accomplish / not attempted / pain

3. Full Squat (Fig. 4.20)

Test Components
- Leg strength
- Control of the leg axis during hip/knee flexion

Execution
- Stand, feet hip width apart and parallel, arms extended at shoulder level
- Squat smoothly
- Keep arms at shoulder level, parallel to the ground
- Spine is straight
- Hips, knees and ankles are aligned

Rating Criteria
- Smooth continuous up and down movement
- Spine can be kept straight as the legs bend
- Hip, knee and ankles are aligned

Scoring Key
- **3 points:** fulfills all of the above criteria
- **2 points:** movement completed, but unable to squat smoothly or alignment is lost
- **1 point:** full flexion/extension are not possible, or requires assistance
- **0 points:** not able to accomplish / not attempted / pain

4. Heel Raise (Fig. 4.21)

Test Components
- Strength of calf muscles
- Balance

Execution
- Standing on one leg, arms at shoulder level parallel to the ground
- Continuously raise and lower the heels
- Fingertip contact with the hands of the trainer may be provided for support

Rating Criteria
- Full plantar flexion of the ankle
- No loss of alignment

Scoring Key
- **3 points:** can do 5 reps with full range of motion, without fingertip contact
- **2 points:** can do 5 reps with full range of motion, requires fingertip contact

Fig. 4.21a,b Heel Raise. **a** Starting position, **b** correct execution

- **1 point:** can do less than 5 reps and needs more support
- **0 points:** not able to accomplish / not attempted / pain

5. Push Up (Fig. 4.22)

Test Components
- Strength of the arms (triceps) and chest muscles
- Core stability
- Stability of the shoulder blades

Execution
- In push up position, bend the elbows maintaining a wide space between the shoulder blades
- Lower the body to approximately 5 cm from the floor
- Return to starting position

Rating Criteria
- Maintain alignment of the spine
- Maintain connection of the shoulder girdle with the trunk
- Wrists, elbows and shoulders are aligned

Scoring Key
- **3 points:** can perform the test once meeting all of the above criteria
- **2 points:** can perform the test once meeting all of the above criteria, but the arms are abducted
- **1 point:** cannot maintain neutral position of the spine, lower the body, or must modify the exercise (knees bent)
- **0 points:** not able to accomplish / not attempted / pain

Fig. 4.22a–c Push Up. **a** Starting position, **b** correct execution, **c** faulty execution

6. Side Lift (Fig. 4.23)

Test Components
- Trunk, shoulder and ankle stability
- Strength of the hip abductors

Execution
- Body supported on the elbow in side plank
- Supporting foot in dorsiflexion, resting on the outer edge of the foot
- Raise the upper leg and hold for 3 seconds

Rating Criteria
- Trunk and shoulder stability can be maintained
- Balance can be maintained

Scoring Key
- **3 points:** can perform the test meeting all of the above criteria
- **2 points:** can perform the test meeting all of the above criteria, but cannot lift the upper leg
- **1 point:** can lift the hip but cannot maintain balance or stability. Must modify: support with upper hand, bend lower leg and rest on knee
- **0 points:** unable to accomplish / not attempted / pain

7. Superman (Fig. 4.24)

Test Components
- Strength of trunk, hip flexibility into extension
- Shoulder organization

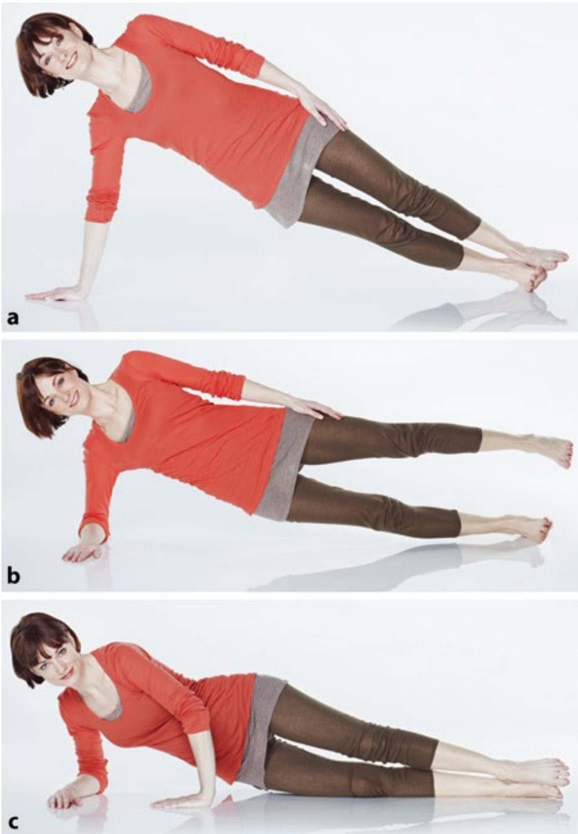


Fig. 4.23a–c Side Lift. **a** Starting position, **b** correct execution, **c** faulty execution

Execution
- Prone position, legs hip width apart
- Arms extended to the side at shoulder level (T position)
- Raise arms, straight legs and upper body

Rating Criteria
- Can lift the spine without loss of axial length
- Can lift the thighs
- Can lift extended arms and maintain shoulder organization

Scoring Keys
- **3 points:** can perform the test meeting all of the above criteria
- **2 points:** cannot lift the chest or thighs, or raises shoulders when lifting
- **1 point:** cannot lift the sternum or thighs and raises shoulders when lifting
- **0 points:** unable to accomplish / not attempted / pain

8. Prone Shoulder Flexion (Fig. 4.25)

Test Component
- Shoulder range of motion in prone position

Fig. 4.24a,b Superman. **a** Correct execution, **b** faulty execution

Fig. 4.25a,b Prone Shoulder Flexion. **a** Correct execution, **b** faulty execution

Execution
- Prone, head resting on the floor
- Arms extended overhead and shoulder width apart
- Legs hip width apart

Rating Criteria
- Can keep shoulders down with arms extended and raised, no tension in the upper trapezius
- Can keep the spine in neutral position, no hyperextension of the neck or lower back

Scoring key
- **3 points:** can perform the test meeting all of the above criteria and hold the arms approximately 2.5 cm above the floor
- **2 points:** can perform the test meeting all of the above criteria but cannot raise both arms
- **1 point:** cannot extend the arms when shoulder width apart and also maintain the spine in neutral position. Must modify: arms extended diagonally and raised
- **0 points:** unable to accomplish / not attempted / pain

9. Prone Knee Bend (Fig. 4.26)

Test Components
- Flexibility of the hip flexors: Mm. rectus femoris and iliopsoas

Execution
- Prone position
- Hold one foot

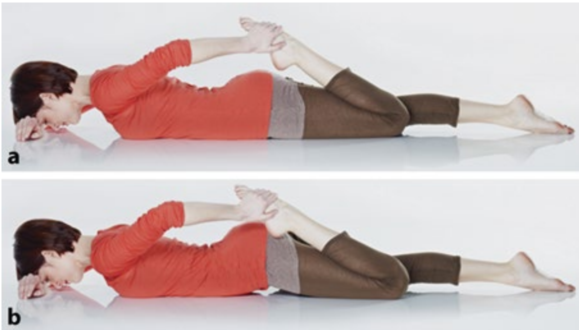


Fig. 4.26a,b Prone Knee Bend. **a** Correct execution, **b** faulty execution

- Place one hand under the forehead, resting the head on the hand
- Knees remain together
- Draw the pubic bone in the direction of the navel, maintain position of the pelvis
- Lift the thigh

Rating Criteria
- Can maintain position of spine and pelvis
- Can maintain position of the pelvis, avoiding rotation or lateral flexion of the spine
- Can lift the thigh

Scoring Key
- **3 points:** can perform the test meeting all of the above criteria
- **2 points:** can perform the test meeting all of the above criteria, but unable to lift the thigh
- **1 point:** cannot grasp the foot (or requires help), and cannot maintain the position of the pelvis
- **0 points:** unable to accomplish / not attempted / pain

10. Prone Press Up (Fig. 4.27)
Test Components
- Mobility of the spine in extension
- Distribution of extension across the individual segments of the cervical, thoracic and lumbar spine
- Alignment of shoulders and arms in a weight-bearing position

Execution
- Active starting position of the spine in prone
- Legs straight, hip width apart
- Hands alongside the chest
- Elbows close to the body, facing the ceiling

Rating Criteria
- No hyperextension of the cervical spine
- Even extension throughout the thoracic spine

Fig. 4.27a,b Prone Press Up/Swan. **a** Correct execution, **b** faulty execution

- Pelvis stable and pubic bone in contact with the mat
- Hips extended
- Abdominal wall active
- Shoulder blades down
- Arms correctly aligned

Scoring Key
- **3 points:** can perform the test meeting all of the above criteria
- **2 points:** can perform the test but does not have uniform articulation of the spine
- **1 point:** cannot articulate the spine evenly into full extension
- **0 points:** unable to accomplish/not attempted/pain

11. Hundred (Fig. 4.28)
Test Components
- Activation and control of the abdominal muscles during spinal flexion

Execution
- Supine position
- Active starting position with legs in table top position
- Arms resting at the sides
- Lift head and shoulders
- Extend legs toward the ceiling, then lower toward the floor

Rating Criteria
- Maintain table top position
- No bulging of the rectus abdominis
- Legs can be extended toward the ceiling without losing the active starting position
- Legs can be lowered toward the floor without losing core control

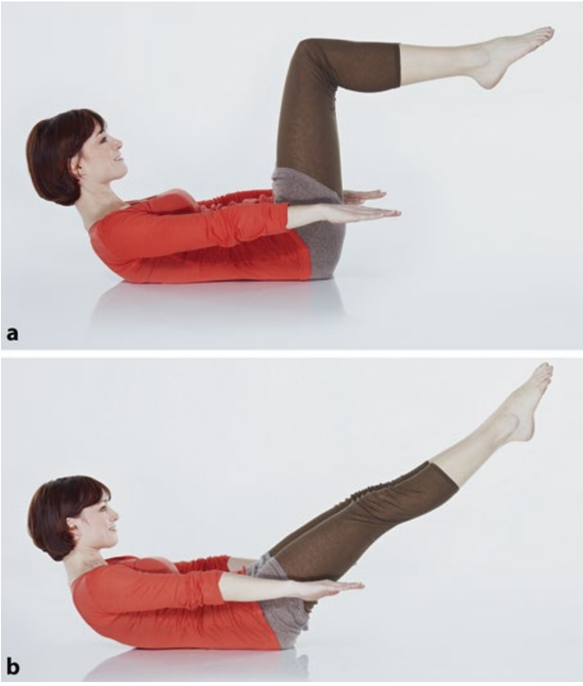


Fig. 4.28a,b Hundred/Abdominals. **a** Starting position, **b** end position

- Shoulder organization can be maintained

Scoring Key

- **3 points:** can perform the test meeting all of the above mentioned criteria and lower the legs to 10 cm above the floor
- **2 points:** can perform the test but only lower the legs slightly
- **1 point:** can flex the trunk without losing abdominal engagement, but cannot extend the legs
- **0 points:** unable to accomplish / not attempted / pain

12. Roll Up (Fig. 4.29)

Test Components

- Articulation of the spine into flexion
- Abdominal strength
- Shoulder organization

Execution

- Supine position
- Arms extended overhead
- Roll up to a seated position, and roll back down

Rating Criteria

- Even, flowing movement avoiding momentum or raising the legs

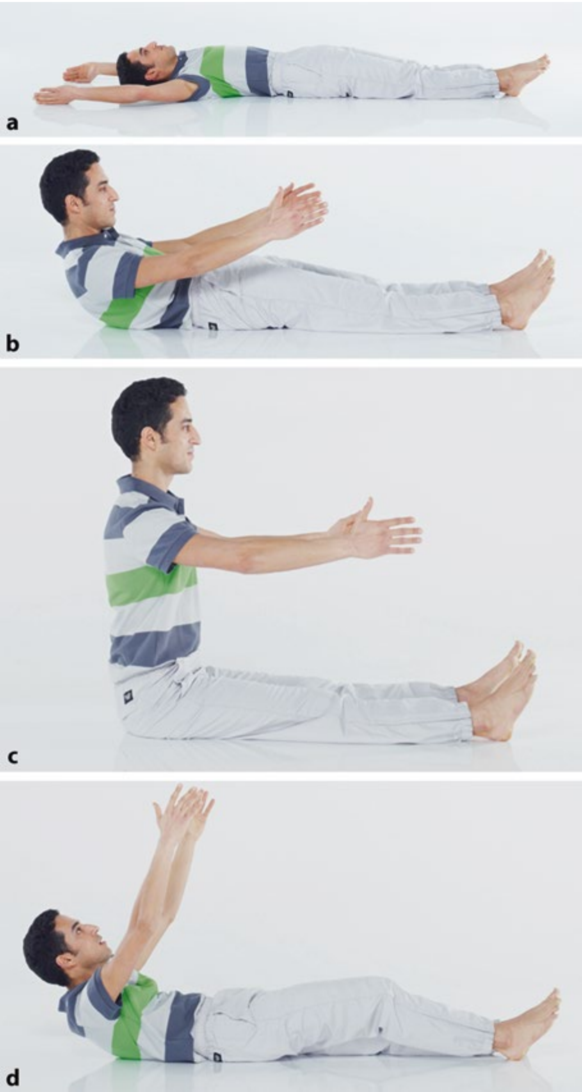


Fig. 4.29a–d Roll Up. **a** Starting position, **b** correct rolling movement, **c** end position, **d** faulty execution

- Maintain organization of the pelvis and trunk throughout the movement
- Maintain shoulder organization

Scoring Key

- **3 points:** can perform the test meeting all of the above criteria
- **2 points:** unable to articulate the spine fully
- **1 point:** test has to be modified
- **0 points:** unable to accomplish / not attempted / pain

13. Long Sitting (Fig. 4.30)

Test Components

- Flexibility of the posterior leg muscles

Fig. 4.30a,b Long Sitting. **a** Correct execution, **b** faulty execution

- Ability to maintain upright posture when sitting

Execution
- Sitting
- Extend legs, shoulder width apart
- Active starting position of the spine

Rating Criteria
- Legs are fully extended, spine upright
- Shoulders are relaxed

Scoring Key
- **3 points:** can perform the test meeting all of the above criteria, and incline the upper body forward slightly from the hip
- **2 points:** active starting position of the spine cannot be maintained
- **1 point:** active starting position of the spine cannot be maintained, legs cannot be fully extended
- **0 points:** unable to accomplish / not attempted / pain

Fig. 4.31a,b Seated Hip Abduction. **a** Correct execution, **b** faulty execution

14. Seated Hip Abduction (Fig. 4.31)

Test Components
- Flexibility of the hip adductors and hip joint
- Ability to maintain an upright posture whilst sitting

Execution
- Sit, possibly against a wall
- Legs straight and shoulder width apart
- Active starting position of the spine

Rating Criteria
- Legs are fully extended, spine is upright
- Shoulders are relaxed

Fig. 4.32a,b Z-Sitting. **a** Correct execution, **b** faulty execution

Scoring Key

- **3 points:** can perform the test meeting all of the above criteria
- **2 points:** legs are abducted <45° from the midline. Active starting position of the spine cannot be maintained. Legs can be fully extended
- **1 point:** Legs are abducted <45° from the midline but active starting position of the spine cannot be maintained. Legs cannot be fully extended
- **0 points:** unable to accomplish / not attempted / pain

15. Z-Sitting (Fig. 4.32)

Test Components

- Inward and outward rotation at the hip joint
- Ability to sit upright

Execution

- Z-sitting
- Active starting position of the spine
- Both sitting bones on the mat

Rating Criteria

- Can align the spine perpendicularly over the pelvis and keep the sitting bones on the mat
- Shoulders are relaxed

Scoring Key

- **3 points:** can perform the test meeting all of the above criteria
- **2 points:** can perform the test meeting all of the above criteria, and keep sitting bone of the rear leg <5 cm above the mat
- **1 point:** cannot keep sitting bone <5 cm above the mat. Loses active starting position of the spine and the perpendicular position above the pelvis
- **0 points:** unable to accomplish / not attempted / pain

Standing Posture and Movement Analysis

Posture in a Standing Position (Fig. 4.33)

The standing position provides a snapshot of the body's posture in relation to gravity. The role played by inert (non-active) structures is of equal importance to that played by the dynamically active components (contractile structures) of the body. A trainer/therapist with appropriate knowledge can also infer much of a psychosomatic nature by observing body posture.

The client will be asked to take a relaxed stance during the assessment, or he may be observed inconspicuously during introductory conversation. The **angle of observation** plays a crucial role:

- Deviations in the frontal plane need to be assessed from the **front** and **rear** of the body.
- From the **side of the body,** divergences from the sagittal plane.
- From **both sides,** indirect deviations in the transverse plane can be observed.

In order to assess changes in posture, but also to examine the organization of the head, neck and shoulder area, the client may be asked to raise his arms.

Roll Up/Down from Standing (Distance from Fingertips to Floor) (Fig. 4.34)

The client is asked to bend forward slowly from the standing position, as far as possible without pain, moving the fingers toward the floor. The knees can be straight or bent. The results provide **information** about:

- Mobility of the spine in flexion
- The daily movement pattern of "bending forward" (shifting weight, dominant areas of loading, movement, compression)
- Flexibility of the pelvic and leg muscles

Fig. 4.33a–c Assessment in standing. Views: **a** ventral, **b** dorsal, **c** lateral

- The strategy of muscle engagement when returning to standing
- Detection of misalignments (scoliosis, blocked spinal segments)

General Testing for Strength and/or Mobility

The techniques of Janda or Seidenspinner (Janda 1994; Seidenspinner 2005) can be recommended.

4.4 Sources of Error

This section addresses the sources of frequently occurring, **typical errors** in the execution of Pilates exercises, and will consider both the Pilates principles, and anatomical and biomechanical issues. Training observation skills facilitates effective correction of movement execution. Pathophysiological compensations, weakness or loss of movement can thus be more clearly understood and issues resolved.

Spine

Cervical Spine/Shoulder/Head

Loss of a Stable Connection Between the Head and the Trunk

Causes may include weakness of the ventral neck muscles or shortening of the short dorsal neck muscles.

Tip

- **Fitness Screening:** Hundred, Roll Up
- If the head can be held correctly with the support of a hand or assistance from the trainer, the issue is **weakness** (active insufficiency). If it is not possible without discomfort, even with support, the issue is muscle **shortening** (contracture).

Fig. 4.34a,b Roll Up/Down From Standing. **a** Starting position, **b** rolling movement

Poor Axial Elongation of the Physiological Cervical Lordosis The physiological lordosis of the cervical spine allows trouble-free movement of the joints; **compression** (loss of axial elongation) adversely affects this motion. The lack of axial elongation of the cervical spine is primarily a result of the organization of the underlying structures. As a result of incorrect alignment of the body in the standing position, the weight of the head must be stabilized horizontally, causing misalignment of the cervical spine.

Tip

- **Fitness Screening:** Long Sitting
- While sitting or standing, place **light pressure on the head** and observe whether the head can easily be maintained over the body's center of gravity. In the case of poor axial elongation, the head will shift anteriorly.

Faulty Shoulder-Cervical Spine Organization Organization of the space between the shoulder girdle and the cervical spine should provide the freedom to position the neck and head functionally, whilst facilitating optimal connections for the joints of the shoulder girdle. Overly elevated (cranial) **shoulder/cervical spine organization** functions as inefficiently as a pattern of organization that provides insufficient support caudally (shoulders positioned too low functionally, as in the case of sloping shoulders). It can be useful to distinguish between organization in a closed chain weight-bearing position, and organization during open chain movements.

Tip

Fitness Screening: Push Up, Prone Shoulder Flexion

Compression of the Cervicothoracic Junction Poor axially alignment of the segments of the body, as in the case of heavy, unsupported abdominal weight, poor alignment of the pelvis over the lower extremities, or increased thoracic kyphosis, may result in compressive stress at the junction between the cervical and thoracic spine. This may become evident in interruptions to the flow of movement, or in a **reversed curvature of the cervicothoracic junction**. In the case of longer term disorder, swelling and congestion become apparent in adjoining areas.

Tip

Fitness Screening: Prone Press Up

Thoracic Spine/Shoulder/Arm

Restricted Physiological Rotation

The rotational capability of the thoracic spine is highly significant functionally. For full respiratory range, an unimpeded gait and dynamic alignment of the trunk during sports, free rotation to both sides is vital. **Loss of rotation is frequently coupled with reduced extension**. The consequences are far reaching, as the transfer of forces both cranially and caudally is disrupted. Arm movements or rotation of the head may appear restricted during motion. However, a lack of thoracic mobility needs to be considered as a possible cause of the issue.

Tip

Test: While sitting or standing, it should be possible to rotate the upper body and look over the shoulder easily, without additional motion in the lumbopelvic area.

Restricted Physiological Extension All restrictions to extension at the major joints result in **disturbances to the physiological process of locomotion**. Normal gait and forward impetus are slowed. The result is increased stress and compensatory hypermobility elsewhere in the body. The lumbar spine may be forced to compensate for the lack of extension elsewhere, for example. Enormous pressure is placed on the ventral structures of the upper body. Disorders such as Scheuermann's or Bechterew's disease may be the root of the problem.

Tip

Fitness Screening: Prone Press Up

Restricted Physiological Flexion Restricted thoracic flexion can be caused by **scoliotic misalignment**, as displacement of the vertebra due to rotation also limits range of motion in the sagittal plane. Otherwise, restricted flexion is relatively rare, and may be caused by tension or disturbance of the organs.

Tip

Fitness Screening: Roll Up, Hundred

Loss of Active Stability in Physiological Movements (e.g., Flat Back) In the case of diminished natural physiological curves, **active** and **passive responses** are also reduced. Stress and discomfort arise, due to the dysfunctional orientation of the intervertebral joints, and the corresponding unfavorable positioning of the muscles. The connection of the convex articulating surface of the shoulder blade with the thorax may be lost, due to the altered form of the ribcage, in the case of a flattened spine. This results in instability.

Tip

Fitness Screening: Half Squat, Full Squat, Side Lift

Reduced Active Connection of Arm Movement with the Trunk (Shoulder Blades) The concave inner surface of the scapula provides a congruent movement plane for the convex joint/sliding surface of the ribcage. Poor organization of the thoracic spine causes the sliding surface of the shoulder blades to shift, with a corresponding detrimental effect on the stabilizing muscle attachments which provide the active connection to the thorax during arm movements. This relative functional instability and disturbance of the **scapulothoracic rhythm** can simulate a purely muscular insufficiency. In actuality, we are dealing with a combination of both, since the connection of the arm movement to the trunk can be stabilized immediately following correction of thoracic alignment.

Tip

Fitness Screening: Push Up, Prone Shoulder Flexion

Loss of Axial Elongation During Movement of the Thoracic Spine Movements of the thoracic spine and adjoining areas rely on **joint closure** (“form closure”), to a greater extent than other areas of the body. The costovertebral joints are only indirectly stabilized locally. Thoracic rib motion is affected by respiratory movement, the intercostal muscles, and the indirect transmission of forces via the rib–pelvis connection. Stability by means of joint closure (capsule/ligamentous structures, bone contact) is predominantly **passive**. If heavy compression occurs at these joints, the passive structures are stressed excessively during articulation. This can result in irritation, pain and arthritic changes. Therefore close attention should be paid to any loss of axial elongation in the thoracic spine. Axial elongation can be observed when movements follow the longest possible arc throughout the range of motion.

Tip

Fitness Screening: Roll Up

Reduced Opening of Ventral Structures (Chest Muscles, Joints, and Sternum) All structures connected ventrally play a role in stabilization, yet also have an essential opening function. A correlation between the opening and closing functions creates balance, in this case between ventral and dorsal structures. In the area of the thoracic spine and rib cage, **restricted opening** interferes with circulation and overloads passive structures such as the acromioclavicular and sternoclavicular joints. The supine position lends itself well to assessment. In this position, the shoulders should open and fall toward the ground and the back of the head and thorax should rest on the same level.

Tip

Fitness Screening: Goal Post, Superman

Inadequate Connection Between Thorax and Pelvis It becomes clear during movement whether a dynamic and stable connection between the thorax and pelvis can be achieved. The connecting muscle systems are challenged either concentrically or eccentrically; **loss of stability** is reflected in a loss of the ratio of lengthening (eccentric) to shortening (concentric). This loss in turn generates stress in related joint structures (thoracolumbar junction, L5/S1 etc.).

Tip

Fitness Screening: Side Lift, Push Up

4

Lower Back/Hips/Pelvis

Limited Physiological Flexion

The main causes of restricted lumbar flexion are contracted hip flexor muscles, tension which limits space in the visceral region, and hypertonicity of the global stabilizers of the lumbar spine. **Hypertonicity** of the global stabilizers, and also of the buttock muscles which cross the pelvis, becomes apparent when the instruction is given to articulate the spine segmentally. Any weakness of the muscles of flexion plays a minor role.

> **Tip**
>
> **Fitness Screening:** Roll Up

Limited Physiological Extension A habitually flexed **position of the lumbar spine** may originally have served to protect an acute or subacute spinal disc issue. Other serious pathologies must also be considered as possible causes (e.g., tumors). These limitations need not necessarily lead to painful inhibition; **hypotonia** of the local lumbar stabilizers can often be the sole issue. To test, the client is requested to lie in the prone position and raise one leg or both legs; in case of reactive inhibition, this will not be possible.

> **Tip**
>
> **Fitness Screening:** Superman

Limited Physiological Lateral Flexion Long-term hypertonicity of the M. quadratus lumborum limits lateral flexion to the opposing side. Ligaments connecting the pelvis and lumbar spine can develop **unilateral restriction**, thereby limiting passive lateral flexion. **Bilateral restriction** is more likely to cause inhibition of flexion. If several lumbar segments are held in extension, unilateral opening and thus lateral flexion will be hindered.

> **Tip**
>
> **Fitness Screening:** Side Lift

Lack of Axial Elongation Insufficient axial elongation of the lumbar spine during movement, results in **compression** of the passive structures involved in the motion. Particularly in the lumbar region, this is one of the most common causes of spinal disc pathologies. This burden is often apparent in a **loss of relative range of motion**. Exercising for long periods results in substantial stress, even when in a static position. Actively maintaining physiological lordosis is a fundamental pre-condition for reducing load.

> **Tip**
>
> **Fitness Screening:** Long Sit, Rollup

Insufficient Connection of Pelvis to Thorax During exercises which demand a stable connection between the two, either the pelvis or thorax may deviate from the plane of motion. If the pelvis is positioned incorrectly, the lumbar spine is brought into faulty alignment as a consequence. The connections of the lower and upper extremities to the trunk will be altered as a direct result. This has consequences for either the active or passive structures which are involved, depending on whether a lateral or sagittal connection is required.

> **Tip**
>
> **Fitness Screening:** Superman, Side Lift, Push Up

Extremities

Upper Extremities

Restricted Movement of the Upper Extremities The upper limb enjoys great freedom of movement and correspondingly great muscular dynamic stability. The glenohumeral joint is poorly stabilized structurally, allowing for a high level of mobility, whilst congruence of the articulating surfaces in all alignments and motion calls for highly differentiated muscular stabilization. Restricted freedom of movement may originate from the **shoulder complex** itself, triggered by muscle imbalances (shortening, weakness) for example, or as a consequence of **secondary factors** (restricted movement of thoracic or cervical spine etc.).

> **Tip**
>
> **Fitness Screening:** Goal Post, Prone Shoulder Flexion

Poor Alignment During Open Chain Movement Open chain movements require optimal integration of the arm onto the trunk, using the muscle chains of the shoulder. This control and connection is apparent in the smooth sliding motion of the shoulder blades during movements. Attention should also be paid to the balance of ventral and dorsal dominance during movement. Dysbalances are commonly manifested as **increased protraction** (dominance of the ventral structures), less frequently as dominance of the dorsal structures (retraction).

Tip

- **Fitness Screening:** Goal Post, Prone Shoulder Flexion
- Raise arms slowly, observing motion of the shoulder blades and potential pro-/retraction.

Poor Alignment in a Closed Chain In a closed chain, the inner and outer muscle systems act to increase congruence of joint movement. **Deviations** may be indicated by the following:

- If the upper body sinks toward the ground while weight-bearing through the arms, it may indicate **weakness of the inner muscle system**.
- If the upper body rounds excessively toward the ceiling, the **inner muscle unit predominates,** with corresponding weakness of the outer muscle system

Tip

Fitness Screening: Push Up

Lack of Axial Elongation The upper extremity is organized through a number of joint chains. Good alignment within these chains allows for undisturbed transmission of force and movement. Axial elongation in peripheral joints is evident in the ability to avoid **compressive joint alignment** within a closed chain:

- At the **elbow joint:** avoid hyperextension
- At the **wrist:** avoid deviation from the mid position

In addition to stabilization of the joint chain through axial elongation, establishing an active connection to the shoulder-trunk complex is crucial in an open chain, in order to enable all hand and arm functions.

Tip

Fitness Screening: Push Up

Lower Extremities

Restricted Movement of the Lower Extremities

The joint chains of the lower extremities achieve full functionality in part, through full **joint congruence**. Freedom of motion is therefore functionally significant for all types of locomotion and the transmission of forces.

Restrictions in abduction or extension are most typical of the **hip joint**. As large, polyarticular muscles cross the joints, it can be useful to differentiate between a movement restriction originating from the joint itself, and one arising through muscle contracture.

Tip

Fitness Screening: Long Sitting, Seated Hip Abduction, Z-Sitting

At the **knee joint,** limited extension is usually the only significant restriction. One of the primary external indicators is a faulty gait pattern, caused by compensation.

At the **ankle**, dorsiflexion of the upper ankle joint and the first metatarsophalangeal joint may be limited. These restrictions alter movement patterns, shifting weight-bearing zones into the tendinous structures (e.g., Achilles tendon) or creating muscle dysfunction.

Tip

Fitness Screening: Heel Raise, Half Squat

Poor Alignment in the Open Chain Open chain movement **patterns of the lower extremity** follow familiar movement paths (swing phase in gait) on the one hand, with the unaccustomed challenge of maintaining an active connection to the trunk without distal contact with the floor. Exercises in the open chain therefore depend heavily on **external guidance**, as an aspect of internal proprioceptive awareness is absent.

Tip

Fitness Screening: Superman, Hundred

Poor Alignment in the Closed Chain Contact with a stable surface facilitates good joint articulation, when muscle chains are engaged simultaneously against the acting force of gravity. **Functional alignment of the movement axes** and **the spirally organized muscle chains** is crucial. An impairment of one or other of these factors will result in friction and errors in execution, leading to degeneration of passive joint structures over time.

Tip

Fitness Screening: Full Squat, Heel Raise

Lack of Active Stability During Movement **Loss of dynamic stability** during movement of the lower extremities is evident in uncontrolled phases of motion. Smooth, precise movement execution plays an important role:

- During **symmetrical movements**, the synchronicity of the two sides can be used to assess active stability.
- During **asymmetric movements,** the greater demand for coordination and control challenges active stability in a variety of patterns.

Complex, asymmetric movements most accurately reflect the challenges of everyday life, therefore emphasis must be placed on proper execution during Pilates exercise. Reactive stability also plays a significant role (▶ Sect. 4.1.4).

Tip

Fitness Screening: Full Squat, Half Squat, Heel Raise

Lack of Axial Elongation A lack of adequate axial elongation is reflected in an inability to **actively maintain decompression** within joint chains. It can be observed

- As a spatial misalignment of the arch of the foot, with **dropped longitudinal** and **transverse arches**
- As a lack of vertical elongation in **all other joints**

Tip

Fitness Screening: Prone Knee Bend, Superman, Side Lift

Dysfunctional Transfer of Motion to the Trunk Hyperextended knee joints, insufficient extension of the hip joint, or rotational misalignment of the ankle and foot joints, lead to the dysfunctional distribution of forces acting on the body. **Rotational compensation in the lower lumbar region,** with corresponding adverse effects, may result from disturbances occurring on one side of the body.

Tip

Fitness Screening: Full Squat, Long Sitting, Seated Hip Abduction

Impairment of Standing Position, Balance and Reactive Stability Since the standing position provides a complete picture of overall body posture, any apparent misalignments must be specifically noted and evaluated. The resulting **equilibrium** is the product of:

- Weight distribution
- Spatial organization of the sensory organs of balance
- Reactive stability

The body must continually respond efficiently, and with the appropriate physical mechanisms, to disruption when in a standing position. If responses are faulty or unclear, the appropriate system should be addressed (e.g., peripheral proprioception, core postural reflexes or structural disorders).

Tip

Fitness Screening: Heel Raise, Half Squat

Whole Body Activity

Poor Coordination in Space **Changing position in space**, and thereby the body's relationship to space, usually alters the relationship to gravity. In the case of errors, such as a delay in establishing stability in the new position, the relevant movements need to be practiced more frequently.

Tip

Fitness Screening: Full Squat, Roll Up, Hundred

Poor Body Coordination During exercises which demand whole body integration (e.g., a succession of sequences involving several parts of the body), **errors** manifest as interrupted flow of movement and faulty placement of the body. Training to increase awareness should precede training for control.

Tip

Fitness Screening: Long Sitting, Roll Up

4.5 Use of Small Apparatus

As previously mentioned, Pilates developed **thick floor mats** for his program. These were used to provide assistance (referred to today as "external focus"), with integral loops through which the feet could be placed, or a wooden stick positioned. He is also known to have used a metal ring, the so-called **Magic Circle,** as a tool – these are assumed to have been created originally using the metal rings from beer barrels.

In a modern Pilates mat class, a wider selection of small apparatus or **props** are available. This book will focus on the following **apparatus**:

- **Pilates Roller:** roller made of hard foam, borrowed from the Feldenkrais method, which has played an integral part in Pilates training around the world since the 1990 s
- **Pilates Circle:** modern version of the Magic Circle, available in varying degrees of resistance

- **Core Band:** approx. 20 cm wide, 1.50 m long strip of material, with "pockets" for the hands or feet
- Theraband
- Fitness Ball

There are inexhaustible ways to integrate these and other apparatus, such as balls of varying sizes, in modern Pilates classes, thereby increasing the diversity of training, and allowing exercises to be made easier or more challenging, and adapted to suit every level.

References

Anderson B (2004) Polestar Ausbildungshandbuch. Polestar GmbH, Köln
Ehlenz H, Grosser M, Zimmermann E (2003) Krafttraining. Grundlagen, Methoden, Übungen, Trainingsprogramme. BLV Buchverlag, München
Feldenkrais M (1981) Die Entdeckung des Selbstverständlichen. Suhrkamp, Frankfurt/Main
Feldenkrais M (1985) Das starke Selbst. Suhrkamp, Frankfurt/Main
Gottlob A (2001) Differenziertes Krafttraining mit Schwerpunkt Wirbelsäule. Urban & Fischer, München
Hamilton C (2009) Lokale Stabilität der Gelenke. Handout Hamilton, Regensburg
Hodges P (1999) Is there a role for transversus abdominis in lumbopelvic stability? Man Ther 4(2):74–86
Janda V (1994) Manuelle Muskelfunktionsdiagnostik. Ullstein, Berlin
Junginger B (2009a) Presentation, Physiotherapist Congress, Fellbach
Junginger B (2009b) Dysfunktion und Training des Beckenbodens. Uro-News. http://www.physiotherapiejunginger.de. Cited December 2009
Keller Y, Krucker J, Seleger M (2007) BeBo® Gesundheitstraining. BeBo Verlag GmbH, Zürich
Larsen C (1997) Die S-Form der Wirbelsäule. Physiotherapie ÖPV Wien 2:1–8
Lesson D (2011) Written communication
Myers TW (2004) Anatomy Trains, 1st edn. Elsevier, München
Schleip R (2009) Faszien im Zentrum der Aufmerksamkeit. Medical Tribune 13. http://www.somatics.de. Cited 4 June 2011
Seidenspinner D (2005) Training in der Physiotherapie. Springer, Heidelberg Berlin New York
Vleeming A, Mooney V, Stoeckart R (2007) Movement, stability and lumbopelvic pain. Elsevier, London
Vleeming A (2011) Funktionelle Anatomie. (Course Manual) Berlin (Kursunterlagen Juni 2011)
Weineck J (2010) Optimales Training. Spitta Verlag, Balingen
Van Wingerden B (1998) Bindegewebe in der Rehabilitation. Scipro, Frankfurt/Main

The Exercises

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_5,

5.1 Pre-Pilates Exercises

Pre-Pilates exercises are **preparatory exercises,** designed to provide a basis for classes at a beginner level, and for regular practice at home. The various Pilates movement categories can be explained and taught using a variety of simple positions, making these exercises essential as part of a preventative exercise program. Accurate instruction and correction, whether verbal or tactile, should be prioritized.

This chapter will focus purely on the **exercises** which are performed **on the mat,** not those performed on the Pilates equipment. The traditional **equipment** can nevertheless be used effectively in the field of prevention, regardless of the motor performance level of clients. The basic structure of the exercises is similar although not identical, and the use of equipment can also encourage greater interest and pleasure gained from movement.

! The mat exercises should also form a regular, 20-minute segment of any one-hour session that otherwise focuses primarily on the Pilates equipment

Clients should be taught a **broad repertoire of mat exercises,** which they can then practice competently and consistently at home**.** Only through regular, independent practice during the week, will the practitioner reach the ultimate goal of improved body awareness and competence, and it is this fact which gives the repertoire of mat exercises its particular significance.

! Resistance is provided by the individual's body weight, therefore, the number of repetitions is dependent on the performance level of the group or individual. Typically, a maximum of 10 repetitions are performed.

5.1.1 Breathing (Fig. 5.1)

According to Joseph Pilates, correct breathing forms the **basis of all movement** (▶ Sect. 3.4). Breathing should therefore be integrated purposefully, to support and assist movement:

- The **inhalation** (through the nose) is used as preparation, to concentrate on execution of the movement which follows.
- The movement takes place during a deep **exhalation** (through the mouth).

With increased exercise experience, choreographed breathing patterns can be used during selected exercises, to provide additional challenge ("paradoxical breathing").

Execution

Supine

- In neutral position, with legs extended or bent (Fig. 5.1a)

Variation A

- Place the hands on the lower abdomen (between the pubic bone and the navel)
- Breathe into the abdomen (relaxed breathing)
- Inhale and exhale through the nose
- Abdominal wall rises and falls with the breath

Variation B

- Place the hands on the sides of the lower ribcage (Fig. 5.1b)
- Breathe into the hands (Pilates Breathing)
- Inhale through the nose and exhale through the mouth
- Allow the abdominal wall and ribs to sink with exhalation
- Gently increase activation of the pelvic floor: inhale keeping the lower abdomen flat, and exhale

Seated

- Place one hand on the sternum and the other hand on the lower abdomen (Fig. 5.1c)
- Breathe alternately into the ribcage (the lower ribs) and into the abdomen
- Placing one hand on the side of the lower rib cage, and several times into this side of the body only (toward this hand), then change sides (Fig. 5.1d)

Movement Category

Supine: Core Integration

Verbal Instruction

- **Inhalation** (ribcage breathing)**:**
  - Inhale into the hands
  - Inhale into the mat
  - Expand the ribcage three dimensionally
  - Control of the abdominal wall: the area of the lower abdomen between the pubic bone and the navel remains flat
- Exhalation:
  - Exhale completely
  - Let the chest bone sink
  - Let the ribs sink
  - The abdominal wall falls inward/let it fall

Tactile Instruction

- In a sitting or standing position place both hands on the participant's shoulder blades and give the instruction to "breathe into my hands", supporting the movement of the shoulder blades.

Variations

- Inhale only into the back of the body: "down to the coccyx"
- Diagonal breathing: toward the right side of the thorax, and the left side toward the shoulder blade

Faulty Movement Patterns

- Shallow breathing
- Exaggerated breathing

Sources of Error

- Limited opening of ventral structures (pectoral muscles, joint connections, chest bone)

Possible Solutions: Regression

- Facilitating tool: Theraband
  - Inhale into the Theraband, exhale with the Theraband (increasing the tension slightly) (Fig. 5.1e)

Fig. 5.1a–e Breathing. **a** Relaxed breathing, **b** Pilates breathing, **c** breathing in a sitting position: breathing into the hands; **d** breathing in a sitting position: breathing into the hands; **e** breathing with Theraband

5.1.2 Pelvic Clock (Fig. 5.2)

Starting Position

- Supine, neutral position: legs bent

Execution

- Sagittal plane:
  - Exhale, tilt the pelvis posteriorly, curl the coccyx in ("flatten the lumbar spine") (Fig. 5.2a)
  - Inhale, tilt the pelvis anteriorly ("arch the back") (Fig. 5.2b)
  - Instruction: move from north to south or from 6 to 12 o' clock
  - Repeat several times
- Transverse plane:
  - Move the pelvis from east to west, or from 9 to 3 o' clock
  - Repeat several times
- Multiple planes:
  - Combine the movements to create a circling motion, avoid lifting the pelvis and emphasize pressing into the mat
  - Breathe fluidly

Movement Category

Supine: Core Integration

Focus: core control and mobility in all planes

Verbal Instruction

- Imagine a clock or a compass resting on your pelvis; the navel is the center point
- Iliac crest right/left: movement direction 9 o' clock to 3 o' clock, or from east to west (lifting and lowering)
- Pubic bone/ribs: movement direction is 6 o' clock to 12 o' clock, or from north to south (arching/flattening the back)

Tactile Instruction

- Tap on the iliac crest with fingertips to indicate the movement from 3 to 9 o' clock (east/west)
- Place the hands around the iliac crest and guide the movement from 6 to 12 o' clock (north/south)

Faulty Movement Patterns

- Excessive muscle tension in the upper trunk and legs
- Loss of leg alignment during the movement

Sources of Error

- Lumbar spine/pelvis:
  - Limited physiological mobility in flexion, extension, rotation
- Lower extremities:
  - Poor alignment in a closed chain (closed chain, ▶ Sect. 8.4.2)

Possible Solutions: Regression

- Place a small ball (partially deflated) or stability cushion beneath the pelvis
- In a sitting position (ball/chair)
- In a standing position

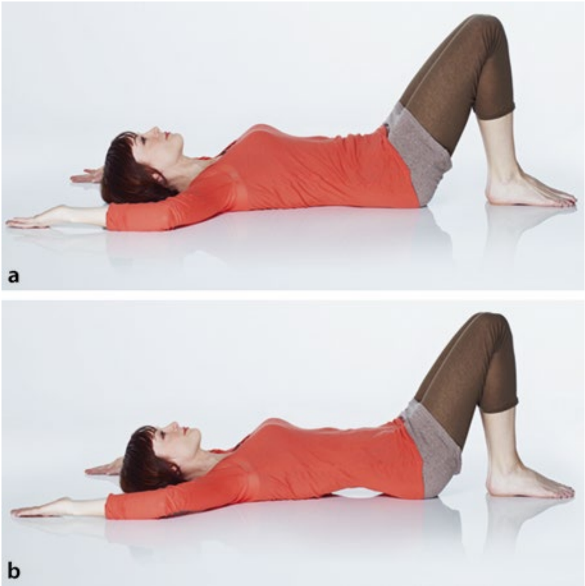


Fig. 5.2a,b Pelvic Clock Sagittal plane: pelvis tilts **a** posterior tilt and **b** anterior tilt

5.1.3 Shoulder Drops (Fig. 5.3)

Starting Position
- Active starting position: sacrum and ribs flat on the mat
- Legs bent
- Arms shoulder width apart, extended toward the ceiling
- Thumbs pointing behind the head, palms facing each other

Execution
- Inhale and reach the arms toward the ceiling, until shoulders peel off the mat; then
- Exhale and let the shoulder blades glide into the mat (Fig. 5.3a)

Movement Category
Supine: Core Integration

Verbal Instruction
- Shoulders wide
- Clavicles reach right and left into space
- Large space between shoulders and ears
- Reach toward the ceiling

Tactile Instruction
- Draw the participant's hands gently upward
- Trainer places hands under the participant's shoulder blades with the instruction, "Allow your shoulders to drop into my hands"

Faulty Movement Patterns
- Cannot keep arms fully extended
- Incorrect positioning of the arm (not vertical, but too far toward the head)
- Shoulder blades cannot drop or fall

Sources of Error
- Restricted mobility of the upper extremities
- Poor alignment in the open chain (open chain, ▶ Sect. 8.4.2)
- Insufficient connection between thorax and pelvis

Possible Solutions: Regression
- Small apparatus: foam roller
- Supine on the foam roller
  - Inhale and reach the arms toward the ceiling, shoulder blades peel off the roller
  - Exhale, allowing the shoulder blades to sink to the right and left of the roller
  - Arms remain straight

Modifications: Progression
- **Open and Close:**
  - Begin with arms raised "as if hugging a large ball", then inhale while opening the arms slowly to the side. Exhale and close the arms, keeping shoulders wide and chest open (Fig. 5.3b)
- **Arm Arcs:**
  - Inhale and reach extended arms toward the back of the room (Fig. 5.3c), maintaining contact between ribcage and mat
  - Exhale and return the arms to the starting position, either reaching toward the ceiling, or on the floor, at the side of the body (Fig. 5.3d)
  - **Verbal instruction:** "Draw the arms lightly across the floor with shoulders wide and chest open, maintaining space between the shoulders and the ears"
- **Windmill:**
  - Extend both arms toward the ceiling
  - Lower the left arm, palm facing up (Fig. 5.3e); then
  - Repeat "Crossing arms" twice: left arm moves toward the back of the room, the right arm down toward the feet; then the right arm moves back and the left arm moves down, palms facing up. Follow with
  - Alternate arm motion in half circles up, down, and opening to the side above the floor: left arm goes back, right arm goes down (Fig. 5.3f); again
  - Repeat "Crossing arms" twice, then follow with one half circle to the side
  - **Verbal instruction:** "Cross, cross, circle; shoulders stay wide, maintain space between the shoulders and the ears, keep the longest possible distance between right and left hands, and reach the hands away from each other"
- Small apparatus:
  - All exercises may also be performed supine on the foam roller

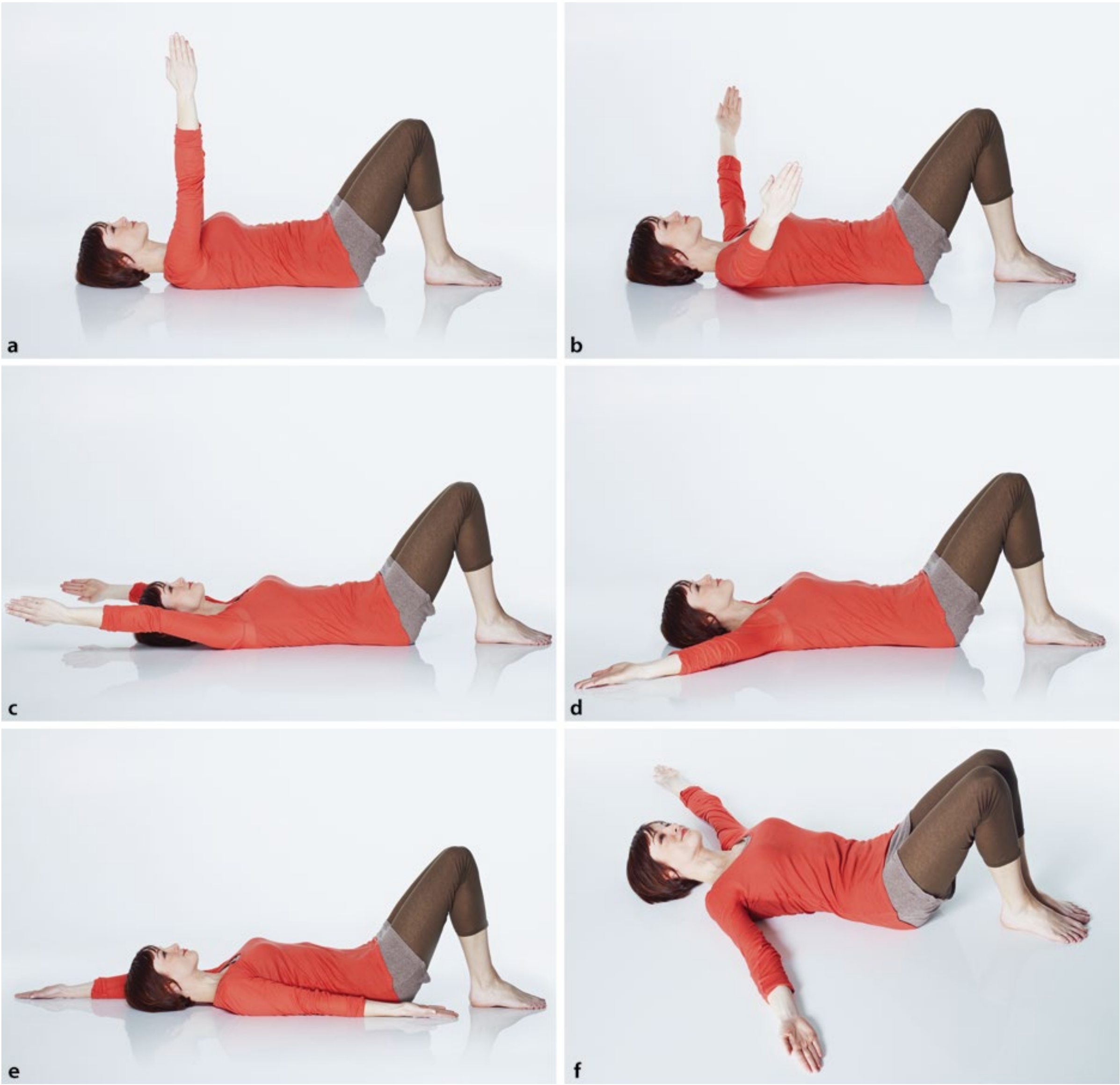


Fig. 5.3a–f Shoulder Drops. **a** Exercise. **b** Progression: Open and Close; **c**, **d** Progression: Arm Arcs; **e**, **f** Progression: Windmill

5

5.1.4 Chest Lift (Fig. 5.4)

Starting Position
- Active starting position: sacrum and ribs flat on the mat
- Legs bent, head resting in the hands

Execution
- Inhale and while exhaling, curl the chin slightly in, lifting the head and rolling up to the tips of the shoulder blades; the pelvis is in a slight posterior tilt (Fig. 5.4a)
- Inhale keeping the abdominal wall flat, then with the exhalation lengthen the spine and roll back down one vertebra a time

Movement Category
Supine: Abdominal Strengthening
Focus: spinal articulation with axial elongation

Verbal Instruction
- Draw the head away from the neck, the neck away from the shoulders; curl the chin in and up
- Maintain a fist sized space between chin and sternum
- Roll through the longest possible arc
- Roll up one vertebra a time
- Keep shoulders wide and low
- The middle sinks (abdomen), to allow the upper body to rise

Tactile Instruction
- Place a hand under the thoracic spine and assist curling up
- Tap with fingertips on the abdominal muscles, to indicate the abdominal wall falling inward

Faulty Movement Patterns
- Shoulders rise toward the ears
- Insufficient control of the abdominal muscles (abdomen bulges outward)

Sources of Error
- Loss of the stable connection between the head and the trunk
- Faulty organization of shoulders and cervical spine
- Limited physiological mobility in flexion

Possible Solutions: Regression
- In case of cervical issues:
- Lay with head and body on a towel
- Hold the corners of the towel
- Roll the upper body away from the floor, with the assistance of the towel (Fig. 5.4b)

Modifications: Progression
- Roll up during exhalation:
  - Inhale and reach the arms toward the pelvis (Fig. 5.4c)
  - Exhale and roll up a little higher
  - Inhale raise the arms toward the ceiling, in line with the ears (Fig. 5.4d)
  - Exhale to roll up slightly higher
  - Inhale placing hands behind the head once more
  - Exhale and roll down
- Keep the arms at the sides, hip height:
  - Palms facing down: execute small, quick pumping movements, up and down (Fig. 5.4e)
  - Thumbs pointing up: similar up and down motion, but chopping with the hands (Fig. 5.4f)
- **Small apparatus:** supine on a foam roller

Fig. 5.4a–f Chest Lift. **a** Chest lift, **b** with towel, **c**, **d** progression: roll up with exhalation; **e** progression: pumping movements; **f** progression: chopping movements

5.1.5 Dead Bug (Fig. 5.5)

- **Starting Position**
- Active starting position: sacrum and ribs flat on the mat
- Legs in Table Top position (hips and knees flexed to 90°), arms resting on the mat, alongside the pelvis

- **Execution**
- Alternately lower the bent leg toward the floor during exhalation (Fig. 5.5a)

- **Movement Category**
- **Supine: Core Integration and Abdominal Strengthening**

Verbal Instruction
- Keep the back long and flat
- Maintain a large space between iliac crest and lower ribs

Tactile Instruction
- Place one hand underneath the spine to check positioning of the lumbar spine
- Client can check positioning of the lumbar spine themselves, by placing a rolled-up tea towel beneath the spine (Fig. 5.5b)

Faulty Movement Patterns
- Insufficient control of the abdominal muscles (abdomen bulges outward)
- Cannot maintain the active starting position of the spine
- Overuse of the hip flexors

Sources of Error
- Insufficient connection between pelvis and thorax
- Loss of axial elongation
- Loss of active stability during the movement

Possible Solutions: Regression
- **Femur arcs:**
  - Legs bent, feet on the floor
  - Spine in active starting position
  - Inhale, flexing the hip and raise one leg to 90/90°position (Fig. 5.5c)
  - Exhale and lower the leg to the starting position
  - Circle one bent leg (90/90°) (Fig. 5.5d)
- **Leg Lowers:**
  - One leg bent with foot on the floor, the second leg extended toward the ceiling
  - Lower the extended leg toward the floor with foot dorsiflexed, and lift the leg back up with foot plantarflexed
- **Bicycle:**
  - Lower the extended leg toward the floor, then bend and draw the leg back toward the body

Modifications: Progression
- **Both legs are bent** and lowered toward the floor:
  - Lower toward the floor, with the feet alternately in plantar or dorsiflexion
  - Move the right foot in plantarflexion and the left foot in dorsiflexion, then change
  - Keep both arms at the sides of the pelvis, or extended overhead
- **Add arm movements**
- **Legs bent**, arms extended toward the ceiling:
  - Right arm reaches back as the left leg moves down toward the floor, and return (Fig. 5.5e), then alternate sides
  - Simultaneously reach both arms overhead and lower both legs toward the floor, and return
- **Legs straight,** arms extended toward the ceiling:
  - Move the opposite arm and leg down toward the floor, then lift them back up
  - Move both arms and both legs down toward the floor, then lift them back up
- With hip **internal/external rotation**, alternating:
  - Hip external rotation: knees facing out, soles of the feet together (Fig. 5.5f)
  - Hip internal rotation: knees together, lower legs separated (Fig. 5.5g)
  - Knees and feet squeezed together, rotate from the hip, lower the legs alternately to the left / right toward the floor, keeping feet in line with the trunk (Fig. 5.5h)
- **Small apparatus:** foam roller (Fig. 5.5i)

Fig. 5.5a–i Dead Bug. **a** Lower legs alternately, **b** self-supporting with towel; **c**, **d** regression: Femur Arcs; **e** progression: arm and leg coordination; **f** progression: external rotation; **g** progression: internal rotation; **h** progression: legs closed, feet tapping right/left; **i** progression: with foam roller

5.1.6 Side to Side (Fig. 5.6)

Starting Position
- Active starting position: sacrum and ribs flat on the mat
- Legs in Table Top position (90/90°)
- Arms extended to the sides with palms facing up (Fig. 5.6a)

Execution
- Inhale, then with the
- Exhalation turn both legs and left hip to the right side and lower slightly toward the floor
- (Fig. 5.6b)
- Inhale and bring the legs back to center;
- Exhale, turn and lower legs and pelvis to the left
- Inhale to return to center

Movement Category
Whole Body Integration: Complex Coordination
Focus: core control in all positions

Verbal Instruction
- The opposite shoulder stays on the floor
- Keep legs closed
- Place knee over knee, foot over foot

Visual Instruction
- Move the legs back and forth like a pendulum

Tactile Instruction
- Pull the arms gently to elongate
- Hold the shoulders still
- Hold and guide the legs/feet

Faulty Movement Patterns
- Shoulders lift away from the mat
- Pelvis tilts anteriorly (arched back)
- Cannot maintain the length of the spine

Sources of Error
- Limited physiological mobility in rotation
- Loss of axial elongation
- Insufficient connection between pelvis and thorax

Possible solutions: Regression
- Keep the feet on the floor
- Keep the knees and feet together and lower to the floor, alternating right and left
- Knee over knee, foot over foot (Fig. 5.6c)

Modifications: Progression
- Reversed breathing pattern: inhale to lower the legs, paying close attention to abdominal engagement!
- Lower bent knees to the side, extend the legs, and bend once more before returning to center
- **For stabilization:** extend legs toward the ceiling (Fig. 5.6d), lower the extended legs slightly to the right, but keep the left hip on the mat. Hold this position for several breaths; then move both legs toward the left, keeping the right hip on the mat. Allow inner thighs to slide past each other, one foot is clearly lower than the other in the final position (Fig. 5.6e)!

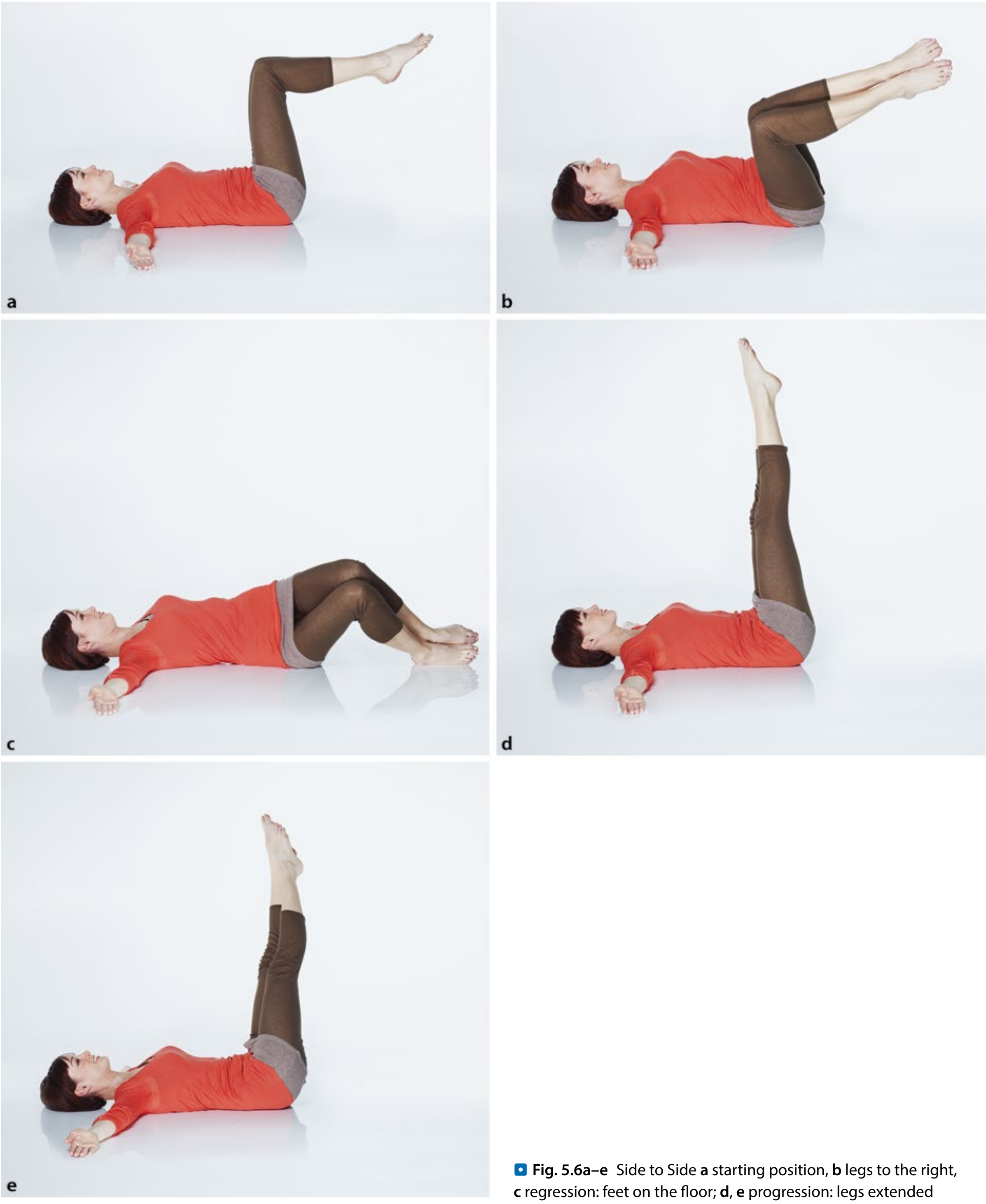


Fig. 5.6a–e Side to Side **a** starting position, **b** legs to the right, **c** regression: feet on the floor; **d**, **e** progression: legs extended

5.1.7 Bridging I (Fig. 5.7)

Starting Position
- Active starting position: sacrum and ribs flat on the mat
- Legs bent and hip width apart, arms at the sides with palms facing down (Fig. 5.7a)

Execution
- Inhale and during exhalation roll the spine up vertebra by vertebra, leading from the coccyx and as far as the shoulder blades (Fig. 5.7b); repeat
- Inhale, and with the exhalation roll down vertebra by vertebra

Movement Category

Supine: Core Integration

Focus: spinal articulation in the sagittal plane

Verbal Instruction
- Rolling up:
  - Allow the sternum to soften and sink
  - Roll the tailbone toward the pubic bone, pubic bone toward the navel, roll vertebra by vertebra
  - Draw the sitting bones toward the back of the knees
- Final position:
  - Pubic bone is higher than the ribs
  - Reach knees to the opposite wall
  - Shoulders relaxed and wide
  - The back drapes as if resting in a hammock
- Rolling down:
  - Draw the vertebrae away from each other
  - Roll through the spine as if placing each piece of the spine along an (imaginary) line
  - Tailbone is further away (from the head) when each reaches the mat, than before the exercise

Tactile Instruction
- Rolling up:
  - Touch the sternum ("Allow it to sink!" or "Relax!")
  - Place the hands right and left on the ilium, and guide the pelvis through the tilting motion
- Final position:
  - Place hands on the knees and guide the reaching motion ("toward the opposite wall")
  - Hold the back of the knees and pull gently
- Roll down movement
  - Place the hand beneath the spine and touch each vertebra in sequence
  - Draw the index and middle fingers along the spine to indicate the movement

Faulty Movement Patterns
- No rolling motion or spinal articulation
- Poor alignment of the legs or feet

Sources of Error
- Limited physiological mobility in flexion
- Poor coordination of the body and awareness of the body in space
- Lack of axial elongation

Possible Solutions: Regression
- Tactile guidance of pelvic motion
- Correction of foot alignment
- **Small apparatus:**
  - Ball or Circle between the knees, to correct alignment of the leg axis

Modifications: Progression
- **Bridging with arm movement:**
  - Roll up during exhalation
  - Inhale and raise the arms first toward the ceiling, then extend behind the head to rest on the floor (Fig. 5.7c)
  - Exhale to roll down
  - Inhale circling the arms out to the side above the floor, and back toward the pelvis
- **Bridging with stabilization:**
  - Roll the pelvis off the mat
  - Place hands (or a gymnastic stick) on the iliac crest
  - Raise the right leg slightly and hold for 10 seconds; avoid rotating or tipping the pelvis!
  - Repeat with left leg, then roll down (Fig. 5.7d)
  - Even breathing
- **Marching:**
  - Roll the pelvis away from the mat
  - Place hands (or gymnastic stick) on the iliac crest
  - Raise the legs alternately
  - Movement imitates running in place, with the least possible motion of the pelvis
- **Small apparatus:**
  - Place feet on an unstable surface (foam roller, rotating disc, ball) (Fig. 5.7e)
  - Place Circle or ball between the knees

Fig. 5.7a–e Bridging I. **a** Starting position, **b** end position, **c** progression: arm movement; **d** progression: stabilization; **e** progression: with foam roller

5.1.8 Roll Over I (Fig. 5.8)

Starting Position
- Active starting position: sacrum and ribs flat on the mat
- Legs in 90/90° position, knees together
- Arms straight and resting at the side of the pelvis, palms facing down (Fig. 5.8a)

Execution
- Inhale, and exhale to roll the pelvis off the mat until weight rests on the shoulder blades (Fig. 5.8b)
- Inhale once more and with the exhalation, roll through the spine vertebra by vertebra with control, returning to the starting position

Movement Category

Overhead Organization (Inverted Position): Mobility and Dynamic Stability

Focus: spinal articulation in the sagittal plane

Verbal Instruction
- Roll the tailbone toward the pubic bone, pubic bone toward the navel
- Keep the shoulders relaxed and wide, and press long arms into the mat
- Avoid momentum
- Lengthen the vertebrae away from each other

Tactile Instruction
- Press feet into the thighs or hands of the trainer, to initiate pelvic motion

Faulty Movement Patterns
- Executing the movement with momentum
- Compression of the cervical spine

Sources of Error
- Lumbar spine/hips/pelvis:
  - Limited physiological mobility in flexion
  - Lack of axial elongation
- Whole body activity:
  - Poor coordination when moving through space
  - Poor body coordination
  - Insufficient connection between pelvis and thorax

Possible Solutions: Regression
- Elevate the pelvis in the starting position (wedge cushion, rolled towel, foam roller)
- Start in **supported sitting position**, rather than supine (Fig. 5.8c):
  - Inhale, extend the thoracic spine and sternum toward the ceiling
  - Exhale, draw both knees toward the chest and roll with control until the weight rests on the shoulder blades (as Fig. 5.8b), then
  - Inhale to roll back to the starting position
  - Keep the elbows in the same position during the movement back and forth!

Fig. 5.8a–c Roll Over I. **a** Starting position, **b** final position, **c** regression: start in supported sitting position

5

5.1.9 Assisted Roll Up/Roll Down (Fig. 5.9)

- **Starting Position**
- Active starting position: supine
- Legs bent
- Hands behind the knees, shoulders down and elbows wide (Fig. 5.9a)

- **Execution**
- Inhale and during exhalation, curl the chin in, lift the head and shoulder blades off the mat while pressing the back of the legs into the hands (Fig. 5.9b). Roll up to sitting position, and place the feet on the floor (Fig. 5.9c), then
- Inhale lengthening the spine, with the next exhalation roll to supine with control, holding the back of the legs

- **Movement Category**
- **Supine: Core Integration and Abdominal Strengthening**

Focus: organization of shoulder, neck and head during flexion

Verbal Instruction
- Do not sink or collapse down
- Roll down one vertebra a time following the longest possible arc of movement
- Maintain a "C-curve" of the spine
- Reach away through the feet

Tactile Instruction
- Trainer may hold and pull gently on the feet, or hold hands and guide the movement by pulling slightly

Faulty Movement Patterns
- Use of momentum
- No rolling movement
- No articulation of the spine

Sources of Error
- Cervical spine/shoulders/head:
  - Loss of a stable connection between the head and trunk
- Lumbar spine/hips/pelvis:
  - Limited physiological mobility in flexion

Possible Solutions: Regression
- **Half Roll Down:**
  - Start in sitting position
  - Inhale, and during exhalation roll halfway down, holding the back of the legs for support if required
  - Stay in this position for several breaths (Fig. 5.9d)
  - Maintain engagement of the abdominal wall, and shoulder girdle organization
  - Exhale and roll back to sitting
  - Repeat the exercise several times

Modifications: Progression
- **Half Roll Down with Arm Movement:**
  - Inhale, and during the exhalation roll halfway down, take the hands away from the legs
  - Inhale (control the abdominal wall!) and reach the right arm toward the ceiling (Fig. 5.9e), exhale and lower the arm
  - Inhale and repeat motion with the left arm
  - Inhale and raise both arms toward the ceiling, exhale and lower the arms down, finally
  - Inhale and while exhaling roll all the way down
- **Half Roll Down with Rotation:**
  - Exhale and roll halfway down
  - While inhaling, rotate the upper body and circle the arms to the right (Fig. 5.9f), return to center with the exhalation
  - Inhale and repeat motion to the left side
  - Exhale and return to center; finally
  - Inhale and while exhaling roll all the way down
  - Later, arm may circle above overhead
- **Assisted Roll Up/Roll Down:**
  - Roll up to sitting with legs bent ("Assisted Roll Up") keeping feet lifted; in the seated position extend the legs. Keep legs extended and slowly roll down

Fig. 5.9a–f Assisted Roll Up. **a** Starting position, **b** legs pushing into the hands to roll up, **c** final position in sitting, **d** Half Roll Down from the sitting position, **e** progression: Half Roll Down with arm movement; **f** progression: Half Roll Down with rotation

5.1.10 Book Opening (Fig. 5.10)

Starting Position

- Lie on the right side with legs bent: 90° flexion at the hips and knees, arms straight and resting one on top of the other at shoulder level, in front of the body
- Active starting position: spine elongated with dynamic tension, waist lifted away from the floor
- Position the head with neck lengthened (Fig. 5.10a)

Execution

- Inhale, during exhalation slide the left arm over the right hand, allowing the head to follow the rotation of the thoracic spine, gaze directed toward the floor (or dependent on mobility, also past the right shoulder toward the back of the room)
- Inhale once more, circling the top arm toward the ceiling, and diagonally behind the body to the opposite side of the room while lengthening through the upper body (Fig. 5.10b); keep top knee over bottom knee, foot over foot
- Exhale and rest the head and arm down
- Inhale, lengthen and return to the starting position, exhale in the starting position

Movement Category

Whole Body Integration: Complex Coordination

Focus: spinal articulation in multiple planes

Verbal Instruction

- Keep knees stacked
- Shoulders down and wide, arms extended and long
- Gaze and rib cage follow the movement
- Allow the spine lengthen, twist and finally rest down
- Narrow the waist

Tactile Instruction

- Correct the position of shoulders/neck
- Correct the leg position

Faulty Patterns of Movement

- Gaze and rib cage do not follow the arm movement

Sources of Error

- Thoracic spine/shoulder/arm:
  - Limited physiological mobility in rotation
  - Loss of axial elongation during movement of the thoracic spine
  - Insufficient connection between pelvis and thorax

Possible Solutions: Regression

- Place the lower arm underneath the head
- Put a flat cushion underneath the head

Modifications: Progression

- Extend lower leg along the floor, keep top knee on or close to the floor
- To conclude, hold the position for several breaths. Taking hold of the , and pull gently toward the floor, pressing the upper arm and the shoulder of the lower arm down into the mat (Fig. 5.10c)
- **Small apparatus:** foam roller to assist shoulder/thoracic spine mobility
  - Side-lying
  - Rest the upper arm on the foam roller (Fig. 5.10d)
  - Roll the foam roller back and forth, using shoulder ab-/adduction, and pro- (Fig. 5.10e) and supination of the arm (Fig. 5.10f)
  - Pelvis remains stationary: keep knees stacked

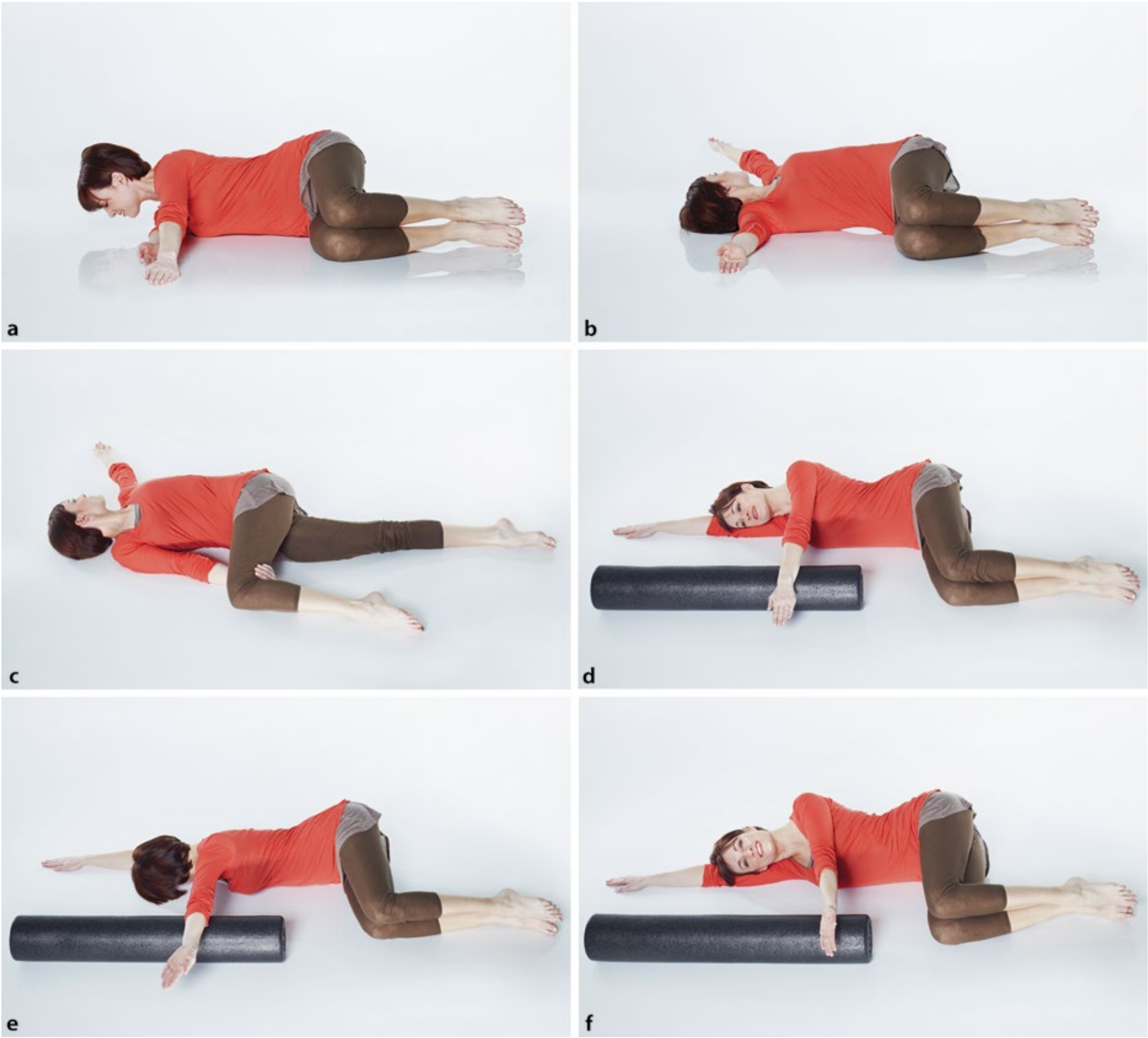


Fig. 5.10a–f Book Opening. **a** Starting position, **b** arm to the left and up, **c** progression: stretch; **d**, **e**, **f** progression: shoulder mobilization

5.1.11 Side Kick Series I (Fig. 5.11)

Starting Position

- Side-lying on the right side, with legs bent: 90° flexion at the hips and knees
- Active starting position: spine under dynamic tension, waist lifted away from the mat
- Head resting on the lower arm
- Upper arm provides support

Execution

- Inhale and lift top leg to hip height,
- Exhale and move the top leg toward the back (hip extension) (Fig. 5.11a)
- Inhale and move the top leg to the front (hip flexion)

Movement category

Side-Lying: Stabilization

Focus: core control in all planes, control of leg axis

Verbal Instruction

- Move the leg from the hip, staying parallel to the floor (as if across the surface of a table)
- Pelvis remains stationary
- Maintain a long space between pelvis and thorax
- Narrow the waist
- Lengthen the leg (maintain muscle engagement)

Tactile Instruction

- With one hand under the waist, the other on the upper iliac crest, draw the pelvis away from the thorax to encourage elongation
- Correct position of the top shoulder (stacked over the bottom shoulder)

Faulty Movement Patterns

- Pelvis rocking back and forth
- Cannot maintain leg at hip height and parallel to the floor

Sources of Error

- Whole body activity:
  - Poor coordination when moving through space
  - Poor body coordination
  - Insufficient connection between pelvis and thorax
- Lower extremities:
  - Limited mobility of lower extremities
  - Poor alignment in the open chain
  - Lack of active stabilization during the movement
  - Lack of axial elongation

Possible Solutions: Regression

- Side-lying against the wall:
  - Back of the head, both shoulders, pelvis and heel of the top leg in contact with the wall (Fig. 5.11b)
  - Hip and knee of lower leg flexed at 90°
  - Lift and lower the extended upper leg
  - Top heel maintains contact with the wall!
- Foot position:
  - Parallel to the floor
  - External hip rotation (foot pointing to the ceiling)
  - Internal hip rotation (foot pointing to the floor)
  - Repeat 10 times with each leg
- Clam:
  - Soles of the feet in line with the trunk, knees flexed to 90°
  - “Open” the top knee toward the ceiling
  - Maintain contact between the medial sides of the feet, with hips stacked (Fig. 5.11c)

Modifications: Progression

- Upper leg is extended
- Reach the upper arm toward the ceiling, removing support! (Fig. 5.11d)
- Move the leg forward and back (hip flexion/extension)
- Raise and lower leg (hip abduction/adduction)
- Draw small circles in both directions
- **Small apparatus:** Theraband or Core Band guide the motion of the extended leg (Fig. 5.11e)
  - Move forward and back
  - Raise and lower
  - Circle

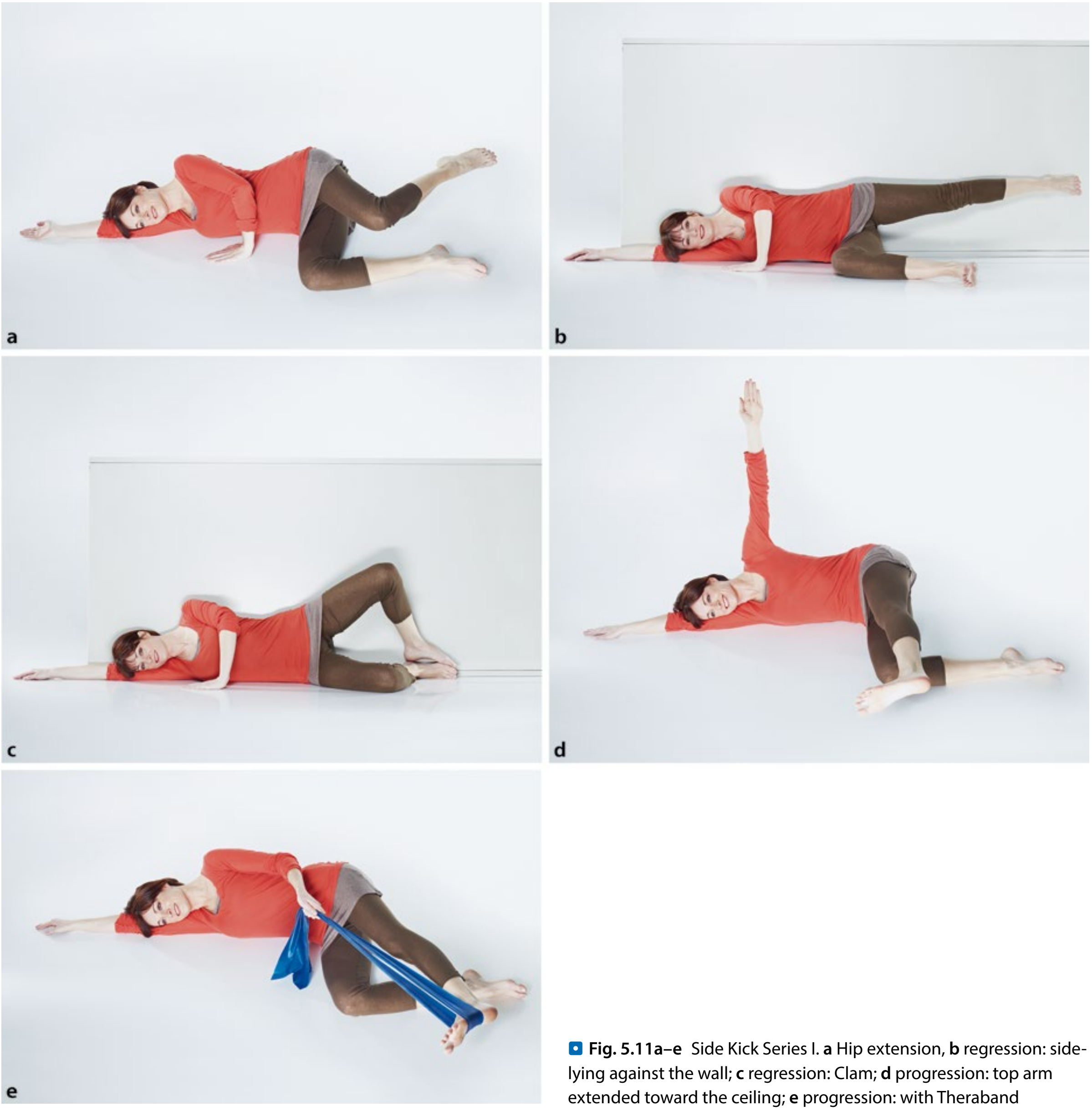


Fig. 5.11a–e Side Kick Series I. **a** Hip extension, **b** regression: side-lying against the wall; **c** regression: Clam; **d** progression: top arm extended toward the ceiling; **e** progression: with Theraband

5.1.12 Side Lift (Fig. 5.12)

Starting Position
- Legs bent with knee, hips and shoulders in one line
- Active starting position: weight supported on forearm (Fig. 5.12a)

Execution
- Inhale, then with exhalation raise the pelvis (Fig. 5.12b), hold for 10–30 seconds

Movement Category
Side Supported Position: Stabilization
Focus: alignment and weight-bearing through the upper extremity

Verbal Instruction
- Dynamic tension
- Narrow the waist
- Stack the hips
- Shoulders wide and down
- Push and pull
- Lift the rib cage

Tactile Instruction
- Correct and assist the positioning of the pelvis

Faulty Movement Patterns
- Shoulders are elevated
- Pelvis can barely be lifted off the mat

Sources of Error
- Upper extremity:
  - Poor alignment in the closed chain
  - Loss of axial elongation
- Whole body activity:
  - Poor body coordination
  - Insufficient connection between pelvis and thorax

Possible Solutions: Regression
- Lift and lower the pelvis dynamically
- Place upper arm in front of the upper body for added support (be aware of rotating the upper body!)

Modifications: Progression
- Extend upper leg and arm
- Lift and lower the upper leg (Fig. 5.12c)
- Both legs extended with feet stacked (Fig. 5.12d)
- Resting top hand on top leg, lift and lower the leg (Fig. 5.12e)
- **Small apparatus:** foam roller
  - Weight supported on the elbow, place foam roller crosswise and rest both legs on the roller
  - Upper leg is in front
  - Raise the pelvis
  - Keep both legs extended
  - Maintain balance

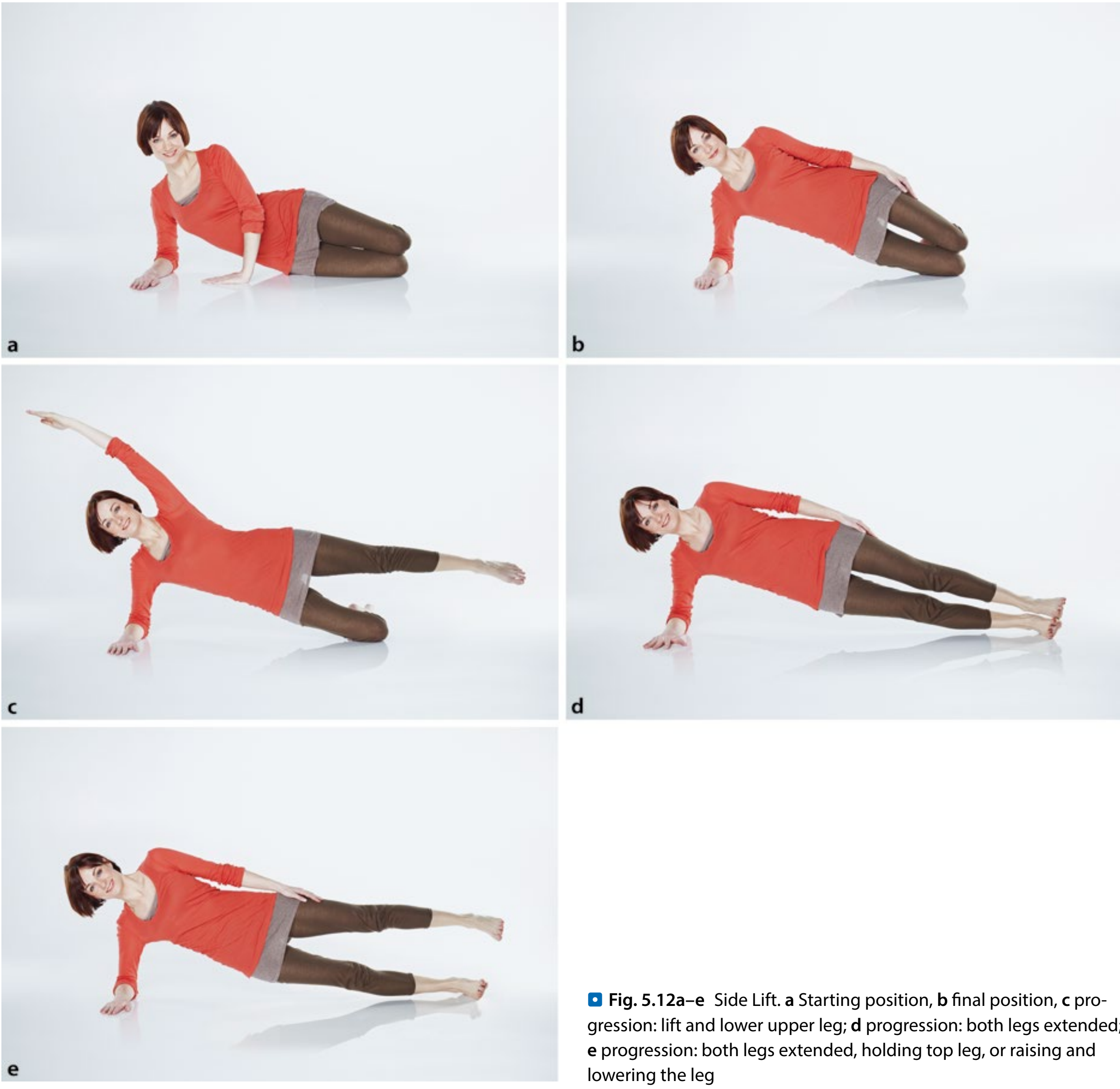


Fig. 5.12a–e Side Lift. **a** Starting position, **b** final position, **c** progression: lift and lower upper leg; **d** progression: both legs extended; **e** progression: both legs extended, holding top leg, or raising and lowering the leg

5.1.13 Spine Stretch I (Fig. 5.13)

Starting Position

- Active starting position: seated (preferably with back against a wall)
- Legs shoulder width apart, slightly bent with knees toward the ceiling
- Arms relaxed at the sides

Execution

- Inhale, lengthening (Fig. 5.13a); exhale curling the chin in, and roll the spine away from the wall, one vertebra at a time. Press the pelvis lightly against the wall (Fig. 5.13b)
- Inhale and roll back up

Movement Category

Seated: Upright Posture

Focus: spinal articulation with axial elongation

Verbal Instruction

- Sitting position:
  - Weight on the sitting bones
  - Push and pull
- Roll down:
  - Extend the crown of the head toward the ceiling, then roll the spine forward and down
  - Press navel toward the wall
  - Keep neck, shoulders and arms relaxed
- Roll up:
  - Stack the vertebra piece by piece
  - Lengthen the vertebra away from each other, creating space/length in the spine

Faulty Movement Patterns

- Shoulders are elevated
- Flexing at the hip instead of moving the spine
- Loss of length through the spine
- Inability to sit in long sitting position
- Insufficient control of abdominal wall

Sources of Error

- Thoracic spine/lumbar spine:
  - Limited physiological mobility in flexion
- Lower extremity:
  - Limitation flexibility of lower extremity

Possible Solutions: Regression

- Sit on a raised surface, for example, a rolled up mat or foam roller

Modifications: Progression

- Practice motion without the supporting surface (wall)
- **Small apparatus:** Core Band or gymnastic stick for correction and alignment of shoulder girdle
  - Sitting against the wall, raise arms in a U shape holding band or stick in hands
  - Inhale (Fig. 5.13c)
  - Exhale and move the stick forward until parallel with the floor, pressing elbows against the wall (Fig. 5.13d)
  - Inhale and extend the arms forward, simultaneously lengthening through the spine (Fig. 5.13e)
  - Exhale and roll the vertebra one by one away from the wall, legs can be extended (Fig. 5.13f)
  - Inhale at the end of the movement, and with the next exhalation roll up, guide the elbows back against the wall (Fig. 5.13d) and return to the starting position

Fig. 5.13a–f Spine Stretch I. **a** Starting position, **b** final position, **c**, **d**, **e**, **f** progression: with gymnastic stick (starting position, mobilizing the shoulder girdle, arms extended to roll down, final position)

5

5.1.14 Mermaid I (Fig. 5.14)

- **Starting Position**
- Active starting position: sit cross legged
- Arms extended to the side, parallel to the floor (Fig. 5.14a)
- Shoulders down and wide

- **Execution**
- Inhale to lengthen the spine, reaching or "lengthening" the arms to the left/right
- Exhale, bringing the right arm toward the ceiling, and curve the spine in a long arc to the left
- (Fig. 5.14b); allow the fingertips of the left hand to slide across the floor
- Inhale to return to the starting position
- Exhale and reach with the left arm toward the ceiling
- Inhale lengthening the spine toward the ceiling, then curve the spine toward the right
- Repeat several times, alternating sides

- **Movement Category**
- **Seated: Upright Posture**

Focus: spinal articulation in sagittal plane

Verbal Instruction
- Extend the crown of the head toward the ceiling, then curve up and over a big ball
- Keep both sitting bones are firmly anchored
- Slide between two pieces of glass
- Shoulders wide and down
- When side bending, maintain the space between the ear and the upper arm

Tactile Instruction
- Stand behind the participant, using one leg to support the back
- "Stroke" along the extended arm to facilitate lengthening
- Correct shoulder elevation if necessary

Faulty Movement Patterns
- Shoulders are raised (elevation)
- Poor arm movement: not extended and lengthening
- No axial elongation of the spine, side bending too early
- During side bending, the upper body flexes forward
- Contralateral sitting bone lifts off the floor (pelvis follows)

Sources of Error
- Limited physiological lateral flexion
- Insufficient opening of ventral structures (chest muscles, joints, sternum)
- Lack of axial elongation

Possible Solutions: Regression
- Sit on a raised surface, for example, a big ball/chair
- Legs extended in long sitting position, shoulder width apart
- Perform the movement with back and arms against a wall

Modifications: Progression
- **Small apparatus:** Circle or Core Band (Fig. 5.14c)

Fig. 5.14a–c Mermaid I. **a** Starting position, **b** final position, **c** progression: final position

5.1.15 Scarecrow (Fig. 5.15)

Starting Position

- Active starting position: prone
- Curl the tailbone slightly in
- Reach the sitting bones toward the heels
- Legs hip width apart and parallel
- Place the arms in U shape, thumbs pointing toward the ceiling (Fig. 5.15a)

5

Execution

- Inhale and lift the forearms; keeping wrists long (Fig. 5.15b)
- Exhale and lift the elbows, keeping hands higher than the elbows (Fig. 5.15c)
- Inhale, extend the thoracic spine and lift the upper body (Fig. 5.15d)
- Exhale, straighten the arms, do not allow the upper body to sink lower (Fig. 5.15e)
- Inhale and bend the arms (Fig. 5.15f)
- Exhale, lower the upper body to the mat (Fig. 5.15g)
- Inhale placing the elbows down (Fig. 5.15h), finally
- Exhale and place the forearms down (Fig. 5.15i)

Movement Category

Prone: Strengthening the Trunk

Focus: core control in prone, dynamic stability of the shoulders in flexion and extension

Verbal Instruction

- Curl the tailbone slightly in
- Reach through the sitting bones toward the heels (lengthening the spine)
- Keep wrists long and straight
- Shoulders wide and down

Tactile Instruction

- Touch the shoulders if they become tense
- Correct alignment of the arms in U shape (elbows 90° flexion)
- Draw the wrist joints straight and long

Faulty Movement Patterns

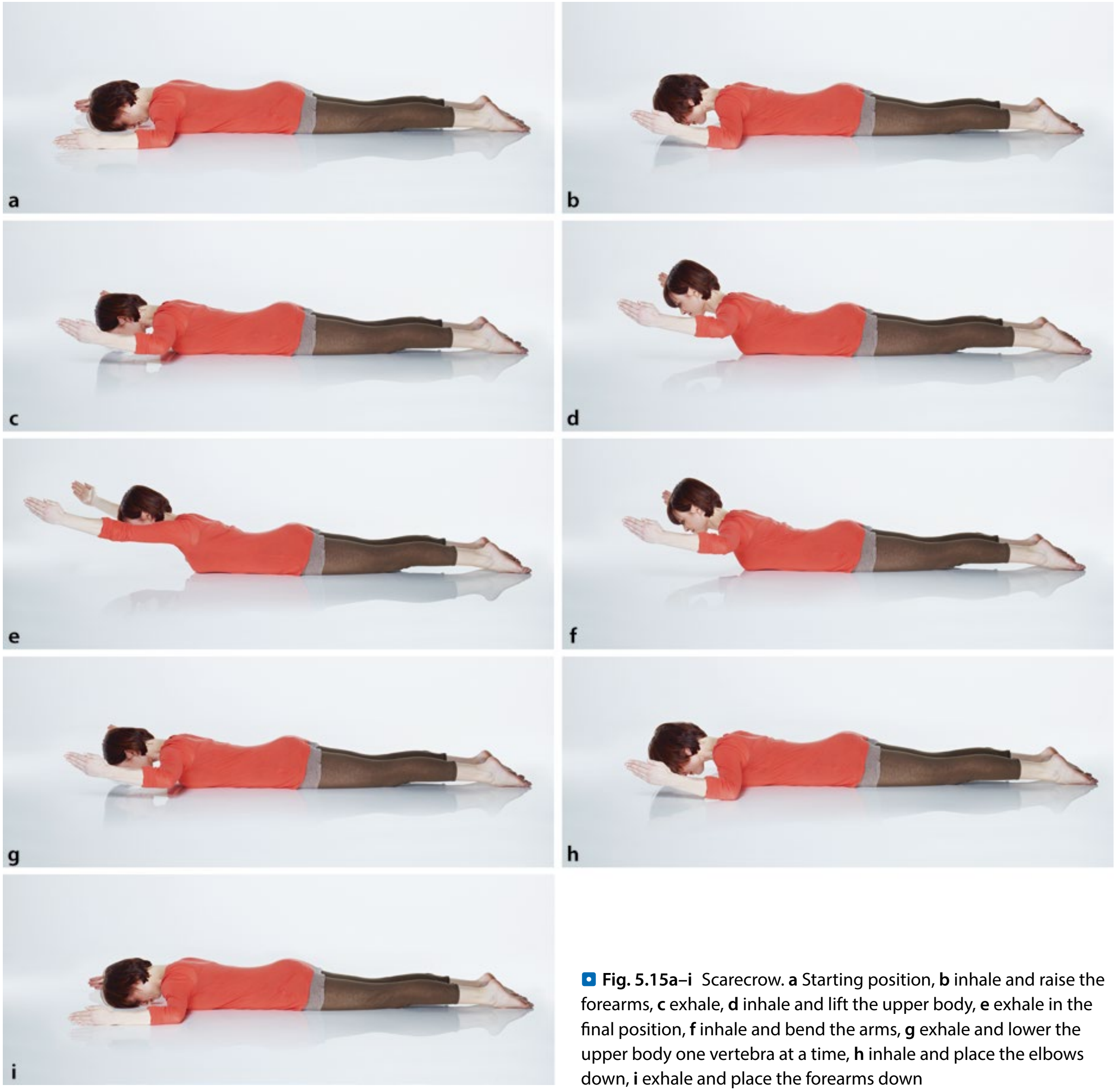
- Adduction or elevation of the shoulder blades
- Loss of core control

Sources of Error

- Limited physiological mobility in extension
- Insufficient opening of the ventral structures (chest muscles, joints, sternum)
- Insufficient connection between pelvis and thorax

Possible Solutions: Regression

- Perform partial movement: first lift the hands through external rotation at the shoulder joint, then lift the upper arms



■ **Fig. 5.15a–i** Scarecrow. **a** Starting position, **b** inhale and raise the forearms, **c** exhale, **d** inhale and lift the upper body, **e** exhale in the final position, **f** inhale and bend the arms, **g** exhale and lower the upper body one vertebra at a time, **h** inhale and place the elbows down, **i** exhale and place the forearms down

5.1.16 Swan (Fig. 5.16)

Starting Position
- Active starting position: prone
- Curl the tailbone slightly in
- Reach the sitting bones toward the heels (Fig. 5.16a)
- Place hands at eye level
- Legs parallel, hip width apart

Execution
- Inhale, and while exhaling press the elbows into the mat, extend the thoracic spine vertebra by vertebra and lift the rib cage up as far as the navel (Fig. 5.16b)
- Inhale, during exhalation lower the upper body

Movement Category
Prone: Strengthening the Trunk
Focus: axial elongation with articulation of the thoracic spine

Verbal Instruction
- Reach the sitting bones toward the heels (lengthen the spine)
- Shoulders wide and down
- Press the elbows into the mat ("Low Swan")
- Draw the head out of the neck, like a turtle

Tactile Instruction
- Correction of elbow motion, indicating movement in the direction of the floor
- Touch the shoulders
- Correct head position, stroking along the neck toward the crown of the head to facilitate length

Faulty Movement Patterns
- Loss of shoulder organization
- Loss of core control

Sources of Error
- Limited physiological mobility in extension
- Whole body activity:
  - Poor coordination when moving through space
  - Poor body coordination
  - Insufficient connection between pelvis and thorax

Possible Solutions: Regression
- **Small apparatus:** foam roller
- Practice moving only the shoulder blades:
  - Arms extended forward, resting on the foam roller
  - Inhale sliding the shoulder blades up toward the ears, rolling the foam roller away and turning the outside border of the hand (small fingers) toward the ceiling (pronation) (Fig. 5.16c); then
  - Exhale and slide the shoulder blades down, turning the palms upward (supination) (Fig. 5.16d)

Modifications: Progression
- Place the hands alongside the rib cage, elbows pointing upward like "little wings" (Fig. 5.16e)
- Inhale and draw the elbows in the direction of the feet, simultaneously extend the spine vertebra by vertebra and lift the upper body ("as high as possible without the support of the hands")
- Exhale and press the hands into the mat, raising the upper body further (Fig. 5.16f)
- If the mobility of the thoracic spine in extension is sufficient, the maximum range of motion is until the pubic bone
- Maintain the connection between the pelvis and the rib cage (ribs are closed)
- Inhale and exhale to lower down
- In case of wrist problems: clench hands into fists and rest them at the side of the chest
- **Breathing variation:**
  - Inhale to draw the elbows toward the feet and straighten the arms simultaneously
  - Exhale while lowering down

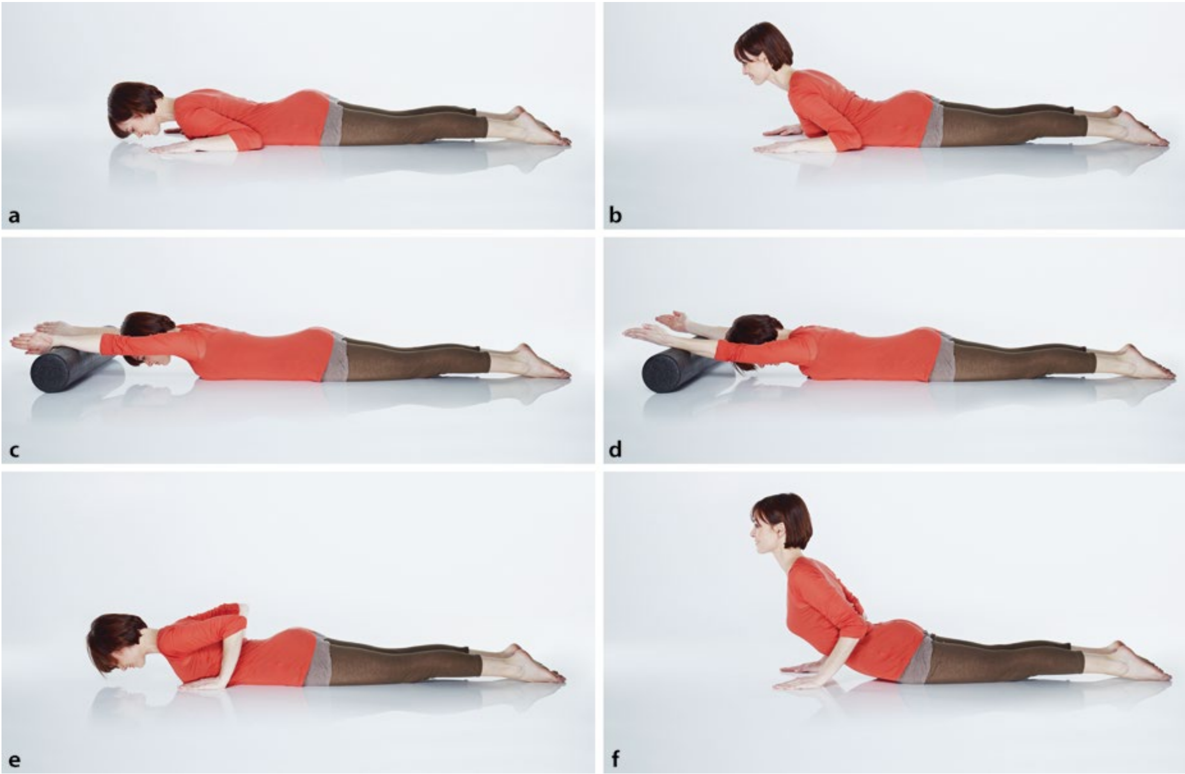


Fig. 5.16a–f Swan. **a** Starting position, **b** final position, **c**, **d** regression: with foam roller, inhale and exhale; **e** progression: inhale; **f** progression: exhale

5

5.1.17 Dart (Fig. 5.17)

Starting Position
- Active starting position: prone
- Curl the tailbone slightly in
- Reach the sitting bones toward the heels
- Legs parallel, hip width apart
- Head is an extension of the spine with axial elongation
- Arms are close to the sides, thumbs pointing down (Fig. 5.17a)

Execution
- Inhale while extending the cervical spine and lift the upper body, lengthen the hands across the mat toward the feet (Fig. 5.17b), then exhale
- Inhale raising the upper body higher, exhale again and lower down

Movement Category
Prone: Strengthening the Trunk
Focus: extension at the shoulder and hip joints

Verbal Instruction
- Reach the sitting bones toward the heels (lengthen the spine)
- Shoulders wide and down
- Draw the head away from the neck, the neck away from the shoulders
- Sternum reaches forward and upward
- Combine breathing with movement
- Only slight engagement of the gluteal muscles

Faulty Movement Patterns
- Hyperextension of the lumbar spine and/ or cervical spine
- Feet are lifted off the mat
- Too much contraction of the gluteal muscles

Sources of Error
- Thoracic spine/shoulder/arm:
  - Limited physiological mobility in extension
  - Loss of axial elongation during movement of the thoracic spine
  - Insufficient opening of the ventral structures (pectoral muscles, joint connections, chest bone)
  - Insufficient connection between pelvis and thorax

Possible Solutions: Regression
- Reverse the breathing pattern: exhale while lifting
- Place a small cushion or a rolled-up towel beneath the abdomen

Modifications: Progression
- Maintain the upper body in a lifted position:
  - Bounce the extended arms gently toward the ceiling, palms facing down
  - Exhale 5 times and inhale 5 times
- Maintain the upper body in a lifted position:
  - Fold the hands together behind the body with thumbs pointing toward the buttocks
  - Reach the hands toward the heels
  - Gently raise the arms/hands toward the ceiling
  - Hold for several breaths
- Arm circles:
  - Inhale, and with exhalation lift the upper body
  - Inhale, open the arms to the side and draw a big circle (Fig. 5.17c), parallel to the floor, moving toward the head (Fig. 5.17d)
  - Exhale, lower the upper body and arms
  - Inhale, lift the arms and the upper body
  - Exhale, arms draw a big circle moving toward the pelvis
  - Inhale to lower down

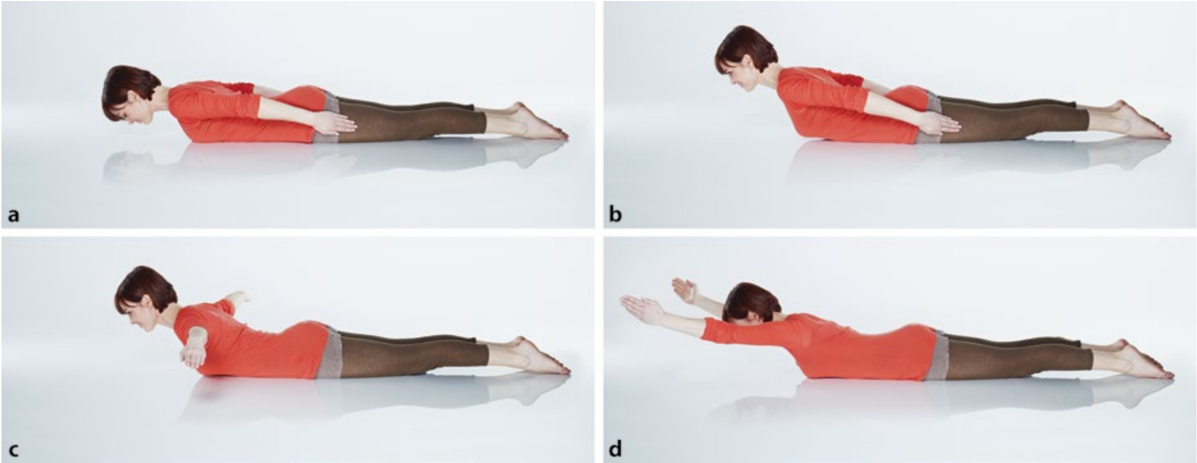


Fig. 5.17a–d Dart. **a** Starting position, **b** final position, **c** progression: inhale, arms to the front; **d** progression: final position

5.1.18 Quadruped (Fig. 5.18)

Starting Position
- Active starting position: on all fours (lengthen the spine)
- Hands directly under the shoulders, knees under the hips (Fig. 5.18a)

Execution
- Inhale, during exhalation lift the right hand off the mat and extend forward until the arm is parallel to the floor (Fig. 5.18b)
- Inhale, return the hand to the mat, repeat with the left arm
- Exhale, slide the left leg back and lift off the mat, until parallel to the floor (Fig. 5.18c), exhale and bring the leg back to the starting position, repeat with left leg
- Repeat the entire sequence several times
- Also, reverse the breathing pattern

Movement Category

Whole Body Integration: Complex Coordination
Focus: core control in all movement planes, weight-bearing though the extremities

Verbal Instruction
- Dynamic tension: reach the tailbone away from the head and the head away from the tailbone
- The arm/chest muscle system: push the sternum between the shoulder blades
- Pelvis remains stationary, no lateral shifting of the pelvis or trunk!
- Press the body away from the floor

Tactile Instruction
- Correct the hips (ensure hips stay above the knees)
- Correct positioning of the arm and leg

Faulty Movement Patterns
- Loss of length and extension of the leg and hip, arms and shoulders, or spine
- Loss of core control

Sources of Error
- Poor coordination when moving through space
- Poor body coordination
- Insufficient connection between pelvis and the thorax

Possible Solutions: Regression
- Practice moving only leg or arm
- Support upper body on forearms, perform only leg movement
- Small apparatus: place forearms on a foam roller or stool

Modifications: Progression
- Combine the arm and leg movements diagonally (Fig. 5.18d)
- Lift the arm and leg on the same side of the body, with minimum adjustment of the pelvis
- Put the hands or knees on a unstable surface (stability cushion)
- **Small apparatus:** foam roller
  - Shins on foam roller, both knees lifted off the mat
  - Extend one leg slowly (Fig. 5.18e)
  - **Forearm support on a foam roller:**
    - Alternately lift and extend the legs posteriorly (Fig. 5.18f)
    - Combine leg motion with arm motion (right arm/left leg)

Fig. 5.18a–f Quadruped/All Fours. **a** Starting position, **b** right arm extended, **c** right leg extended, **d** progression: combined arm and leg movement; **e** progression: use of foam roller; **f** progression: use foam roller and forearms supporting

5.1.19 Roll Down (Fig. 5.19)

Starting Position

- Active starting position: standing with legs parallel, hip width apart
- Arms loose and shoulders relaxed

Execution

- Inhale, lengthen (Fig. 5.19a)
- Exhale and roll the spine forward and down one vertebra at a time (Fig. 5.19b), allow knees to bend slightly if necessary
- Inhale and while exhaling roll up, lengthening the vertebra away from each other, straightening the knees

Movement Category

Standing: Alignment of the Leg Axis, Stability, and Axial Elongation

Focus: spinal articulation with axial elongation

Verbal Instruction

- Feet are the foundation: fight against gravity
- Roll down and up one vertebra at a time
- Arms and shoulders stay relaxed
- Weight is evenly distributed on both feet

Tactile Instruction

- Place one hand gently on top of the head to facilitate lengthening of the spine: “Push my hand away!”
- Touch the shoulders to correct shoulder elevation

Faulty Movement Patterns

- Hyperextension of the knees
- Poor segmental movement when rolling
- Neck and/or shoulders become tense
- Shifting the weight into the heels

Sources of Error

- Lumbar spine/hips/pelvis:
  - Limited physiological mobility in flexion
  - Loss of axial elongation
- Lower extremity:
  - Impaired balance, reactive stability, or alignment in standing,

Possible Solutions: Regression

- **Roll down against a wall:**
  - Stand one foot length away from the wall (Fig. 5.19c)
  - Bend the knees slightly if necessary, knees may also remain straight
  - Rest against the wall
  - Roll down one vertebra a time, maintaining contact of the pelvis on the wall (Fig. 5.19d)

Fig. 5.19a–d Roll Down. **a** Starting position, **b** final position, **c**, **d** regression: Roll Down against the wall, starting and final position

5.1.20 Standing Balance (Fig. 5.20)

- **Starting Position**
- Active starting position: standing
- Legs parallel and hip width apart (Fig. 5.20a)

- **Execution**
- Inhale and raise the heels (Fig. 5.20b)
- Exhale and lower down the heels

- **Movement Category**
- **Standing: Alignment of the Leg Axis, Stability, and Axial Elongation**

Verbal Instruction
- The feet are the foundation: fight against gravity
- Push and pull: grow tall out of the ground
- Shoulders wide and down

Faulty Movement Patterns
- Pronation or supination of the standing foot
- Raised shoulders

Sources of Error
- Lower extremity:
  - Impaired balance, reactive stability, or alignment in standing
- Loss of axial elongation

Possible Solutions: Regression
- **Small apparatus:**
  - **Foam roller:**
    - Place one foot on the foam roller
    - Raise and lower the heel of the standing leg (Fig. 5.20c)
    - With roller on a mat (due to risk of sliding) or close to a wall, stand and balance on the roller (Fig. 5.20d)
  - **Core Band:**
    - Arms raised and parallel to the floor, place the Core Band under tension (Fig. 5.20e)
    - Inhale, raise the arms and heels (Fig. 5.20f)
    - Exhale, lower the arms and the heels

Warning

Always stand on a mat or close to a wall when performing balancing exercise standing on the foam roller, to avoid the risk of the roller sliding.

Fig. 5.20a–f Standing Balance. **a** Starting position, **b** inhale, raise the arms and heels; **c** regression: using a foam roller, raise and lower the heel of the standing leg; **d** with both feet on the foam roller, **e** with Core Band, starting position; **f** inhale to raise the heels

5.2 Pilates Exercises: Program for Progression

The exercises presented in this section are appropriate for the **intermediate to advanced level**. Sufficient knowledge and experience of the pre-Pilates repertoire should be acquired, before progressing to these exercises, as an existing level of physical fitness is a prerequisite for beginning the more advanced training program. The large number of modifications allows the exercises to be individually customized.

In the program for progression, strength must be used efficiently (as little as possible, as much as necessary) and flow of movement is emphasized, with the integration of smooth transitions (▶ Sect. 5.2.17)

Resistance is provided by body weight, therefore the number of repetitions can be adjusted, depending on the goals and performance level of the group or individual.

Each exercise will normally be performed for a maximum of 10 repetitions.

5.2.1 Hundred (Fig. 5.21)

Starting Position
- Active starting position: supine
- Legs together and bent at 90/90°
- Arms at the sides of the body (Fig. 5.21a)

Execution
- Inhale, arms reach toward the ceiling, shoulders sink into the mat
- Exhale and roll the upper body away from the mat. Keep arms at hip height, legs together and extended toward the ceiling. Lower the legs toward the mat (do not exceed the point at which the pelvis can be kept stable) (Fig. 5.21b); begin small, controlled pumping movements with straight arms, i. e., move the arms approx.10 cm up and down
- Inhale for 5 counts and exhale for 5 counts, breathing evenly (100 counts in total, hence the name "Hundred")

Movement category
Supine: Core Integration
Focus: breathing

Verbal Instruction
- Abdomen becomes flatter with each exhalation
- Adductors and pelvic floor active
- Gaze toward the knees or the navel
- Only lower the legs as far as the center of the body can remain stable
- The center of the body sinks, to allow the opposite ends of the body (head/legs) to remain lifted (and "work")
- Arms/hands/legs/feet long, reach through the fingertips and toes

Faulty Movement Patterns
- Loss of abdominal control (abdominal wall bulges outward)
- Shoulders are lifted toward the ears

Sources of Error
- Insufficient connection between pelvis and thorax
- Loss of axial elongation
- Faulty organization of the shoulders, loss of active stability during movement
- Poor alignment in an open chain

Possible Solutions: Regression
- **Reduce the length of each breath:**
  - Reduce the counts, for example, to 3 counts
  - Reduce the breathing cycle: start with 3 breaths; gradually increase the cycle to 10
  - First practice the Pre-Pilates breathing exercise ▶ Sect. 5.1.1)
  - Insufficient connection between pelvis and thorax and/or faulty shoulder organization and loss of active stability during the movement:
  - Chest Lift (▶ Sect. 5.1.4)
  - Legs stay in Table Top position, do not straighten the legs (Fig. 5.21c)
  - With head resting down, perform the pumping movement of the arms only, with legs bent or straight
  - Extend the legs toward the ceiling, lower down, head rests in the hands
  - Extend the legs toward the ceiling, lower down, press hands against the knees (Fig. 5.21d)

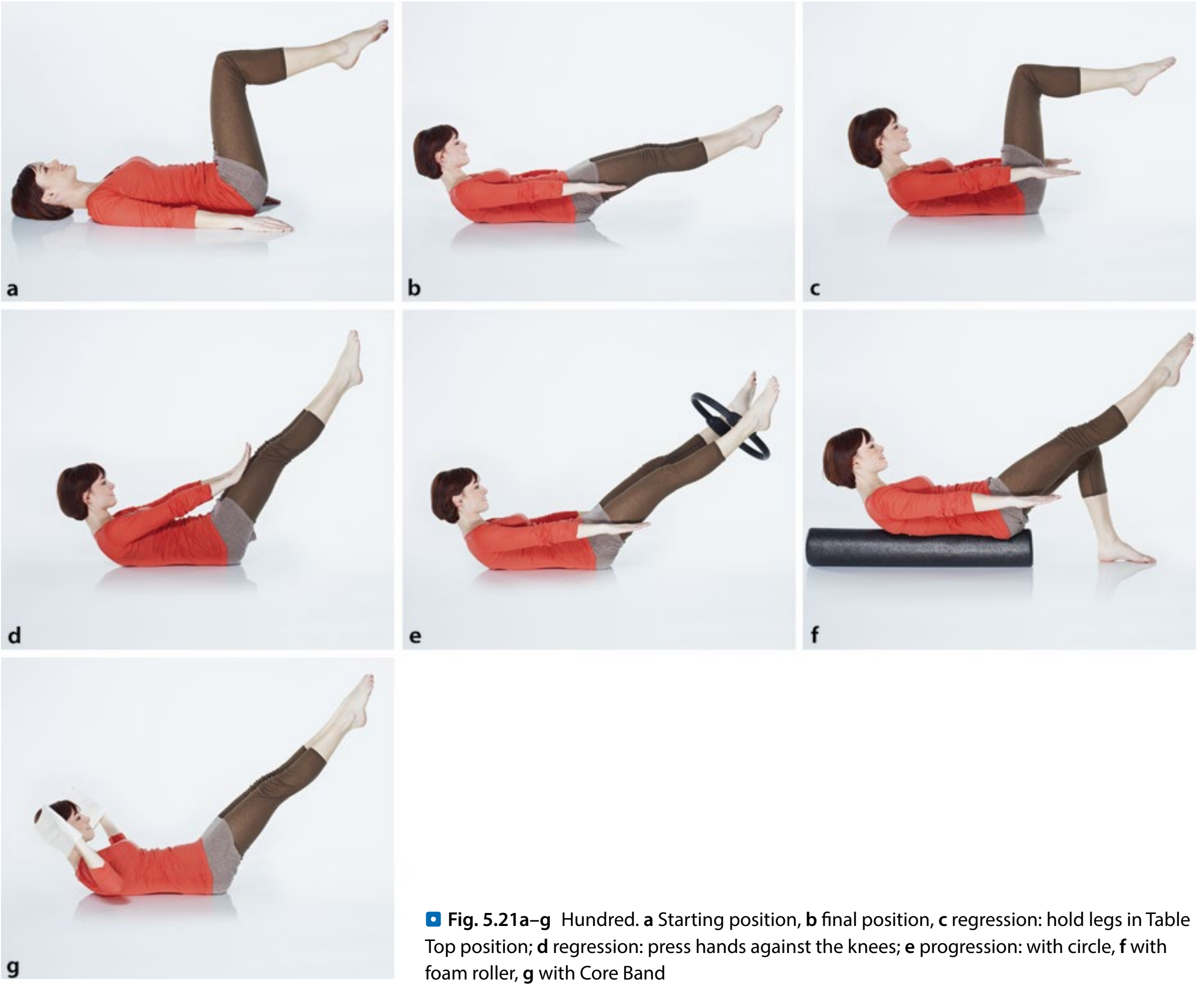


Fig. 5.21a–g Hundred. **a** Starting position, **b** final position, **c** regression: hold legs in Table Top position; **d** regression: press hands against the knees; **e** progression: with circle, **f** with foam roller, **g** with Core Band

Modifications: Progression

- **Percussive Breathing** (staccato breathing):
  - Inhale audibly through the nose and count 1-2-3-4-5
  - Exhale and push the air through the pursed lips out and count 1-2-3-4-5
  - Move the arms in pumping motion, following the same rhythm
- **Small apparatus:**
  - Circle or ball between the legs (Fig. 5.21e)
  - Unstable surface lying on foam roller (Fig. 5.21f)
  - Resting the head in the Core Band (Fig. 5.21g)

5.2.2 Roll Up (Fig. 5.22)

- **Starting Position**
- Active starting position: supine
- Extend the arms behind the head, keeping lower ribs on the mat
- Legs together, feet in plantarflexion (Fig. 5.22a)

- **Execution**
- Inhale, reaching the arms to the ceiling and releasing the shoulder blades onto the mat
- (Fig. 5.22b), roll the head and upper body off the mat and dorsiflex the feet (Fig. 5.22c)
- Exhale and reach the hands toward the feet, roll up in a smooth motion (Fig. 5.22d)
- Inhale and begin rolling back
- Exhale, slowly roll all the way down, plantarflex the feet

- **Movement Category**
  - **Supine: Core Integration and Abdominal Strengthening**

Focus: core control with spine flexion

Verbal Instruction

- Dynamic tension
- Roll vertebra by vertebra
- Shoulders wide and down
- Narrow the waist
- Hands reaching to the opposite wall: “Follow the hands!”
- Inner thighs active, legs pressed together

Faulty Movement Patterns

- Poor segmental movement when rolling
- Insufficient control of the abdominal muscles (abdominal wall bulges outward)
- Raised shoulders

Sources of Error

- Limited physiological mobility in flexion
- Loss of axial elongation
- Insufficient connection between pelvis and thorax
- Faulty organization of shoulders and cervical spine

Possible Solutions: Regression

- Assisted Roll Up, Roll Down (► Sect. 5.1.9)
- Half Roll Down (► Sect. 5.1.9)
- Chest Lift (► Sect. 5.1.4)

  or:
- Hold the right leg (Fig. 5.22e) and roll up to a seated position (Fig. 5.22f)
- Roll down with arms and legs straight
- Repeat, alternating legs
- **Small apparatus:**
  - Theraband: wrap the Theraband around the feet to assist during rolling motion (Fig. 5.22g)
  - Gymnastic stick: to facilitate alignment of the arms during rolling motion, hold the gymnastic stick in the hands, parallel to the floor (Fig. 5.22h)

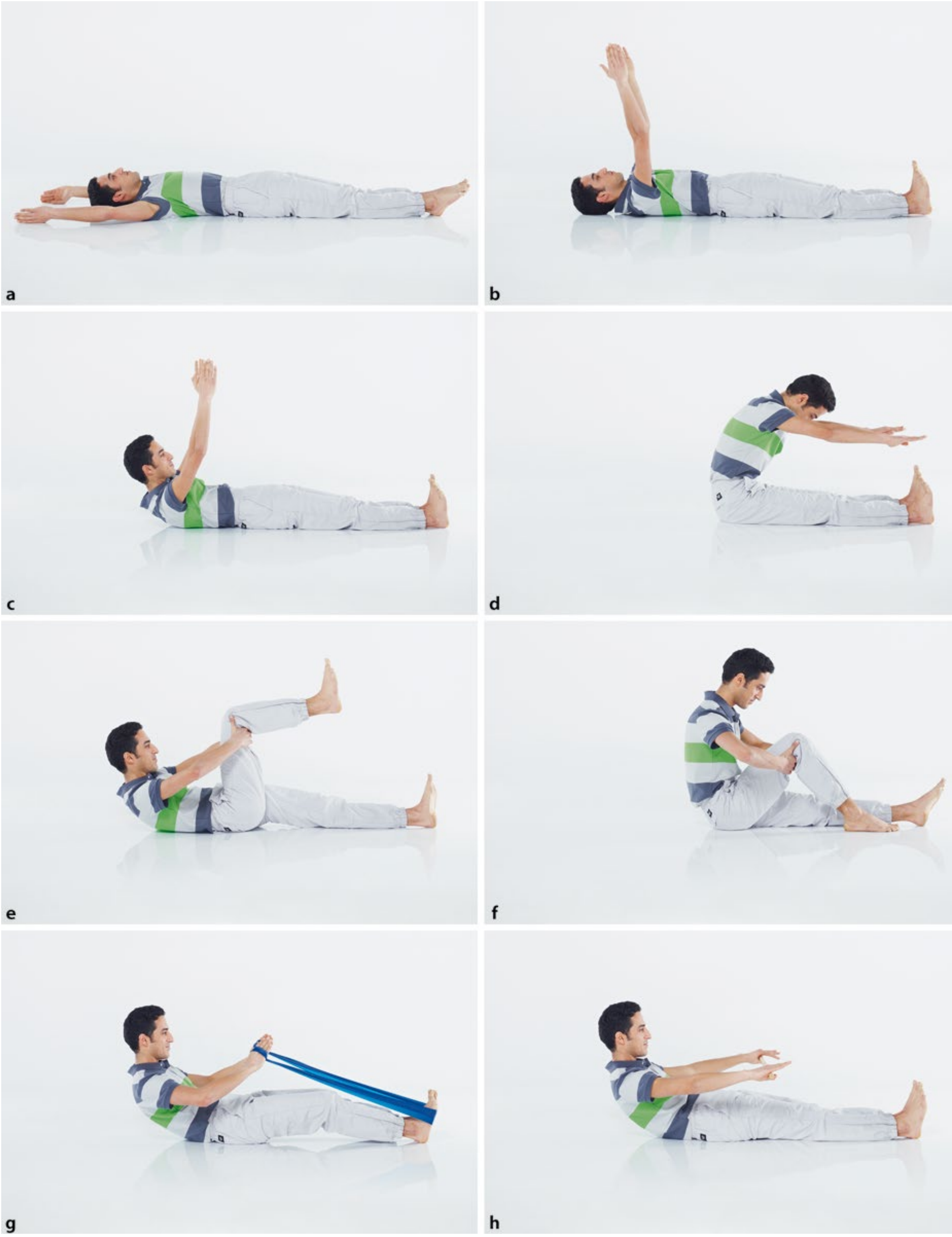


Fig. 5.22a–h Roll Up. **a** Starting position, **b** inhale, arms toward the ceiling, **c** roll up, **d** final position, **e** regression: holding one leg; **f** regression: roll up to seated position; **g** regression: with Theraband; **h** regression: with gymnastic stick

5.2.3 Roll Over II (Fig. 5.23)

Starting Position
- Active starting position: supine
- Spine in contact with the mat, lengthening through dynamic tension
- Legs closed and extended toward the ceiling, feet in plantarflexion
- Arms extended alongside the pelvis
- Palms facing down (Fig. 5.23a)

5

Execution
- Inhale
- Exhale, extending the legs overhead toward the back wall, and roll the pelvis and spine off the mat until weight rests on shoulder blades (Fig. 5.23b)
- Inhale and open the legs shoulder width apart, dorsiflex the feet (Fig. 5.23c)
- With the exhalation, slowly roll through the spine vertebra by vertebra, returning to the starting position; circle the legs out to the sides and back to the starting position with legs together and feet in plantarflexion (Fig. 5.23d)
- From this position, (legs ca. 45°degree from vertical) repeat the movement approx. 3 times, before reversing the direction of movement
- Inhale and open the legs shoulder width apart, feet in dorsiflexion (Fig. 5.23c)
- With the exhalation roll over
- Inhale, close the legs and plantarflex the feet (Fig. 5.23d)
- Exhale, roll down with legs together

Movement Category
Overhead Organization (Inverted Position): Mobility and Dynamic Stability
Focus: core control in the overhead position

Verbal Instruction
- Curl the tailbone toward the pubic bone, the pubic bone toward the navel
- With relaxed shoulders, press straight arms down into the mat
- Avoid momentum
- Draw the vertebrae away from each other
- Reach the sitting bones toward the ceiling
- Do not roll onto the neck, keep weight resting on the shoulder blades

Faulty Movement Patterns
- Use of momentum during the movement
- Hyperflexion of the neck
- Toes touching the floor behind the head, unable to maintain legs parallel to the floor

Sources of Error
- Limited physiological mobility in flexion
- Loss of a stable connection between head and trunk
- Loss of axial elongation

Possible Solutions: Regression
- Roll Over I (► Sect. 5.1.8)

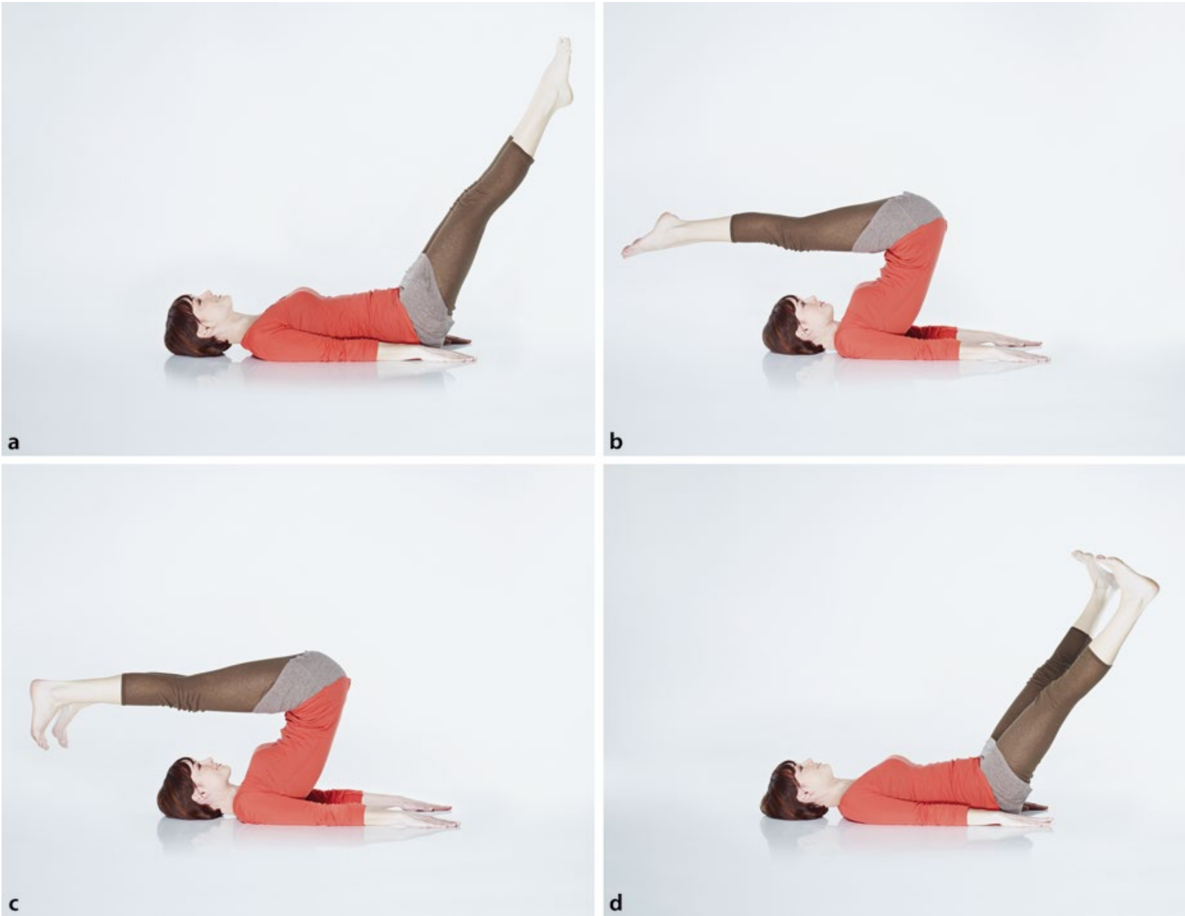


Fig. 5.23a–d Roll Over II. **a** Starting position, **b** final position, **c** open the legs, dorsiflex the feet; **d** roll down, legs circling outward in half circle

5.2.4 Single Leg Circles (Fig. 5.24)

Starting Position
- Active starting position: supine
- Arms next to the pelvis, palms facing down
- Left leg extended on the mat, right leg reaching toward the ceiling (Fig. 5.24a)

Execution
- Inhale, press the arms into the mat and draw the right leg toward the opposite shoulder
- Exhale, draw a circle on the ceiling with the leg (Fig. 5.24b),
- Circle 5 times from inside to outside, 5 times from outside to inside, before lowering the leg and
- Repeat the exercise with the left leg

Movement Category
Supine: Core Integration
Focus: core control

Instructions
- Elongate the spine through dynamic tension
- Draw circles with (right) foot on the ceiling
- Relax the front of the hip as much as possible
- Press the (left) leg into the mat
- Extended (left) leg is an extension of the spine
- Relax the neck and shoulders

Faulty Movement Patterns
- Shoulders lift away from the mat
- Short hamstrings

Sources of Error
- Limited mobility of the lower extremity
- Poor alignment in an open chain
- Loss of active stability during the movement
- Loss of axial elongation

Possible Solutions: Regression
- Femur Arcs (► Sect. 5.1.5)
- Leg Circles as before, but with the arms extended to the side at shoulder level, palms facing up (T-Position), pressing into the mat
- Leg Circles, with the raised leg slightly bent
- **Small apparatus:**
  - Guide the circling motion of the leg with a Thera-band or Core Band (Fig. 5.24c)

Modifications: Progression
- Reach the arms toward the ceiling (may hold a Pilates Circle, band or ball)
- Increase the range of motion:
  - Allow the hip of the free leg to move with the leg and lift off the floor, as the leg reaches across toward the opposite shoulder, but maintain core control! (Fig. 5.24d)
- **Small apparatus:** foam roller
  - Supine
  - One leg bent, foot on the floor
  - Arms at the sides or extended toward the ceiling (Fig. 5.24e)

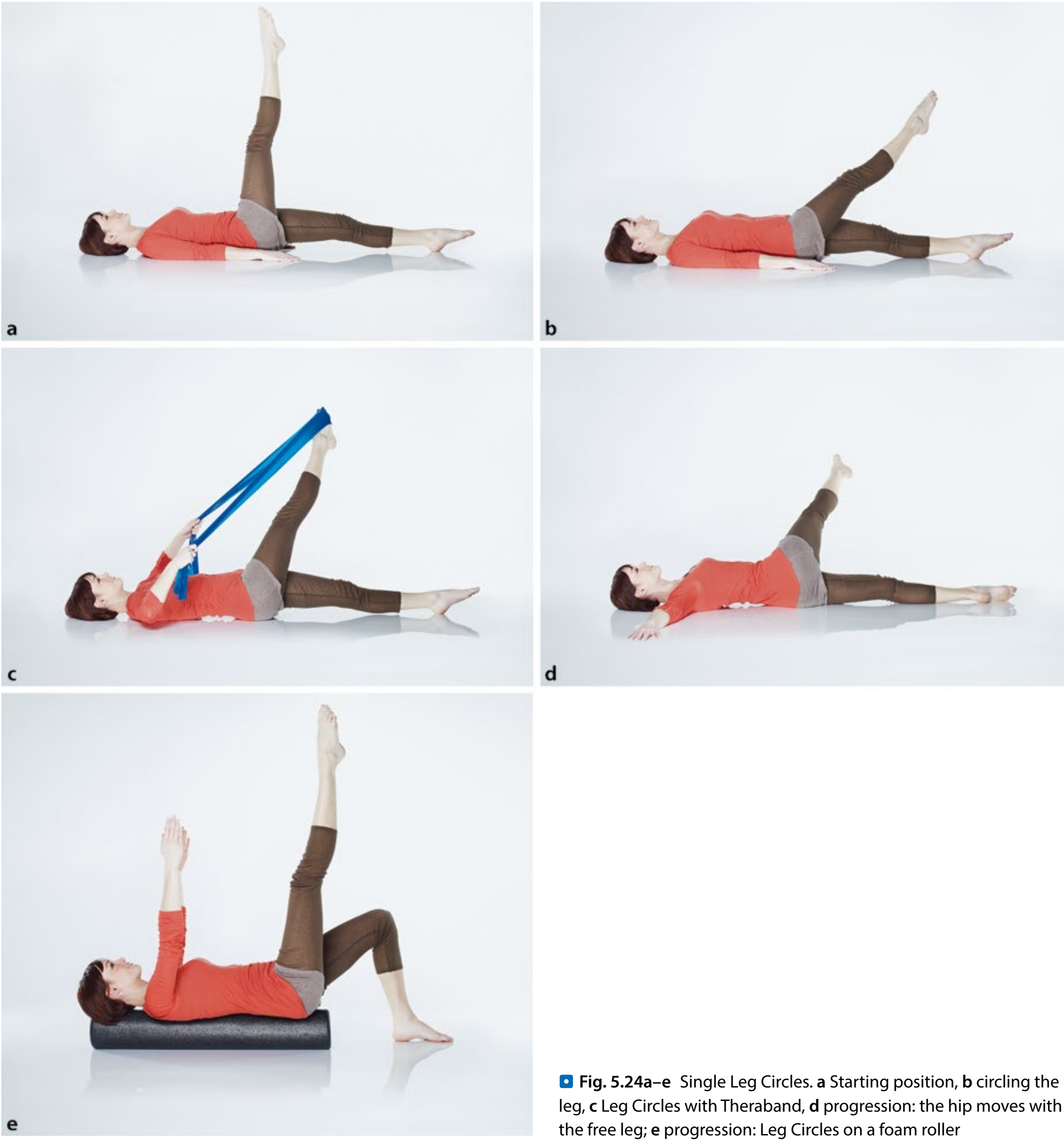


Fig. 5.24a–e Single Leg Circles. **a** Starting position, **b** circling the leg, **c** Leg Circles with Theraband, **d** progression: the hip moves with the free leg; **e** progression: Leg Circles on a foam roller

5.2.5 Rolling Like a Ball (Fig. 5.25)

- **Starting Position**
- Active starting position: seated
- Legs extended on the mat
- Roll weight behind the sitting bones
- Bend the legs one at a time
- Knees are shoulder width apart
- Hands holding the shins above the ankles
- Curl the head slightly in: "C-curve" of the spine
- Balance behind the sitting bones (Fig. 5.25a)

5

- **Execution**
- Inhale and roll backward until weight rests on the shoulder blades (Fig. 5.25b), head should not touch the mat
- Exhale and roll to balance briefly in the sitting position; maintain "C-curve" of the spine avoiding extension, feet do not touch the mat

- **Movement Category**
- **Whole Body Integration: Complex Coordination**

Focus: coordination and balance through conscious breathing

Verbal Instruction
- Avoid using momentum
- The distance between shoulders and knees stays the same
- Core control: abdomen stays flat
- The breath leads the movement

Faulty Movement Patterns
- Shoulders lifted toward the ears
- Gaze is not directed: e.g., looking up toward the ceiling while rolling back
- Rolling motion is initiated by pulling on the legs, due to lack of trunk strength and flexibility
- Feet/head touch the floor

Sources of Error
- Poor coordination when moving through space
- Poor body coordination
- Loss of axial elongation
- Insufficient control of abdominal muscles

Possible Solutions: Regression
- Avoid curling too tightly: place hands at the back of the thighs, close to the knees (Fig. 5.25c)
- Practice balancing in a sitting position
- Extend the arms parallel to the floor, at shoulder level
- Lengthen the spine: maintain axial elongation and slight posterior pelvic tilt (Fig. 5.25d)
- Roll back once, maintaining a "C-curve" (Fig. 5.25e), return to balance in sitting position
- Practice several times
- **Small apparatus:** feet and hands in the Core Band (Fig. 5.25f)
  - Hands pull (thumbs pointing up) outward and upward against the Band
  - Feet are placed in the middle sized pocket
  - Rolling movement is facilitated through pushing and pulling

Modifications: Progression
- **Maintain space:**
  - Place the fingertips by the ears
  - Press the elbows against the knees, and the knees against the elbows
  - Do not lose the connection between knees and elbows during the movement! (Fig. 5.25g)

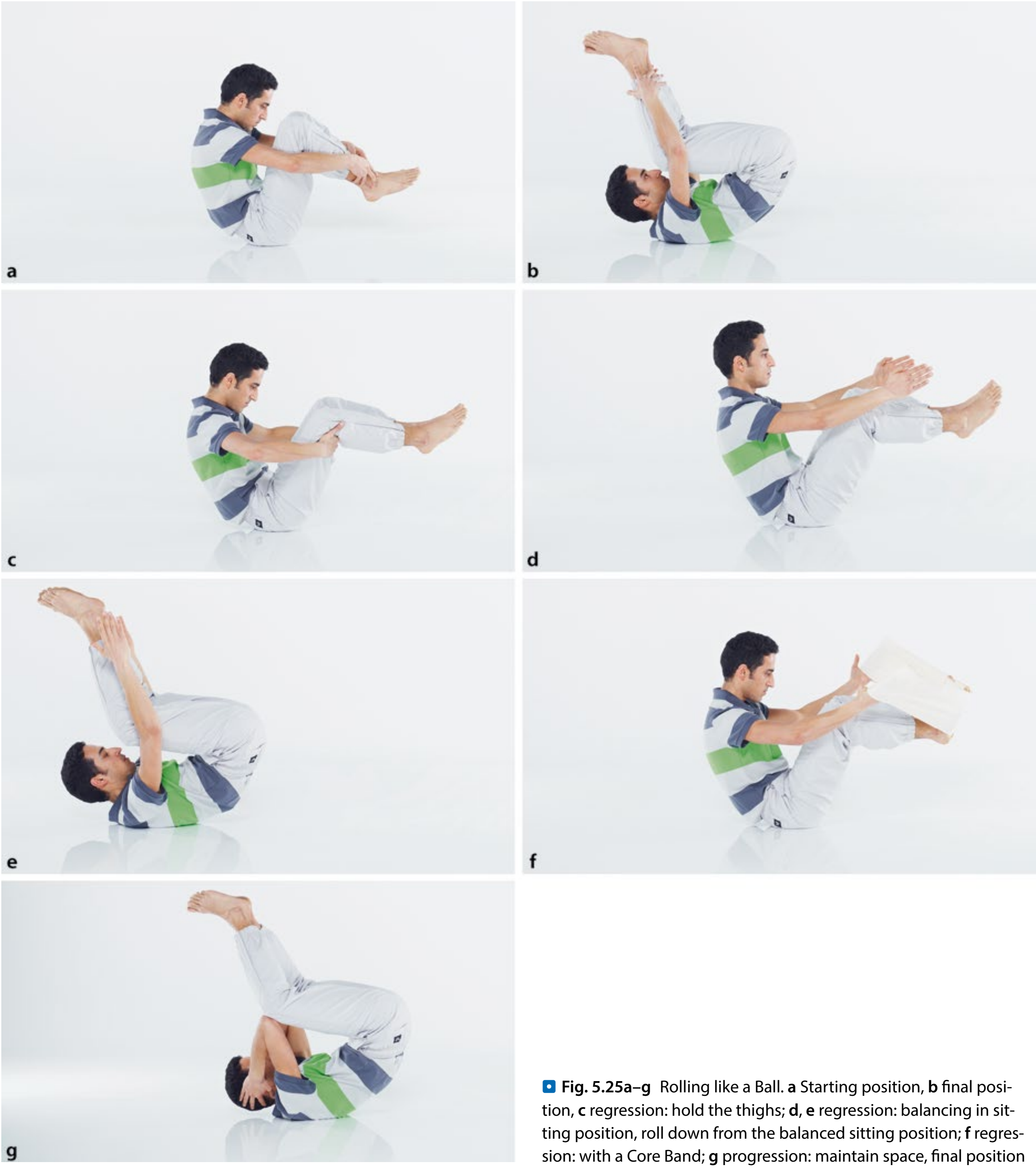


Fig. 5.25a–g Rolling like a Ball. **a** Starting position, **b** final position, **c** regression: hold the thighs; **d**, **e** regression: balancing in sitting position, roll down from the balanced sitting position; **f** regression: with a Core Band; **g** progression: maintain space, final position

5.2.6 Single Leg Stretch (Fig. 5.26)

- **Starting Position**
- Active starting position: supine
- Posterior pelvic tilt
- Upper body raised
- Both legs bent
- Hands touching the knees (Fig. 5.26a)

- **Execution**
- Inhale
- Exhale and extend the left leg above the floor; right hand to right ankle, left hand to right knee, with elbows lifted
- Inhale to bend the leg once more, switch legs
- Exhale and extend the right leg left hand to left ankle right hand to left knee, with elbows lifted (Fig. 5.26b)
- Repeat several times, alternating sides

- **Movement Category**
- **Supine: Abdominal Strengthening/Whole Body Integration: Complex Coordination**

Focus: core control with spinal flexion

Verbal Instruction
- Anchor the (body) center, freeing the ends of the body to stay lifted
- Elongate the spine through dynamic tension
- Wide elbows, shoulders down
- Do not let the extended leg fall, maintain height
- Keep a large space between pelvis and ribs (no wrinkles in the T-shirt)
- Keep equal space between ribs and pelvis on both sides
- Keep as much space as possible between the head and the big toe (of the extended leg)

Faulty Movement Patterns
- Uncontrolled movements of the legs or arms
- Body swaying from side to side
- Loss of trunk stability
- Abdominal wall bulging outward

Sources of Error
- Poor coordination in space
- Poor body coordination
- Insufficient connection between pelvis and thorax

Possible Solutions: Regression
- Chest Lift (Sect. 5.1.4)
- Instead of extending the leg above the floor, reach the leg in the direction of the ceiling (Fig. 5.26c)
- Replace movement of hands to ankles/knees; place both hands on the bent knee
- Rest the arms on the floor alongside the body (Fig. 5.26d)
- Rest the head in the hands, opening elbows wide; perform Single Leg Stretch motion with the legs
- Rest the head on the floor with arms alongside in a U shape, plantar- or dorsiflex the feet: “Pressing the heels away!” (Fig. 5.26e)
- Rest the head on the floor, reach the arms forward and press palms against bent knee

Modifications: Progression
- Lower the legs further
- Extend arms overhead close to the ears and hold this position
- Increase speed of leg motion, adjusting the breath: change the legs twice per breath
- **Small apparatus:**
  - Rest the head on the Core Band (Fig. 5.26f)
  - Laying on the foam roller, hands on the floor, perform the leg motion
  - Hold a Circle/ball/band in the hands and reach upward, with arms alongside the ears

■ **Fig. 5.26a–f** Single Leg Stretch. **a** Starting position, **b** exhale, extend the left leg; **c** regression: extend the leg toward the ceiling; **d** leaving out arm movements; **e** regression: arms on the floor; **f** progression: rest the head on the Core Band

5.2.7 Criss-Cross (Fig. 5.27)

Starting position
- Active starting position: supine
- Posterior pelvic tilt
- Upper body raised
- Hips and knees bent at 90° (Fig. 5.27a)
- Rest the head in the hands

Execution
- Inhale, with the exhale twist the upper body to the right, drawing the left elbow toward the right knee, the left leg extended above the floor, (Fig. 5.27b)
- Inhale and during the exhalation change sides, drawing the right elbow toward the left knee
- Repeat the exercise several times

Movement Category
Supine: Abdominal Strengthening/Whole Body Integration: Complex Coordination
Focus: core control with spine in flexion

Verbal Instruction
- Anchor the center (of the body), freeing the ends of the body to stay lifted
- Rotate from the rib cage, the head and arms follow
- Rotation: reach the (top) elbow toward the ceiling, the lower elbow should not touch the mat
- Elongate the back as much as possible: (thoracic spine) lift up, stretch out, twist
- When turning the upper body, do not allow it to sink toward the mat
- Shoulders wide and down, reach the elbows wide
- Feel the oppositional forces
- Bend one leg in a line with the hip (as if working against a resistance), lengthening the opposite leg toward the wall

Faulty Movement Patterns
- Limited rotation of the upper body, compensating with movement of the shoulders/arms
- Cannot anchor the pelvis, which rocks from side to side
- Abdominal wall bulges outward
- Cannot fully extend the legs
- Knees are not in line with the hips, legs are internally rotated

Sources of Error
- Limited physiological mobility in rotation
- Insufficient connection between pelvis and thorax
- Loss of axial elongation during movement of the thoracic spine
- Axis of the legs: poor alignment in an open chain

Possible Solutions: Regression
- Isolated upper body rotation:
  - Legs extended on the floor
  - Upper body lifted
  - Head resting in the hands
  - As if pelvis and legs are "cemented"
  - Inhale, during exhalation slowly twist to one side (Fig. 5.27c)
  - Inhale, while exhaling return to the starting position
- **Small apparatus:** Core Band
  - Hold the arms in a U shape, resting the head on the Core Band (Fig. 5.27d)

Modifications: Progression
- **Small apparatus:** foam roller
  - Legs bent slightly, feet on the floor
  - Head resting on the left hand
  - Inhale and while exhaling lift upper body and bent right leg (Fig. 5.27e)
  - Inhale and while exhaling twist the upper body, drawing the left elbow toward the right knee (Fig. 5.27f)
  - Inhale, come back to center, repeat 5 times; then
  - Lower the leg and rest the upper body down; change sides
  - Lift the upper body, head resting on the right hand, drawing the right elbow toward the left knee etc.

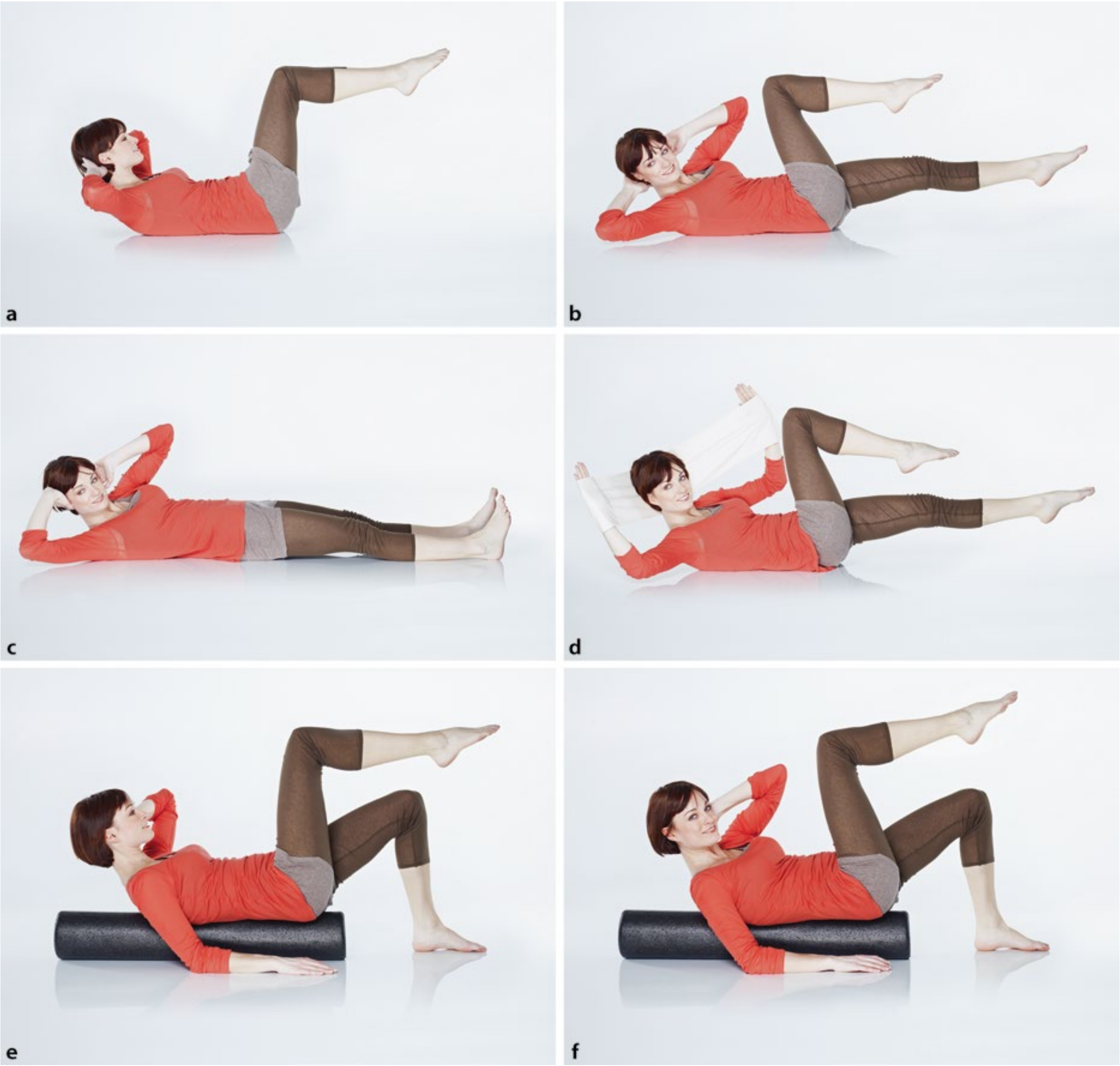


Fig. 5.27a–f Criss-Cross. **a** Starting position, **b** final position, **c** regression: keep the feet on the floor; **d** regression: with Core Band; **e**, **f** progression: on the foam roller, starting position, rotation

5.2.8 Bridging II (Fig. 5.28)

- **Starting Position**
- Active starting position: supine
- Legs bent, hip width apart
- Arms alongside the pelvis
- Palms facing down (Fig. 5.28a)

- **Execution**
- Inhale and during exhalation, roll the pelvis and spine off the mat, vertebra by vertebra (Fig. 5.28b)
- Inhale and raise the bent right leg toward the chest, before extending the leg toward the ceiling (Fig. 5.28c)
- Exhale, lower the leg to the height of the left knee, foot in dorsiflexion (Fig. 5.28d)
- Inhale and swing the leg in the direction of the head, foot in plantar flexion
- Repeat the motion, then
- Exhale and bend the leg, placing the foot back in the starting position
- Inhale and extend the left leg toward the ceiling

- **Movement Category**
- **Whole Body Integration: Complex Coordination**

Focus: spinal articulation in the sagittal and transverse planes

Verbal Instruction
- Roll vertebra by vertebra
- Sternum softens
- Reach the sitting bones toward the back of the knees
- Roll up until the weight rests on the shoulder blades
- Keep the shoulders wide and relaxed
- Keep both hip joints at the same level
- Press the foot of the standing leg into the mat
- Keep the pelvis stable and stationary
- Activate the inner side of the legs

Faulty Movement Patterns
- No spinal articulation
- Poor alignment of the legs/feet
- Weight-bearing on the neck, rather than the shoulders

Sources of Error
- The spine:
  - Limited physiological mobility in flexion
  - Insufficient connection between pelvis and thorax
  - Loss of axial elongation
- Lower extremity:
  - Poor alignment in both open and closed chains
  - Poor coordination in space, and of the body
- Cervical spine/thoracic spine
  - Deformation (compression) of the cervicothoracic junction

Possible Solutions: Regression
- Pelvic Clock (▶ Sect. 5.1.2)
- Bridging I (▶ Sect. 5.1.7)

Modifications: Progression
- Bridging with pelvic motion (Fig. 5.28e)
- **Roll the pelvis off the mat:**
  - Lower the right hip toward the floor, then raise it again; lower the left hip down, then raise; repeat the movement several times, then roll down through the center (place a gymnastic stick across the pelvis to assist alignment of the pelvis)
  - Lower the right hip toward the floor, shifting the pelvis sideways at a diagonal; lower the left hip down, shifting the pelvis diagonally, creating a zigzag motion toward the floor, and then moving back up again (place a gymnastic stick across the pelvis to assist)
  - Draw a figure 8 with the pelvis, alternating the direction of movement

> **Tip**
>
> **Isolate the movement of the pelvis**, moving the knees and shoulder girdle as little as possible.

- **Small apparatus: foam roller**
  - **Supine on a foam roller, feet on the floor:**
    - Bridging – both legs
    - Reach the arms toward the ceiling (Fig. 5.28f) or circle the arms (▶ Sect. 5.1.7.1, Bridging with Arm Movement)

Fig. 5.28a–k Bridging II. **a** Starting position, **b** roll up with exhalation, **c** right leg extended toward the ceiling, **d** lower the leg to the level of the knee, **e** progression: pelvic motion, **f** progression: supine on the foam roller, Bridging – both legs; **g** supine position on the foam roller, Bridging – single leg, lifting and lowering the other leg; **h** progression: supine position on the mat, feet on the foam roller, Bridging – both legs; **i** Bridging – single leg, lift and lower the other leg; **j** roll the foam roller back and forth, **k** extend both legs completely

- Extend one leg upward, draw small circles on the ceiling
- Arms resting on the floor, or reaching toward the ceiling (▣ Fig. 5.28g)

Lying on the mat supine, feet on a foam roller:

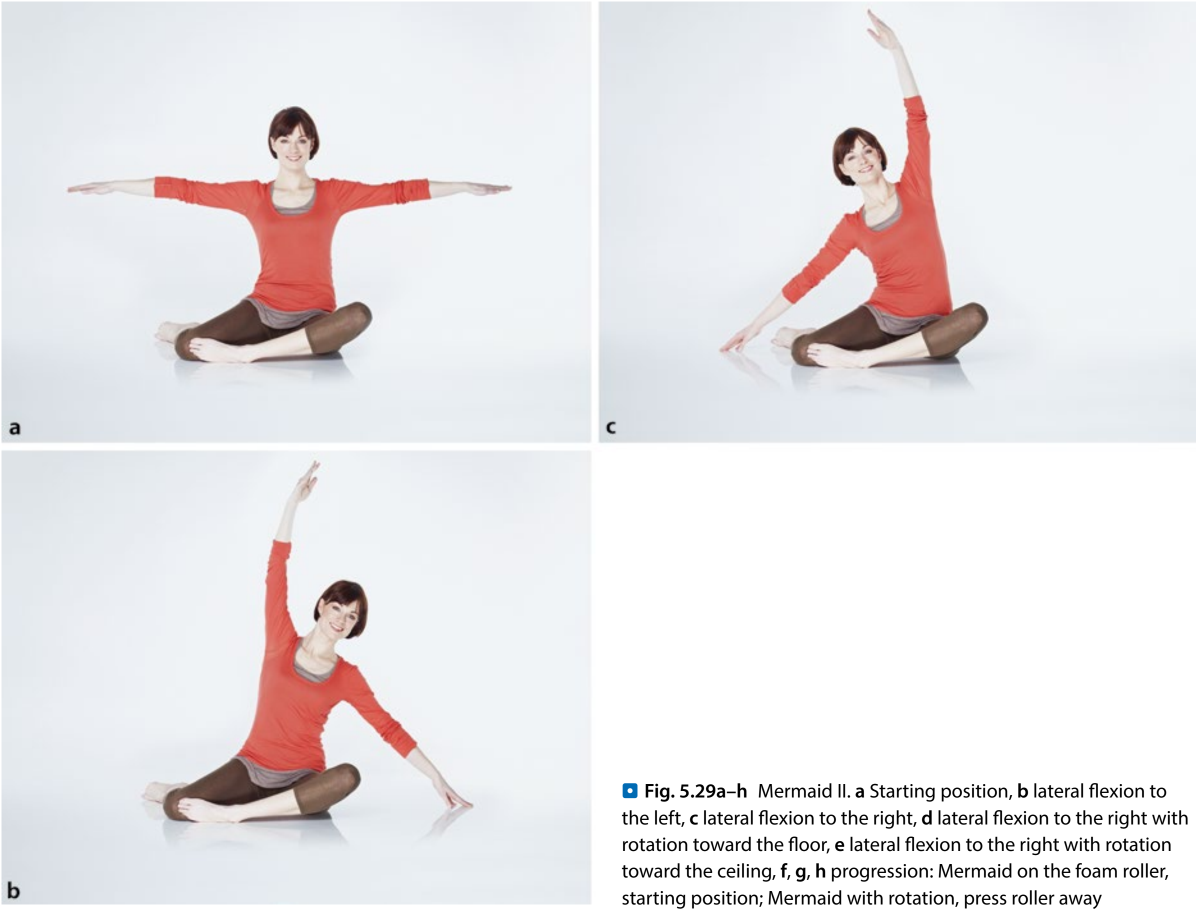
- Bridging – both legs, arms at the sides resting on the floor (▣ Fig. 5.28h)
- **Increase the challenge:** reach the arms toward the ceiling or circle the arms (▶ Sect. 5.1.7.1)
- Bridging – single leg; arms are at the sides, resting on the floor
- Lower the extended leg below the height of the supporting knee; the pelvis must be kept stationary throughout the movement!
- **Increase the challenge:** extend the arms toward the ceiling (▣ Fig. 5.28i)
- Articulate into bridge position, then roll the foam roller forward and back in small increments (▣ Fig. 5.28j)
- **Increase the challenge:**
- Remain in the final position (whole body elongated) for several breaths (▣ Fig. 5.28k)
- Option; reach the arms toward the ceiling
- Option; lift and extend one leg, then place the leg down
- "Run" back to the starting position

Fig. 5.28a–k (*continued*) Bridging II. **a** Starting position, **b** roll up with exhalation, **c** right leg extended toward the ceiling, **d** lower the leg to the level of the knee, **e** progression: pelvic motion, **f** progression: supine on the foam roller, Bridging – both legs; **g** supine position on the foam roller, Bridging – single leg, lifting and lowering the other leg; **h** progression: supine position on the mat, feet on the foam roller, Bridging – both legs; **i** Bridging – single leg, lift and lower the other leg; **j** roll the foam roller back and forth, **k** extend both legs completely

5.2.9 Mermaid II (Fig. 5.29)

- **Starting Position**
  - Active starting position: Z-Sitting (side sitting)
  - Feet to the right side
  - Both sitting bones on the mat
  - Arms extended to the side, parallel to the floor (Fig. 5.29a)

- **Execution**
  - Inhale
  - Exhaling, reach the right arm toward the ceiling, curve the spine in a long arc to the left side; slide the fingertips of the left hand across the floor (Fig. 5.29b), keeping both shoulders down
  - Inhale, lengthen toward the ceiling and return to the starting position; change arms
  - Exhale and reach the left arm toward the ceiling, slide the right hand across the floor. Curve the spine in a long arc in the direction of the feet (Fig. 5.29c)
  - Repeat several times, then move legs to the left side



■ **Fig. 5.29a–h** Mermaid II. **a** Starting position, **b** lateral flexion to the left, **c** lateral flexion to the right, **d** lateral flexion to the right with rotation toward the floor, **e** lateral flexion to the right with rotation toward the ceiling, **f**, **g**, **h** progression: Mermaid on the foam roller, starting position; Mermaid with rotation, press roller away

Movement Category

Seated: Upright Body Posture

Focus: spinal articulation in frontal and transverse planes

Verbal Instruction

- Reach up and over a big ball
- Anchor the sitting bones firmly
- Slide between two pieces of glass
- Large space between shoulders and ears
- The distance between the ear and the top arm remains the same (head aligned with the spine)
- First elongate, then bend

Faulty Movement Patterns

- Insufficient elongation of the spine, beginning lateral flexion too early
- Sitting bones lift off the mat (pelvis follows)

Sources of Error

- Thoracic spine:
  - Loss of axial elongation during movement of the thoracic spine
  - Limited physiological mobility in lateral flexion and rotation
  - Insufficient active connection of the arm movement to the trunk (shoulder blades)
- Arm movement:
  - Loss of axial elongation
  - Poor alignment in an open chain

Possible Solutions: Regression

- Mermaid I (▶ Sect. 5.1.14)
- Cross-legged sitting position, if the right sitting bone is more than two fingers away from the mat
- Tactile correction of sitting position and arm movement

Modification: Progression

- **Mermaid with rotation:**
  - Cross-legged or Z-sitting with feet to the right
  - Inhale and reach the left arm toward the ceiling, lengthening/opening the left side of the body; side bend to the right in a long arc (Fig. 5.29c)
  - Exhale and rotate the thoracic spine toward the floor, pay attention to direction of gaze: sternum directed toward the floor! (Fig. 5.29d)
  - Inhale, rotate the thoracic spine back toward the ceiling, concentrating on direction of gaze: sternum directed toward the ceiling! (Fig. 5.29e)
  - Exhale returning to the starting position
  - Change sides, reaching the right arm toward the ceiling
  - Repeat exercise 3 times in both directions, then change leg position;
  - If sitting cross-legged, place the other leg in front
  - In Z-Sitting, move the feet to the left side
- **Small apparatus:** foam roller
  - Z-Sitting: foam roller left, feet right
    - Small finger side of the left hand on the foam roller
    - Reach the right arm toward the ceiling
    - Inhale and lengthen,
    - Exhale and roll the foam roller to the left side (Fig. 5.29f); sitting bones do not follow the movement
    - Inhale and return to center
    - Opposing movement: slide the right hand across the floor, reach toward the ceiling with the left hand
    - Repeat
    - Switch sides: foam roller on the right, feet to the left
  - **Mermaid with rotation:**
    - Z-sitting (right sitting bone raised as little as possible), foam roller on the left side of the body, feet on the right
    - Inhale, lengthen and direct gaze toward the ceiling, placing both hands on the foam roller (Fig. 5.29g)
    - Exhale, push the foam roller away while extending the right, top leg out and long. Inhale while lengthening; press the palms of the hands away and allow the shoulders to slide toward the ears (Fig. 5.29h)
    - Exhale, draw the shoulder blades toward the waist and press the arms into the foam roller; leading with the right sitting bone, draw the pelvis back to center, bending the right leg once more; roll through the spine vertebra by vertebra until upright and return to the starting position
    - Repeat several times
    - Change sides

Fig. 5.29a–h (*continued*) Mermaid II. **a** Starting position, **b** lateral flexion to the left, **c** lateral flexion to the right, **d** lateral flexion to the right with rotation toward the floor, **e** lateral flexion to the right with rotation toward the ceiling, **f**, **g**, **h** progression: Mermaid on the foam roller, starting position; Mermaid with rotation, press roller away

5.2.10 Spine Stretch II (Fig. 5.30)

Starting Position
- Active starting position: Long sitting
- Arms extended at shoulder height, parallel to the floor with palms facing down
- Legs shoulder width apart, toes toward the ceiling, feet in dorsiflexion

Execution
- Inhale and lengthen (Fig. 5.30a)
- Exhale, roll forward curving from the crown of the head through the lumbar spine, one vertebra at a time (Fig. 5.30b); the pelvis stays stationary
- Inhale, while rolling up one vertebra at a time

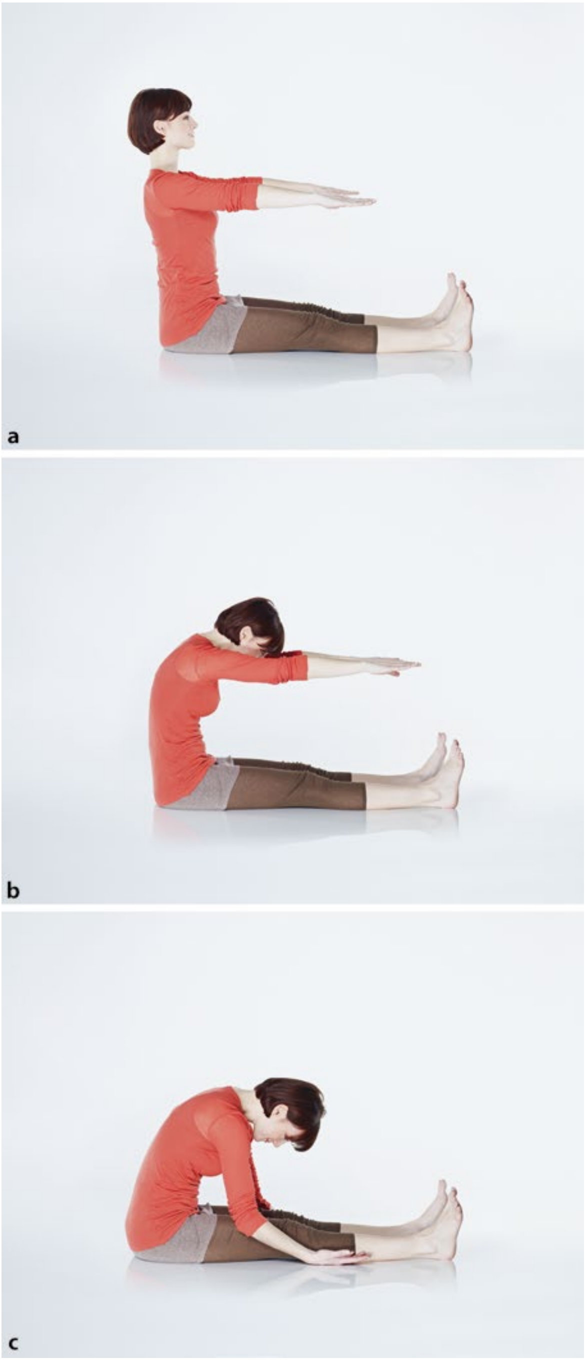
Movement Category
Seated: Upright Posture
Focus: spinal articulation with axial elongation of the thoracic spine

Verbal Instruction
- Root the sitting bones down into the ground, grow upward
- Lengthen the spine out of the pelvis
- Shoulders wide and down
- Roll up:
  - Stack the vertebra on top of each other like Lego building blocks
  - Oppositional movement: draw the abdomen in and back, reach the arms and head toward the opposite wall
  - Reach the arms forward as if gliding across a tabletop

Faulty Movement Patterns
- Shoulders raised
- Hip flexion instead of spine flexion
- Inability to sit in long sitting position

Sources of Error
- Spine:
  - Limited physiological mobility in flexion
  - Limited physiological mobility in extension
  - Loss of axial elongation
  - Faulty organization of shoulders and cervical spine
- Lower extremity:
  - Limited flexibility of the lower extremity

Possible Solutions: Regression
- Keep legs slightly bent, knees pointing toward the ceiling
- Allow arms to hang by the sides with shoulders wide and palms facing up
- Roll forward one vertebra at a time, sliding the backs of the hands across the floor toward the feet (Fig. 5.30c); or
- Place the palms on the thighs, roll down vertebra by vertebra and allow the hands to slide along the thighs toward the feet
- Sit on a raised surface (rolled up mat, foam roller, ball)
- Standing Roll Down (► Sect. 5.1.19)
- Spine Stretch I (► Sect. 5.1.13)



■ **Fig. 5.30a–c** Spine Stretch II. **a** Starting position, **b** final position, **c** regression: arms hang by the sides

5.2.11 Spine Twist (Fig. 5.31)

- **Starting Position**
- Active starting position: Long sitting
- Legs shoulder width apart
- Feet in dorsiflexion
- Arms extended to the side at shoulder level, thumbs pointing up (Fig. 5.31a)

- **Execution**
- Inhale and while exhaling twist the upper body to the right (Fig. 5.31b)
- Inhale, return to center
- Exhale, twist to the left
- Repeat several times, alternating right and left

- **Movement Category**
- **Seated: Upright Posture**

Focus: spinal articulation in the transverse plane with axial elongation

Verbal Instruction
- Inhale, grow tall out of the pelvis
- Gaze follows the direction of movement
- Exhale, twist, spiraling toward the ceiling
- Anchor the sitting bones firmly, distribute weight evenly
- Root downward, lengthen upward
- Twist the rib cage, allow the arms to follow
- Move the arms as if resting on a tabletop, parallel to the floor

Tactile Instruction
- Correct the position of the arms
- Correct the sitting position

Faulty Movement Patterns
- Sitting bones lose contact with the floor, pelvis lifts and twists along with the body
- The arms rotate instead of the thoracic spine

Sources of Error
- Spine:
  - Limited physiological mobility in rotation
  - Loss of axial elongation during movement of the thoracic spine
- Upper extremity:
  - Poor alignment in an open chain

Possible Solutions: Regression
- Cross-legged sitting position
- Sit on a raised surface (ball, rolled mat, foam roller, small box)
- Sit on the heels (Fig. 5.31c)
- Bend the arms, placing the fingertips on the shoulders (Fig. 5.31d)

Modifications: Progression
- Vary the breathing pattern: inhale and twist
- Rebound effect: gently bounce deeper into the rotation 3 times, with 3 staccato breaths
- Stay for 3 or more breaths in the rotated position, deepening the twist with each exhalation
- **Improve articulation of the thoracic spine** with the addition of isolated movement:
  - Exhale, rotate to the right and hold the position
  - Inhaling, turn the head only to the left (Fig. 5.31e)
  - Exhale and turn the head to the right again, repeat 5 times
  - The head stays right, move the eyes only
  - Look left, right, left, repeat 5 times
- **Small apparatus:**
  - With **Core Band** to assist alignment and positioning of the arms:
    - Pull the Band taut with palms facing down (Fig. 5.31f)
  - With **Pilates Circle** for controlled rotation of the thoracic spine:
    - Rest the Pilates Circle against the sternum
    - Elbows lifted
    - During rotation, keep the hands parallel to the sternum (Fig. 5.31g)

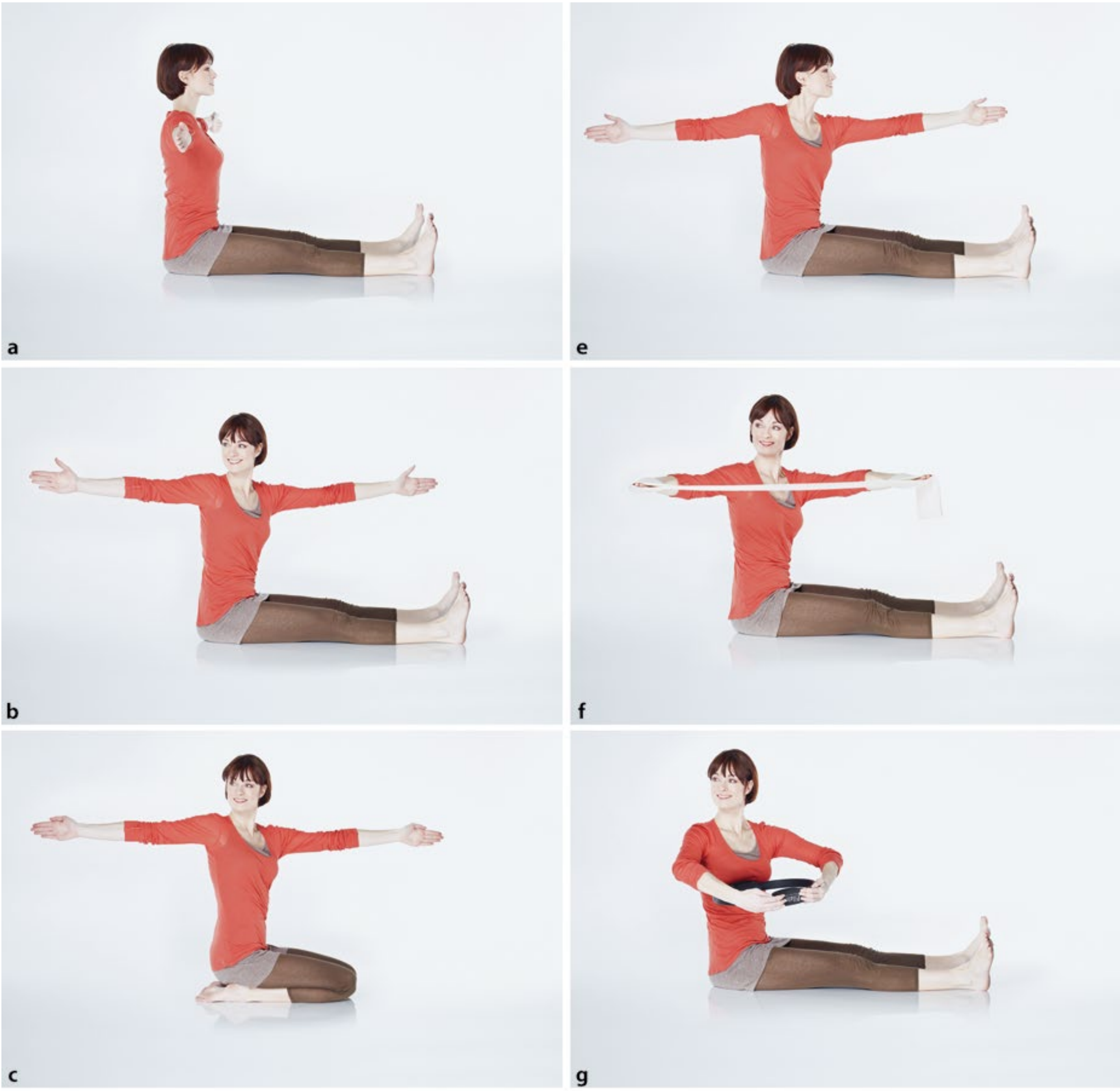


Fig. 5.31a–g Spine Twist. **a** Starting position, **b** final position, **c** regression: siting on heels; **d** regression: fingertips on the shoulders; **e** progression: isolated head movement; **f** with Core Band, **g** with Pilates Circle

5.2.12 Swan Dive (Fig. 5.32)

- **Starting Position**
- Active starting position: prone
- Place the hands at the sides of the rib cage, elbows pointing toward the ceiling
- Legs parallel, hip width apart, possibly slightly wider if more comfortable for the back (Fig. 5.32a)

- **Execution**
- Inhale and draw elbows toward the feet, press the hands into the mat, straighten the arms (Fig. 5.32b)
- Exhale and bend the elbows, lifting the hands off the mat; keep spine and hips in extension and roll forward across the front of the body, lifting the legs away from the floor (Fig. 5.32c)
- Inhale and press the hands into the mat once more to lift the upper body (Fig. 5.32d)

- **Movement Category**
- **Whole Body Integration: Complex Coordination**

Focus: spinal articulation in extension

Verbal Instruction
- Be fully extended, as far as possible
- Rock the body up and down like a teeter totter
- Narrow the waist
- Engage the gluteal muscles

Faulty Movement Patterns
- Knees are not fully extended
- Abdominal wall is not flat and drawn inward to support
- Loss of length through the neck

Sources of Error
- Faulty organization of the shoulders and cervical spine
- Loss of axial elongation during movement of the thoracic spine
- Poor coordination in space
- Poor body coordination
- Insufficient connection between pelvis and thorax

Possible Solutions: Regression
- Swan (Sect. 5.1.16)

Modifications: Progression
- **Swan Rocking:**
  - Inhale and press the hands into the mat, straightening the arms
  - Exhale, reach the arms out in front and roll forward; maintain axial length and extension of the spine and hips
  - Maintain engagement of the whole body and rock back and forth several times (“Dive in and dive out!”) (Fig. 5.32e)
  - Conclude by placing hands on the floor, returning slowly to the prone position
- **Small apparatus:** foam roller
  - **Swan Rocking:**
    - Extend the arms over the foam roller, palms facing each other
    - Inhale, pressing into the foam roller and lifting the upper body (Fig. 5.32f)
    - Exhale and “dive” forward, lifting the legs up (Fig. 5.32g)

Fig. 5.32a–g Swan Dive. **a** Starting position, **b** inhale, stretch out the arms; **c** exhale, roll forward across the front of the body; **d** inhale, support with arms; **e** progression: Swan Rocking; **f** Swan Rocking with foam roller: inhale; **g** exhale and "dive"

5.2.13 Single Leg Kick (Fig. 5.33)

Starting Position

- Active starting position: prone, supported on forearms
- Hands and legs together
- Press the pubic bone gently into the mat
- Curl the tailbone in
- Lengthen the sitting bones toward the heels
- Keep the spine long (Fig. 5.33a)

Execution

- Inhale, bend the right leg with foot in dorsiflexion, and kick the heel toward the buttocks twice
- (Fig. 5.33b)
- Exhale, extend the leg and place it down; change sides
- Inhale and bend the left leg

Movement Category

Prone: Strengthening the Trunk

Focus: core control with axial elongation in prone

Verbal Instruction

- Sitting bones reach toward the heels
- Keep the spine under dynamic tension
- Press forearms into the mat, grow out of the floor
- Shoulders wide and down
- Slightly engage the gluteal muscles
- Pelvis stays stationary
- Narrow the waist

Tactile Instruction

- Correct the shoulder position
- Correct the position of the feet: toes, heels, knees and hips in a line

Faulty Movement Patterns

- Shoulders are raised
- Feet turn outward while kicking

Sources of Error

- Loss of axial length in the physiological cervical lordosis
- Faulty organization of shoulders and cervical spine
- Limited physiological mobility in thoracic extension
- Poor alignment in an open chain (leg)

Possible Solutions: Regression

- Rest the upper body/head on the floor
- Place the hands on top of each other, resting forehead on top
- Inhale, "Pull the leg out of the hip" and lift, keep 3 points of contact (right/left iliac crest and pubic bone) pressing into the mat
- Exhale to bend the leg, draw the heel with/without kick toward the buttocks (Fig. 5.33c)
- Inhale, extend and lengthen the leg
- Exhale and lower the leg; or
- Keep the lumbar spine on the floor, use the arms to support the upper body, depending on the mobility of the thoracic spine in; "Pull the leg out of the hip" and lift, bend with/without kick (Fig. 5.33d)
- **Small apparatus:** foam roller
  - Ribcage resting on the foam roller, bend the knee with/without kicks (Fig. 5.33e)
  - Arms straight, resting on the foam roller, shoulders down, with head and spine elongated
  - Lift one leg, bend with/ without kicks (Fig. 5.33f)

Modification: Progression

- Coordination
- Bend foot when kicking 3 times in dorsiplantar–dorsiflexion
- Trunk stability in neutral spine position
- Pelvis lifted
- A diagonal line from upper body to the upper thigh
- Kick twice, knee stays on the mat (Fig. 5.33g)
- Increase the challenge:
  - Inhale, kick twice
  - Exhale, lift the knee, push the heel toward the ceiling (Fig. 5.33h)

Fig. 5.33a–h Single Leg Kick. **a** Starting position, **b** kick twice, **c** regression: keep the upper body on the floor; **d** regression: keep the lumbar spine on the floor; **e** regression: ribcage on the foam roller; **f** regression: arms on the foam roller; **g** progression: spine in neutral position; **h** progression: lift the knee to increase the challenge

5

5.2.14 Side Kick Series (Fig. 5.34)

- **Starting Position**
- Active starting position: side-lying supported on the forearm
- Supporting arm: palm flat, fingertips pointing forward
- Hips flexed at a 45° angle, legs diagonal to the front corner of the mat, slightly rotated outward

Extend the top leg out of the hip and raise to hip level (Fig. 5.34a)

- **Execution**

Perform all leg movements from this starting position:

- **Forward/backward:**
  - Inhale, swing the extended leg forward, staying parallel to the floor, kick twice toward the head with the foot in dorsiflexion (Fig. 5.34b)
  - Exhale and swing the leg backward, foot in plantarflexion
- **Up/down:**
  - Inhale, keep the leg in line with the trunk and lift toward the ceiling, avoiding internal or external rotation; (Fig. 5.34c)
  - Exhale, lower the leg slowly as if against resistance
- **Small circles:**
  - Draw small circles with the top leg at hip height (Fig. 5.34d), then
- **Inner side:**
  - Lower the upper body and bring both legs in a line with the body
  - Lower the upper body, lift the lower leg and/or draw small circles (Fig. 5.34e)
- **Transition to the opposite side:**
- Balance:
  - Extend both arms overhead and balance, elongating the entire body
  - Option, moving arms and legs simultaneously, lift and lower (Fig. 5.34f)
  - Roll into a prone position, with arms and legs lifted
  - Roll to the opposite side and repeat the series
- **Prone Heel Beats:**
  - Roll to a prone position
  - Place forehead on the hands, legs parallel and/or slightly turned out, quickly tapping heels together
  - Inhale for 5 counts and exhale for 5 counts, max. 10 breaths (Fig. 5.34g)
  - Turn and repeat series on the opposite side

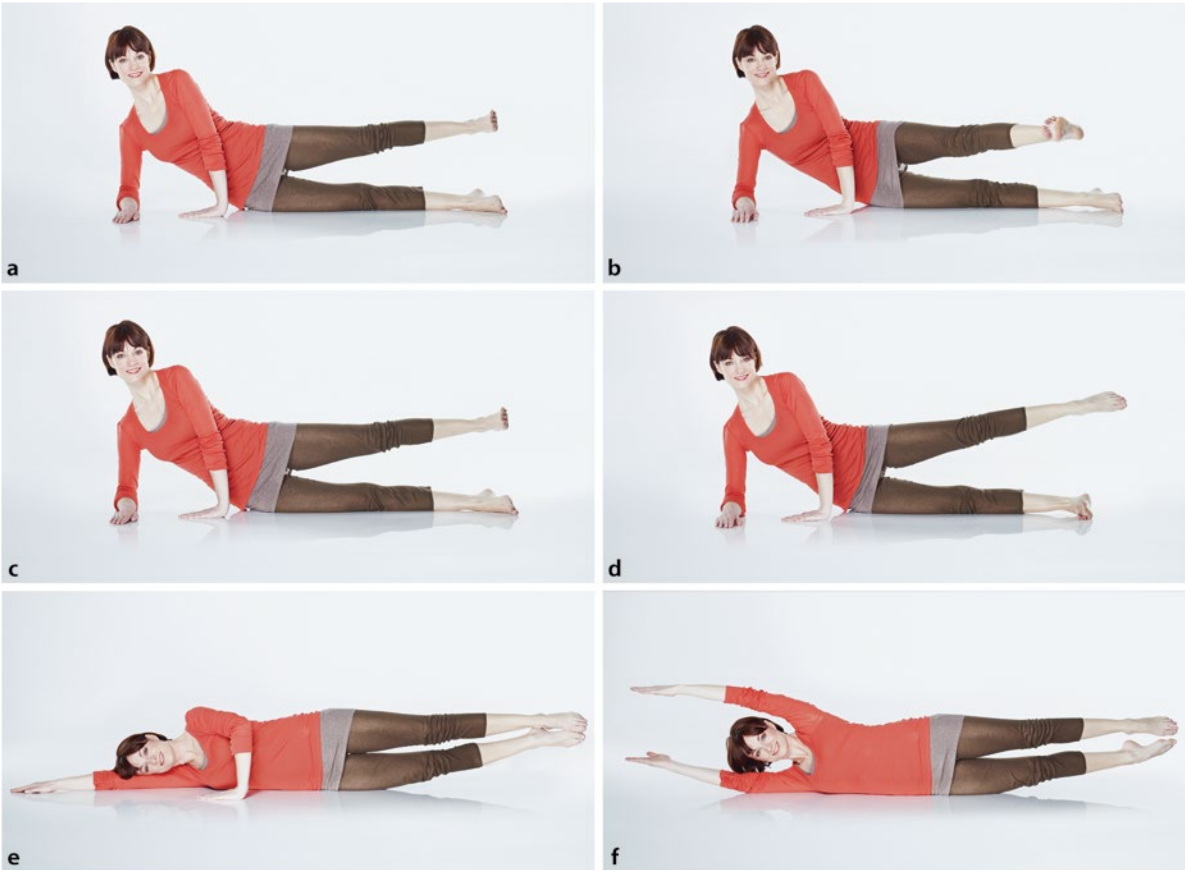


Fig. 5.34a–k Side Kick. **a** Starting position, **b** Side Kick forward/backward, **c** Side Kick up/down, **d** Side Kick with leg circles, **e** lift the lower leg, lower down, circle**, f** transition to switch sides: balance, **g** transition to change sides: Prone Heel Beats; h progression: forearm supporting; **i** progression: supported on the elbow; **j** progression: side-lying with straight legs; **k** lift and lower the lower leg

5

■ Movement Category

■■ Side-Lying: Stabilization

Focus: alignment in the open chain, core control in all planes

Verbal Instruction

- Head, shoulders and hips in one line
- Stack top hip over bottom hip
- Elongate the spine through dynamic tension
- Press the supporting arm into the mat and grow out of the floor
- Isolate movement at the hips: fold at the hips, not at the waist
- Integrate ribs and pelvis
- Imagine: the back of the head, shoulders and pelvis in contact with a wall

Faulty Movement Patterns

- Rotation in the thoracic spine
- Lack of trunk control, no dissociation of movement at the hip

Sources of Error

- Spine:
  - Loss of axial elongation
  - Insufficient connection between pelvis and thorax
- Upper extremity:
  - Poor alignment in a closed chain
- Lower extremity:
  - Limited of mobility of the lower extremity
  - Poor alignment in an open chain

Possible Solutions: Regression

- Trochanter discomfort: bend the lower leg
- Side-lying (▶ Sect. 5.1.11)
- Rest the head on an extended lower arm
- Keep the lower leg bent (◘ Fig. 5.11b)

Modifications: Progression

Possible positions for the supporting arm:

  - Forearm/hand turned either in the direction of the head (◘ Fig. 5.34h) or of the pelvis
  - Supported on the elbow, fold hands behind the head and press the back of the head against the hands, keeping elbows wide and aligned. Rib cage lifted, no "sagging" of the torso
  - (◘ Fig. 5.34i)
  - Both arms extended, with head between the outstretched arms; then
- Kick the top leg to the front and back, lift /lower and draw circles (◘ Fig. 5.34j)
- Lift the lower leg to meet the top leg, lower it down, repeating several times (◘ Fig. 5.34k)
- **Small apparatus:**
  - Hold a Magic Circle/ball overhead with straight arms, and perform the complete leg series
  - Hold a Magic Circle/ball between the legs, lift and lower the legs, draw small circles

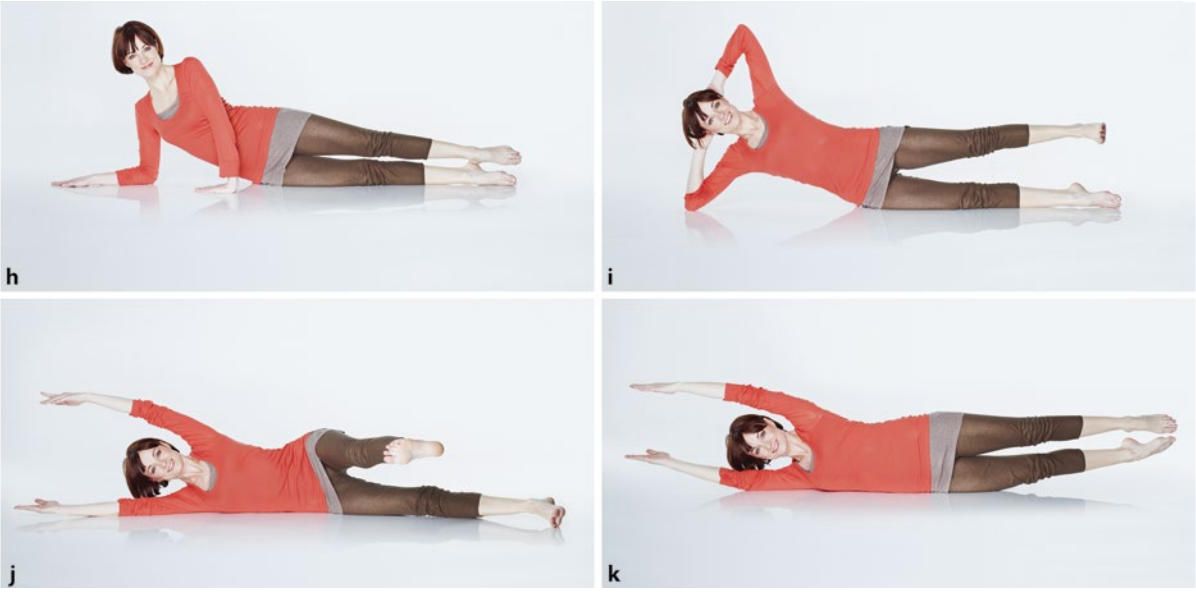


Fig. 5.34a–k (*continued*) Side Kick. **a** Starting position, **b** Side Kick forward/backward, **c** Side Kick up/down, **d** Side Kick with leg circles, **e** lift the lower leg, lower down, circle**, f** transition to switch sides: balance, **g** transition to change sides: Prone Heel Beats; **h** progression: forearm supporting; **i** progression: supported on the elbow; **j** progression: side-lying with straight legs; **k** lift and lower the lower leg

5.2.15 Swimming (Fig. 5.35)

Starting Position
- Active starting position: prone
- Arms extended overhead, resting on the floor
- Palms facing down

Execution
- Inhale, with exhalation raise the head, arms and legs (Fig. 5.35a)
- Rapidly alternate lifting and lowering right arm/left leg, and left arm/right leg (Fig. 5.35b)
- Breathe evenly: inhale for 5 counts through the nose, exhale for 5 counts through the mouth; up to 10 breaths

Movement Category

Prone: Strengthening the Trunk

Focus: core control in prone

Verbal Instruction
- Pelvis cemented or glued to the mat
- Avoid rocking from side to side
- First elongate, then lift
- Shoulders wide and down, arms long
- Stay active right to the tips of the fingers/ toes
- Head in alignment with the spine

Faulty Movement Patterns
- Hyperextension of the cervical spine
- Shoulders are raised

Sources of Error
- Poor body coordination
- Limited mobility of the upper and lower extremities
- Loss of axial elongation
- Insufficient connection between pelvis and thorax

Possible Solutions: Regression
- Slow the movement tempo
- Exhale to lift the right arm and left leg
- Inhale and lower
- Exhale to lift the left arm and right leg, and so on
- Repeat the exercise several times on each side
- Reverse the breathing pattern: inhale to lift, exhale to lower

Modifications: Progression
- Palms turned toward each other
- **Small apparatus:**
  - Prone position on a stability cushion
  - Place hands in the loops of the Core Band (Fig. 5.35c)
  - Palms facing down: use the small finger side of the hand to pull the band taut
  - Palms facing each other: press with the back of the hands to pull the band taut

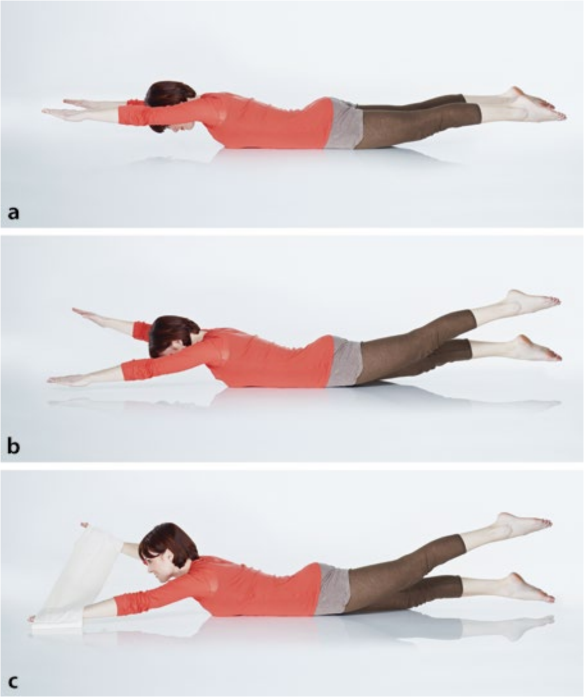


Fig. 5.35a–c Swimming. **a** Starting position, **b** alternate lifting and lowering of arms and legs, **c** with the Core Band

5.2.16 Leg Pull Front (Fig. 5.36)

- **Starting Position**
- Active starting position: push up position (plank)
- Hands directly beneath the shoulders (Fig. 5.36a)

- **Execution**
- Inhale, raise the right leg and extend the foot (plantarflexion), press 2 times toward the ceiling
- (Fig. 5.36b)
- Exhale and place the foot down
- Alternate, lifting the left leg and extending the foot, press 2 times toward the ceiling
- Repeat the exercise, alternating sides

- **Movement Category**
- **Whole Body Integration: Complex Coordination**

Focus: core control in push up position

Verbal Instruction
- Shoulders wide and down
- Maintain a diagonal line from head to pelvis and feet
- Keep pelvis stationary as the foot presses toward the ceiling
- Float the ribcage up between the shoulders

Faulty Movement Patterns
- Sinking between the shoulders, shoulders blades are detached from the rib cage
- The pelvis sinks or tilts to the side when the leg is raised

Sources of Error
- Spine:
  - Loss of axial elongation
- Upper extremity:
  - Poor alignment in a closed chain
  - Insufficient active connection between the shoulder blades and the trunk
- Lower extremity:
  - Poor alignment in both open and closed chains

Possible Solutions: Regression

Hold the push up position for several breaths, without lifting the leg
- Simply lift the leg, without pressing up
- Use forearms for support during the exercise (wrist joint issues)
- Quadruped/All Fours
- With legs bent, raise both knees approximately 2 cm from the mat, hold for several breaths
- **Increase the challenge:**
  - Lift the knees approx. 2 cm, then lift the right foot off the mat and hold briefly, before lowering down; lift the left foot etc. (Fig. 5.36c)
  - “Crawling”: lift both knees, crawl with right arm/left leg, then with left arm/right leg etc. moving forward and back; keep the back parallel to the floor! (Fig. 5.36d)

Modifications: Progression
- **Combination:** alternating
  - Press the right leg upward 2 times; no movement of the pelvis – focus on axial length!
  - Press the heel of the standing leg (left leg) backward 2 times, dorsiflex and plantarflex the foot alternately (Fig. 5.36e)
- **Small apparatus:**
  - Forearms or hands support the body on a foam roller
  - In case of pain in the toe joints (Hallux Valgus) or as a variation, place the foam roller under the shins close to the ankles (Fig. 5.36f)

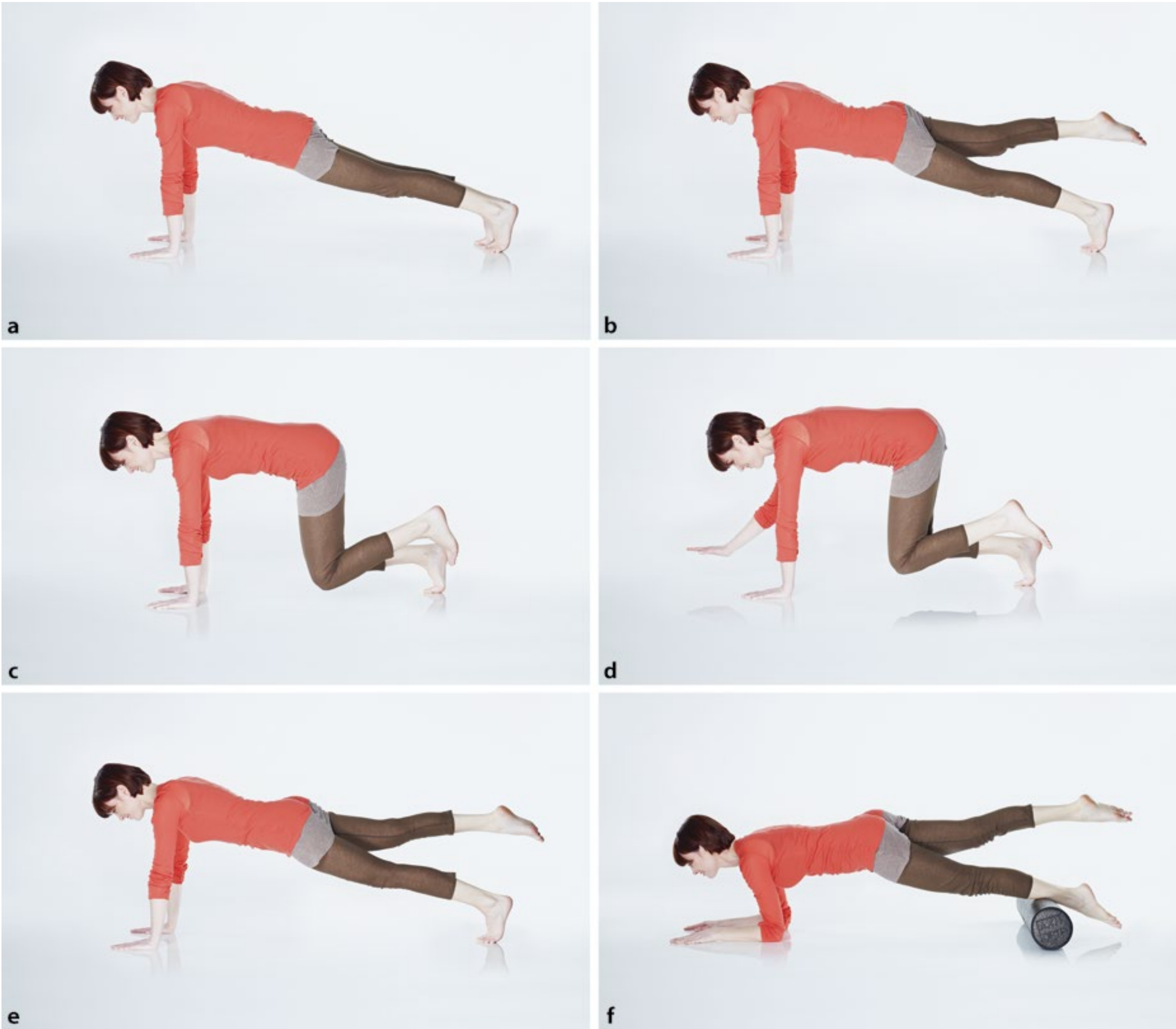


Fig. 5.36a–f Leg Pull Front. **a** Starting position, **b** execution, **c** regression: Quadruped/All Fours ; **d** regression: crawling; **e** progression: press alternating dorsi-/plantarflexion of the standing foot; **f** with a foam roller

5.2.17 Side Bend (Fig. 5.37)

Starting Position

- Active starting position: side sitting
- Supporting hand on the floor, free hand resting on the legs (Fig. 5.37a)

Execution

- Inhale, while exhaling raise the pelvis and move into a lateral supported position (side plank); shoulder directly above the supporting hand, feet stacked on top of each other with weight on the lateral side of the lower foot (Fig. 5.37b)
- Inhale, lower the pelvis without touching the floor (Fig. 5.37c) and look toward the feet
- Exhale, lift the pelvis and stretch the top arm overhead; arm, trunk and legs are in a straight line, gaze directed toward the floor (Fig. 5.37d)
- Repeat, then
- Sit down and change sides

Movement Category

Whole Body Integration: Complex Coordination

Focus: core control in all positions

Verbal Instruction

- Maintain dynamic tension all the way from the feet to the head
- Press the body away from the floor with hands and feet

Faulty Movement Patterns

- Shoulders are raised
- Difficulty lifting the pelvis
- Lack of elongation through the whole body

Sources of Error

- Poor alignment in a closed chain
- Loss of axial elongation

Possible Solutions: Regression

- Side Bend with forearm support (Fig. 5.37e,f)

Fig. 5.37a–f Side Bend. **a** Starting position, **b** lateral support position, **c** inhale, lower the pelvis; **d** exhale, lift the pelvis; **e** regression: forearm support, lift the pelvis; **f** regression: forearm support, lower the pelvis

5.2.18 Standing Single Leg Balance (Fig. 5.38)

Starting Position
- Active starting position: standing
- Feet together
- Arms at the sides of the body

Execution
- Inhale, bend and lift the right leg, hip flexed approx. 90°; hold the back of the thigh
- (Fig. 5.38a) and keep shoulders relaxed
- Exhale and extend the leg (Fig. 5.38b)
- Inhale, bend the leg
- Repeat several times, then change legs

Movement Category

Standing: Alignment of the Leg Axis, Stability and Axial Elongation

Verbal Instruction
- Dynamic tension in the spine
- Fight against gravity
- Grow tall, out of the floor
- Shoulders wide and down

Faulty Movement Patterns
- Asymmetric standing posture, and poor alignment and elongation (loss of basic muscle engagement)
- Incorrect positioning of the feet
- Poor balance

Sources of Error
- Poor alignment in both open and closed chains
- Lack of active stability during the movement
- Loss of axial elongation
- Dysfunctional transfer of movement to the trunk
- Impaired balance and reactive stability

Possible Solutions: Regression
- Do not straighten, but keep the leg bent
- Extend the arms to the sides at shoulder level
- Standing Balance (► Sect. 5.1.20)

Modifications: Progression
- **Different movement planes:**
  - Open the leg at the side (abduct) and extend (Fig. 5.38c)
  - Place the foot of the standing leg on an unstable surface

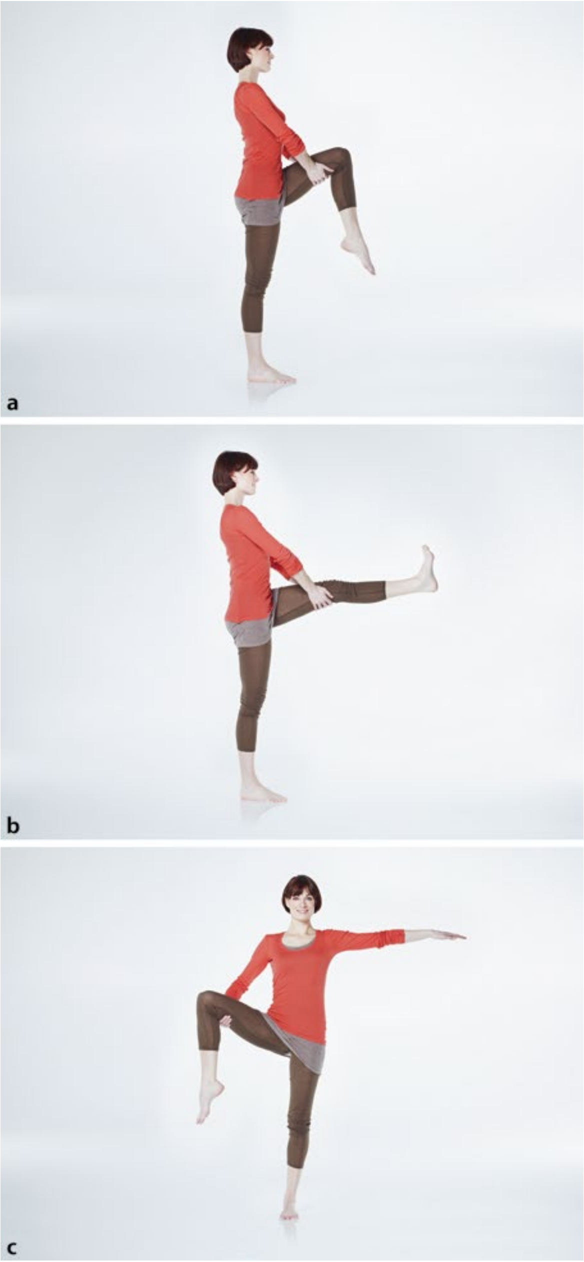


Fig. 5.38a–c Standing Single Leg Balance. **a** Starting position, **b** exhale, straighten the leg; **c** different planes of movement: abduct the leg and straighten

5.3 Transitions and Stretches

5.3.1 Transitions

Pilates demanded "**flowing movements**", and during a class, the exercises should be performed with flow; each movement should transition smoothly into the next. Performing tasks which challenge coordination not only develops focus and discipline, but benefits everyday motor skills (Gottlob 2001, p 164).

The practitioner learns (consciously at first, then unconsciously) to develop strategies for moving more efficiently, altering everyday posture and body organization for the better.

Modern Pilates choreography sets almost no limits on personal creativity (suggestions c.f. Halprin 1997).

Transitional Positions (Fig. 5.39)

The following positions or exercises can be used to create useful **transitions** from:

- Sitting to prone
- Prone to standing
- Standing to supine
- Prone to side-lying
- "In between"

(Descriptions of the transitions can be found below).

Child's Pose (Fig. 5.39a)

- Following exercises in the prone position, reach the arms forward or place them alongside the body, and hold this position for several breaths
- Lying supine (not illustrated) draw both legs toward the chest, hold for several breaths

Seated on Heels (Fig. 5.39b)

- From Child's Pose, curl up vertebra by vertebra to Seated on Heels
- Vary the position of the feet: backs of the feet on the floor, or toes curled under

Squatting (Fig. 5.39c)

- From Seated on Heels, place the hands on the floor and rise to a deep Squatting position
- The neck is relaxed, allow the head to hang loosely between the knees

V-Stretch (Fig. 5.39d)

- From Child's Pose, reach the arms forward, curl the toes under
- Lift the sitting bones up toward the ceiling
- Press the body away from the floor with hands and feet
- Lower the heels toward the mat
- Elongate and stretch the back
- Shoulders wide and low

Fig. 5.39a–h Positions. **a** Child's Pose, **b** Seated on Heels, **c** Squatting, **d** V-Stretch

High Kneeling (Fig. 5.39e)

- From Seated On Heels, rise to High Kneeling

Single Knee Bend (Fig. 5.39f)

- From High Kneeling position, place the left leg forward in a line with the left hip, hip and knee flexed at a 90° angle.
- Right knee remains under the right hip
- Ball/toes of the right foot curled under, heel raised
- Focus on maintaining dynamic tension on the spine!
- Arms lifted to the side and parallel to the floor, or reaching toward the ceiling with palms facing each other
- Straighten both legs, (Fig. 5.39g) then bend once more
- Repeat 10 times, then change legs

Warning

In case of knee issues, begin in a standing position rather than the kneeling. Exercise within pain-free range!

Mountain Pose (Vad V (2004), Fig. 5.39h)

- To readjust and reorganize between exercises, lie down in the supine position
- Inhale, extending the arms over the head toward the floor, feet in dorsiflexion (make yourself as long as possible/elongate)
- Exhale, bring the arms back to the sides of the pelvis (with Shoulder Drop, ► Sect. 5.1.3), plantarflex the feet

Suggested Exercise Sequences

Sitting to Prone

- Following the "Mermaid", "Spine Stretch", or "Twist" exercises in sitting, roll slightly behind the sitting bones, bend and lift the legs one after the other to come to Seated Balance Position (Fig. 5.25d)
- Fold the legs underneath the body in the Seated On Heels position (Fig. 5.39b)
- Place hands first on knees, then on the floor to support as you extend the legs one after the other behind the body, moving into a Push Up position (Fig. 5.36a)
- From either the V-Stretch (Fig. 5.39d) or the Push Up position (Fig. 5.36a) move into the prone position

Prone to Standing

Variation A

- Move from the prone position into Child's Pose (Fig. 5.39a)
- From Child's Pose transition into V-Stretch position (Fig. 5.39d)
- Walk the feet toward the hands and come into full Squatting position (Fig. 5.39c)
- Roll the spine up vertebra by vertebra, moving from Squatting to standing (Fig. 5.19b)
- **Increase challenge:**
  - Roll down from standing and walk the hands forward in approximately 3 movements to come into a Push Up position (Fig. 5.36a). After performing a push up, walk the hands back to the feet, and roll up to standing; repeat 3 to 5 times

Variation B

- Move from prone to Child's Pose (Fig. 5.39a)
- From there, roll up one vertebra a time to Seated On Heels position (Fig. 5.39b)
- From this position, rise to High Kneeling (Fig. 5.39e)
- In the High Kneeling position, place one leg in front and perform Single Knee Bends (Fig. 5.39f)
- Repeat 10 to15 times on the right,
- Kneel to change legs, 10 to 15 repetitions with the left leg
- Stand up, bringing the legs together

Standing to Supine

- Roll down one vertebra a time (Fig. 5.19b)
- Squatting (Fig. 5.39c)
- Come to sitting and "Half Roll Down" (Fig. 5.9d)

Fig. 5.39a–h Positions (*continued*) **e** High Kneeling, **f** Single Knee Bend, starting position; **g** straighten both legs, **h** Mountain Pose

5.3.2 Stretches

Stretching can be integrated into the sequence of exercises without interrupting the flow of Pilates choreography. The goal is for the movements to flow harmoniously from one into the other.

Stretches are used as transitions.

If it becomes clear that there are issues of muscle **shortening**, specific, intensive stretching techniques should be applied; these can be introduced most effectively in separate sessions, ideally 2 to 3 times a week (further reading: Weineck 2010; Knebel 2005; Martins 1997; Egoscue and Gittines 1999).

Stretching of Muscles or Muscle Groups (Fig. 5.40)

Hamstrings

Prior to "Single Leg Circles":

- Draw bent right leg toward the chest
- Press the left leg into the mat with foot flexed (Fig. 5.40a)
- Exhale, extending the right leg toward the ceiling, keeping the foot flexed (Fig. 5.40b)
- Release
- Repeat several times, using a Core Band or Theraband for assistance if necessary

Quadriceps

Prone:

- Hold one foot
- Press the back of the foot into the hand
- Lift the knee, pressing the pelvis and pubic bone firmly into the mat (▶ Sect. 4.3, Prone Knee Bend, Fig. 4.26)

Side-lying (e.g., after "Side Kicks"):

- Align the pelvis and press forward
- Bend the bottom leg toward the chest
- Hold the top leg near to the ankle joint with the top hand, and draw the leg toward the buttocks, staying parallel to the floor; bring the knee behind the hip joint
- Be aware of compensatory movements of the pelvis, and alignment of the top leg (Fig. 5.40c)

Piriformis

Supine (e.g., after "Bridging"):

- Left leg bent with foot on the floor, right leg extended toward the ceiling
- Bend the right leg and place the lower leg, slightly above the ankle, on top of the left thigh
- Lift the bent left leg and draw it toward the body (Fig. 5.40d)
- Change legs

Iliopsoas

Lunges prior to "Single Knee Bend" (Fig. 5.40e)**:**

- Option: link the hands and stretch the arms toward the ceiling

Adductors

Sit with legs abducted wide, following "Spine Stretch" or "Twist":

- Dynamic stretching with exhalation
- From center, over the right leg to the right, over the left leg to the left (Fig. 5.40f)

Shoulder Girdle

Standing, hold the hands together behind the back:

- Bend the upper body forward (trunk flexion)
- Reach the hands toward the ceiling, and stretch with exhalation (Fig. 5.40g)
- Also at the conclusion of exercises in a prone position: link the hands behind the body with thumbs toward buttocks, and pull the hands gently toward the ceiling

Fig. 5.40a–g Stretching of muscles and muscle groups. **a**, **b** Hamstrings: starting position, leg extended; **c** Quadriceps in side-lying position, **d** Piriformis, **e** Iliopsoas, **f** Adductors, **g** Shoulder Girdle

References

Egoscue P, Gittines R (1999) Schmerzfrei Leben. Beust Verlag, München

Gottlob A (2001) Differenziertes Krafttraining mit Schwerpunkt Wirbelsäule. Urban & Fischer, München

Halprin A (1997) Bewegungsritual – Tänzerische Meditationsübungen. Hugendubel, München

Knebel KP (2005) Muskelcoaching: Top in Form mit Stretching. Rororo, Hamburg

Martins P (1997) New York City Ballet Workout: Fifty stretches and exercises anyone can do for a strong, graceful and sculpted body. William Morrow and Company Inc., New York

Weineck J (2010) Optimales Training. Spitta Verlag, Balingen

Class Formats

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_6, © Springer Berlin Heidelberg 2014

The "**safety first**" rule applies to the teaching of group classes in the field of prevention, which means:

- The **choice of exercises** will be appropriate to performance level and
- Inexperienced participants will be carefully guided, with concise and clearly worded instruction

Physical competence can only be developed through personal experience and self-awareness. Bearing this in mind, one session per week is inadequate; training less than twice a week will not suffice to produce improvements in strength, endurance, and agility (Van Wingerden 1998, p 296).

6

Pilates mat training usually offers a fun (a factor not to be underestimated), intensive 1-hour movement workout, which encompasses the whole body and provides ideas and motivation to fuel further training at home.

The following chapter presents exercise selections and sequences as examples, illustrating class formats structured around the movement categories presented previously (► Sect. 4.1.1) (► **Overview 6.1**).

Overview 6.1 Pilates Mat Training Sequences

- Mat program (Beginner) (► Sect. 6.1)
- Mat program (Intermediate) (► Sect. 6.2)
- Mat program (Advanced) (► Sect. 6.3)
- Exercises with the foam roller (► Sect. 6.4)
- Mat program for a strong back (► Sect. 6.5)
- Mat program for men (► Sect. 6.6)
- Mat program (prenatal) (► Sect. 6.7)
- Mat program for osteoporosis (► Sect. 6.8)

6.1 Pilates Mat Program: Beginner

Beginners will be familiarized with Pilates terminology and exercise instructions. The goal of these **fundamental exercises** is to (► **Overview 6.2**):

- Build trunk stability
- Improve spinal mobility

When working with beginners in particular, the trainer is challenged to provide just the right amount of instruction, at the right time.

Overview 6.2 Pilates Mat Program: Beginner

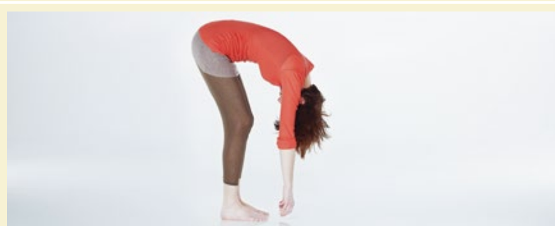
Exercise	Chapter	Figure
Supine		
Mountain Pose	► Sect. 5.3.1	
Breathing	► Sect. 5.1.1	
Pelvic Clock	► Sect. 5.1.2	

Exercise	Chapter	Figure
Shoulder Drops	► Sect. 5.1.3	
Arm Arcs		
Windmill		
Chest Lift	► Sect. 5.1.4	
Assisted Roll Up/Roll Down	► Sect. 5.1.9	
		
Dead Bug: regression "Femur Arcs" and "Leg Lowers"	► Sect. 5.1.5	

Exercise	Chapter	Figure
Dead Bug	► Sect. 5.1.5	
Side to Side Stretch: extend both legs toward the ceiling, bend; repeat several times; then place feet down one at a time.	► Sect. 5.1.6	
Bridging I	► Sect. 5.1.7	
Book Opening	► Sect. 5.1.10	
Stretch	► Sect. 5.1.10	
Side Kick Series I	► Sect. 5.1.11	
Transition to Side-lying on the left, through Mountain Pose (5.3.1); then transition to sitting through Assisted Roll Up (5.1)		
Spine Stretch I or	► Sect. 5.1.13	

6

Exercise	Chapter	Figure
Spine Stretch II	► Sect. 5.2.10	
Mermaid I	► Sect. 5.1.14	
Side Lift right/left	► Sect. 5.1.12	
Transition to Prone		
Seated Balance Position	► Sect. 5.2.5	
Seated On Heels	► Sect. 5.3.1	
Push Up Position then move to prone		

Exercise	Chapter	Figure
Scarecrow	► Sect. 5.1.15	
Dart Hands at the side of the body	► Sect. 5.1.17	
Quadruped	► Sect. 5.1.18	
		
Transition to Standing		
Child's Pose	► Sect. 5.3.1	
Squatting		
Standing Roll Up/Roll Down	► Sect. 5.1.19	
Standing Balance	► Sect. 5.1.20	

6.2 Pilates Mat Program: Intermediate

Participants are familiar with the fundamental exercises and terminology, and have mastered the basic skills of the Pilates repertoire. **Modifications** (progressions) can be incorporated into the exercises at the Intermediate level. More complex exercises and oppositional movements further the **goal** of increasing body control and trunk stability (▶ **Overview 6.3**).

Overview 6.3 Pilates Mat Program: Intermediate

Exercise	Chapter	Figure
Supine		
Mountain Pose	▶ Sect. 5.3.1	
Chest Lift	▶ Sect. 5.1.4	
Also with progression		
Assisted Roll Up to sitting	▶ Sect. 5.1.9	
Half Roll Down	▶ Sect. 5.1.9	
Dead Bug with progression	▶ Sect. 5.1.5	

Exercise	Chapter	Figure
Hundred with regression	► Sect. 5.2.1	
Side to Side Also with progression exercises	► Sect. 5.1.6	
Bridging I Also with progression "arm movements"	► Sect. 5.1.7	
Bridging I with stabilization	► Sect. 5.1.7	
Roll Over I	► Sect. 5.1.8	
Hamstring Stretch	► Sect. 5.3.2	
Single Leg Circles	► Sect. 5.2.4	

Exercise	Chapter	Figure
Single Leg Stretch	► Sect. 5.2.6	
Criss-Cross with regression Transition into side-lying	► Sect. 5.2.7	
Book Opening	► Sect. 5.1.10	
Stretch	► Sect. 5.1.10	
Side Kick Series I with progres-sion	► Sect. 5.1.11	
Side Lift	► Sect. 5.1.12	
Transition to side-lying on the left, through prone Heel Beats	► Sect. 5.2.14	
Rolling Like a Ball	► Sect. 5.2.5	

Exercise	Chapter	Figure
Spine Stretch II	► Sect. 5.2.10	
Mermaid II	► Sect. 5.2.9	
Transition to Prone		
Seated Balance Position	► Sect. 5.2.5	
Seated on Heels	► Sect. 5.3.1	
V-Stretch		
Push Up position into prone	► Sect. 5.2.16	
Dart with progression "Arm Circles"	► Sect. 5.1.17	

Exercise	Chapter	Figure
Swan with progression	► Sect. 5.1.16	
Child's Pose	► Sect. 5.3.1	
Quadruped/All Fours	► Sect. 5.1.18	
Transition to Standing		
Knee Bends	► Sect. 5.3.1	
Roll Down	► Sect. 5.1.19	
Standing Single Leg Balance	► Sect. 5.2.18	

6.3 Pilates Mat Program: Advanced

Regular attendance and a long period of consistent practice are prerequisites for the exercises in the Advanced Program. The movements encompass **the entire range of motion,** with complete **core control**. Exercises from the preparatory programs can be practiced incorporating further progressions (more difficulty) (► **Overview 6.4**). The trainer increasingly fades into the background, as one exercise transitions smoothly into the next: movement flow!

Overview 6.4 Pilates Mat Program: Advanced

Exercise	Chapter	Figure
Standing		
Standing Balance	► Sect. 5.1.20	
Roll Down to sitting	► Sect. 5.1.19	
Half Roll Down with progression "Rotation"	► Sect. 5.1.9	
Hundred	► Sect. 5.2.1	
Roll Up	► Sect. 5.2.2	

Exercise	Chapter	Figure
Roll Over II	► Sect. 5.2.3	
Hamstring stretch	► Sect. 5.3.2	
Single Leg Circles	► Sect. 5.2.4	
Rolling Like a Ball	► Sect. 5.2.5	
Single Leg Stretch	► Sect. 5.2.6	
Criss-Cross	► Sect. 5.2.7	
Bridging II	► Sect. 5.2.8	

Exercise	Chapter	Figure
Side to Side with progression: Extend the legs toward the ceiling, then move the legs right/left; transition into side-lying position*	▶ Sect. 5.1.6	
Side Kick Series – right side	▶ Sect. 5.2.14	
Stretch	▶ Sect. 5.1.10	
Side Kick-Series – left side Stretch Roll Up from supine to sitting		
Mermaid II, also with progression "Rotation"	▶ Sect. 5.2.9	
Spine Stretch II	▶ Sect. 5.2.10	
Spine Twist	▶ Sect. 5.2.11	

Exercise	Chapter	Figure
Transition to Prone		
Seated Balance position	► Sect. 5.2.5	
Seated on Heels	► Sect. 5.3.1	
V-Stretch		
Push Up position	► Sect. 5.2.16	
Swan Dive	► Sect. 5.2.12	

Exercise	Chapter	Figure
Single Leg Kick II	▶ Sect. 5.2.13	
Swimming	▶ Sect. 5.2.15	
Child's Pose	▶ Sect. 5.3.1	
Leg Pull Front	▶ Sect. 5.2.16	
Side Bend right/left	▶ Sect. 5.2.17	
Push Up position	▶ Sect. 5.2.16	

Exercise	Chapter	Figure
V-Stretch into High Kneeling	► Sect. 5.3.1	 
Knee Bends with stretch in standing position	► Sect. 5.3.1	
Standing Roll Down	► Sect. 5.1.19	
Standing Single Leg Balance	► Sect. 5.2.18	

6.4 Exercise Sequence: Pilates Using the Foam Roller

The foam roller has become an indispensable tool for Pilates training – due in part to the increased proprioceptive challenge – and is very popular among course participants!

A number of exercises are presented in this section, all of which lend themselves well to variations integrating the roller, and have become part of the standard foam roller repertoire (► **Overview 6.5**). They can be selected and combined into a 1-hour "Foam Roller" class, according to the performance level and training goals of the participants.

6

Overview 6.5 Pilates Using the Foam Roller

Exercise	Chapter	Figure
The following mat exercises that are illustrated without a foam roller can also be performed effectively lying supine on a foam roller; legs are hip-width apart, feet on the floor		
Breathing*	► Sect. 5.1.1	
Pelvic Clock*	► Sect. 5.1.2	
Shoulder Drops with progression*:	► Sect. 5.1.3	
Open and Close*		
Arm Arcs*		

Exercise	Chapter	Figure
Windmill*	► Sect. 5.1.3	
Arm Arcs and Windmill can also be performed with legs straight, on the floor. Otherwise, extend the legs occasionally, taking the arms overhead and stretching in all directions; "sprawl" and rock back and forth on the roller		
Chest Lift*	► Sect. 5.1.4	 
Dead Bug	► Sect. 5.1.5	
Hundred	► Sect. 5.2.1	

Exercise	Chapter	Figure
Bridging II	► Sect. 5.2.8	 
Single Leg Circles	► Sect. 5.2.4	
Criss-Cross	► Sect. 5.2.7	 
Place the feet down one at a time, roll sideways off the foam roller and stretch out on the floor		

Exercise	Chapter	Figure
Side-Lying		
Shoulder mobilization	► Sect. 5.1.10	
Hip mobilization*: Place the bent leg on the foam roller above the knee, roll the foam roller back and forth (hip abduction and adduction); similar motion to shoulder mobilization	–	–
Side Lift with Foam Roller*: Extend the legs and place them on the foam roller, lift and lower the pelvis, then hold	► Sect. 5.1.12	
Supine on the Floor (rest the pelvis on top of the foam roller, placed across the width of the mat), (spine slightly flexed, above the knee as if draped in a "hammock")*		
Hip Flexor stretch: Draw the right leg toward the chest holding behind the knee, move the left leg in the direction of the floor with a long cycling motion, do not move the pelvis! Then rest the left leg on the floor for several breaths and change sides*	► Sect. 5.3.2	–
→ Based on the classic exercise sequence using the "Spine Corrector": draw both legs toward the chest, then "Scissors", "Walking", "Bicycle", "Circles", "Helicopter", "Roll Over", "Corkscrew"		
Supine on the Floor (foam roller resting across the mat, feet on the foam roller)		
Bridging II with Roller	► Sect. 5.2.8	
Bridging II with progression "Single Leg"		

6

Exercise	Chapter	Figure
Bridging II with progression "Tiny Steps"	► Sect. 5.2.8	
Bridging II with progression "Whole Body Lengthening"		
Prone		
Shoulder Mobilization	► Sect. 5.1.16	 
Swan Dive	► Sect. 5.2.12	 

Exercise	Chapter	Figure
Single Leg Kick	► Sect. 5.2.13	 
Child's Pose: arms resting on the foam roller, relax*	► Sect. 5.3.1	
Quadruped: forearms supporting, extend one leg parallel to the floor	► Sect. 5.1.18	
Quadruped: hands supporting, shins on the foam roller		
Leg Pull Front* Variation: both legs on the foam roller, bend and straighten the legs ("Rolling In/Rolling Out")	► Sect. 5.2.16	

Exercise	Chapter	Figure
Seated on the Floor		
Mermaid II, all variations	► Sect. 5.2.9	  
Seated on the Foam Roller (foam roller placed across the mat), legs slightly bent with feet on the floor		
Spine Stretch*	► Sect. 5.2.10	
Spine Twist*	► Sect. 5.2.11	
Massage, "roll out" the spine* Hands behind the foam roller for support, roll over the back moving upward from the pelvis. Later, massage the back with hands linked behind the head for support.	–	–

Exercise	Chapter	Figure
Standing		
Knee Bends, beginning in High Kneeling and bending one knee to the front*: Place the front foot on the roller (foam roller across the mat), bend and straighten both legs	► Sect. 5.3.1	
Standing Balance	► Sect. 5.1.20	 

*** Not illustrated with foam roller**

6.5 Pilates Mat Program For a Strong Back

There is not necessarily a relationship between strength of the trunk muscles and low back pain; a strong back can also experience pain! However, a well-conditioned trunk musculature noticeably reduces the likelihood of repeatedly suffering from back pain. Pain patients have less strength because they move less, often due to fear of pain. It is therefore vital to alleviate the fear of movement in participants with **chronic pain,** and educate them about the benefits of following a balanced exercise program to stay active (Hamilton 2009). Functional issues and causal relationships can be taken into account during Pilates training, due to the general holistic approach: amongst other factors, movement restrictions of the extremities may provoke or intensify back pain.

6

Training focuses primarily on **stabilization of the lumbo-pelvic-hip region** and increased mobility (► **Overview 6.6**). It is important to practice movements that have a low potential for error, in specific sequences at home, as a form of "First Aid Training" in the event that back pain reoccurs. Any posture can be bad posture, if sustained too long or at the expense of other postures that provide a counterbalance. This applies to sitting, as well as to any sporting activities that are one-sided in nature. Poor posture leads to a loss of function in the structures that contribute to the stabilization of the center of the body (power cylinder).

If movement behavior or in the case of recurrent pain, motor control firing (feed-forward) is altered over the long term, it requires muscle stimulation through frequent, if possible daily training (► Chap. 10, Instruction and Specific Training), in order to be successfully transferred into everyday movement behavior.

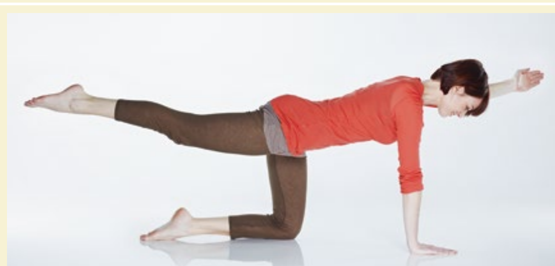
Overview 6.6 Pilates Mat Program for a Strong Back

Exercise	Chapter	Figure
Supine		
Mountain Pose	► Sect. 5.3.1	
Breathing	► Sect. 5.1.1	
Shoulder Drops	► Sect. 5.1.3	
Pelvic Clock	► Sect. 5.1.2	

Exercise	Chapter	Figure
Chest Lift	► Sect. 5.1.4	 
Assisted Roll Up/Roll Down with Half Roll Down	► Sect. 5.1.9	
Dead Bug with a towel for assessment To conclude, place feet down one after the other	► Sect. 5.1.5	
Bridging I	► Sect. 5.1.7	
Bridging I with progression "Stabilization" and "Marching"		
Piriformis stretch	► Sect. 5.3.2	

Exercise	Chapter	Figure
Hamstring stretch	► Sect. 5.3.2	 
Single Leg Circles Roll to the right side	► Sect. 5.2.4	
Book Opening	► Sect. 5.1.10	
Side Kick Series I	► Sect. 5.1.11	
Quadriceps stretch, side-lying	► Sect. 5.3.2	
Stretch Transition to side-lying on the left, via the supine position. Repeat Book Opening etc. on the left side, then roll up through Assisted Roll Up to sitting	► Sect. 5.1.10	

Exercise	Chapter	Figure
Mermaid I or	► Sect. 5.1.14	
Mermaid II	► Sect. 5.2.9	
Spine Stretch I or II	► Sect. 5.1.13	
Adductor stretch	► Sect. 5.3.2	
Side Lift	► Sect. 5.1.12	
Transition to Prone		
Seated Balanced Position	► Sect. 5.2.5	

Exercise	Chapter	Figure
Seated On Heels	► Sect. 5.3.1	
V-Stretch		
Push Up position	► Sect. 5.2.16	
Dart Then place hands at the sides	► Sect. 5.1.17	
Child's Pose	► Sect. 5.3.1	
Quadruped/All Fours	► Sect. 5.1.18	

Exercise	Chapter	Figure
V-Stretch into High Kneeling	► Sect. 5.3.1	 
Knee Bends with stretch in standing position	► Sect. 5.3.1	 

6

Exercise	Chapter	Figure
Goal Post	► Sect. 4.3	
Roll Down	► Sect. 5.1.19	
Standing Single Leg Balance	► Sect. 5.2.18	
Standing Balance	► Sect. 5.1.20	

6.6 Pilates Mat Program For Men

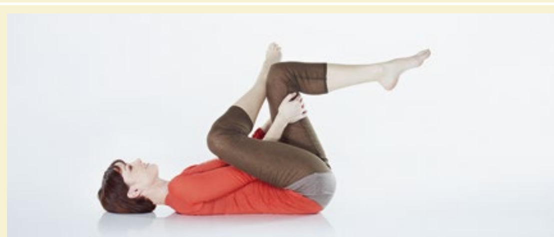
Anyone who believes that Pilates is a gentle wellness activity suited to women is entirely wrong! It is also challenging for men to use their own body weight as resistance, as it requires not only strength, but flexibility and coordination.

According to Van Wingerden (1998, p 417) strength gain is significantly higher when **training for strength and stretching** are **combined** than when training purely for strength (▶ **Overview 6.7**). The two elements are combined in a Pilates program.

Overview 6.7 Pilates Mat Program for Men

Exercise	Chapter	Figure
Standing		
Breathing and stretching: Inhale and raise the arms, exhale and lower the arms; then link the hands and stretch the arms/palms to the front. From there, reach toward the ceiling, extension to the right/left, rotation to the right/left*	▶ Sect. 5.3.1	–
Roll Down	▶ Sect. 5.1.19	
Squatting, transition into sitting	▶ Sect. 5.3.1	
Half Roll Down, with progression – arm movements and rotation	▶ Sect. 5.1.9	
Hundred	▶ Sect. 5.2.1	
Mountain Pose	▶ Sect. 5.3.1	

Exercise	Chapter	Figure
Roll Up/Roll Down	► Sect. 5.2.2	
In the seated position – support and bend the legs		
Roll Over I from sitting, roll to supine	► Sect. 5.1.8	 
Hamstring stretch	► Sect. 5.3.2	 

Exercise	Chapter	Figure
Side to Side, also with progression "legs extended"	► Sect. 5.1.6	
Single Leg Stretch	► Sect. 5.2.6	
Modified Criss-Cross	► Sect. 5.2.7	
Criss-Cross		
Piriformis stretch	► Sect. 5.3.2	
Bridging II Roll onto the right side	► Sect. 5.2.8	

Exercise	Chapter	Figure
Book Opening	► Sect. 5.1.10	
Stretch	► Sect. 5.1.10	
Quadriceps stretch side-lying on the right side	► Sect. 5.3.2	
Transition to the left side via Mountain Pose and perform Book Opening etc. on the left side, then transition again through the Mountain Pose and Roll Up to sitting	► Sect. 5.3.1	
Mermaid I	► Sect. 5.1.14	
Spine Stretch II	► Sect. 5.2.10	
Spine Twist	► Sect. 5.2.11	

Exercise	Chapter	Figure
Adductor stretch	► Sect. 5.3.2	
Rolling Like a Ball	► Sect. 5.2.5	
Transition to Prone		
Seated Balanced Position	► Sect. 5.2.5	
Seated on Heels	► Sect. 5.3.1	
V-Stretch		
Push Up position	► Sect. 5.2.16	
Scarecrow	► Sect. 5.1.15	

Exercise	Chapter	Figure
Dart	► Sect. 5.1.17	
Swimming	► Sect. 5.2.15	
Single Leg Kick II, initial regression exercise	► Sect. 5.2.13	
Child's Pose	► Sect. 5.3.1	
V-Stretch	► Sect. 5.3.1	
Leg Pull Front	► Sect. 5.2.16	
Side Bend right	► Sect. 5.2.17	

Exercise	Chapter	Figure
Leg Pull Front	► Sect. 5.2.16	
Side Bend left	► Sect. 5.2.17	
Push Up position: 3 push ups	► Sect. 5.2.16	
		
Walk hands toward the feet, Roll Up to standing, Roll Down, walk the hands forward in 3 steps to Push Up position*	► Sect. 5.3.1	
		

6

Exercise	Chapter	Figure
Push Up position: 5 push ups	► Sect. 5.2.16	 
V-Stretch	► Sect. 5.3.1	
Iliopsoas Stretch	► Sect. 5.3.2	
High Kneeling: Knee bends	► Sect. 5.3.1	

Exercise	Chapter	Figure
		
Shoulder Girdle Stretch	► Sect. 5.3.2	
Standing Single Leg Balance	► Sect. 5.2.18	
Standing Balance	► Sect. 5.1.20	

*Not illustrated

6.7 Prenatal Pilates Mat Program

Pilates also offers an ideal opportunity to move functionally during pregnancy. The fact that movement has additional benefits for the growing child is beyond question. Pregnancy is not an illness, and those accustomed to regular exercise and training should continue do so at a moderate level, up to three times a week – provided that the pregnancy is free of complications. Pregnant Pilates beginners are recommended to join either a **beginners** or a **specially designated class**. Learning to breathe consciously into the lateral rib cage can improve the wellbeing of pregnant women during the third trimester, as the diaphragm is unable to lower fully, which often leads to shortness of breath. It also makes an excellent preparation for birth. Exercises to increase **awareness of** the pelvic floor and **Pilates Basics** such as lengthening and elongating the spine through dynamic tension, or proper alignment of the shoulders – maintaining an upright posture despite shifting of the center of gravity due to the swelling abdomen – all make pregnancy easier and provide an ideal foundation for the stressful time following the birth. Training with the Pilates equipment can be diverse and full of variety; pregnant women can continue to train safely and effectively until the end of pregnancy.

What applies to one participant is not necessarily applicable to the next, therefore regular reminders to listen to one's own body are essential. Overly ambitious participants should be "slowed down" – pregnancy is not the time to develop a competitive spirit.

Warning

Intense abdominal and pelvic floor training is generally not recommended during pregnancy as it may lead to diastasis recti (Hamilton 2009).

The primary focus is on **stabilizing** and **strengthening exercises** for the shoulder girdle, arms and back (▶ **Overviews 6.8**, **6.9**).

» Regular training throughout pregnancy increases movement confidence and develops the ability to coordinate the proportions of the body, which are constantly changing due to breast and abdominal development at the front of the body. In addition, it helps to offset postural defects and back problems (Korsten-Reck et al. 2009).

Overview 6.8 Prenatal Pilates: Guidelines

Guidelines for the first trimester:

- **No general contraindications**, unless it is a high-risk pregnancy!
- In cases of high-risk pregnancy, avoid training completely, or moderate strongly during the first 12 weeks.
- Training content: back muscles, shoulder girdle, arm strength and mobility, moderate abdominal training.
- Avoid adductor training due to the risk of destabilizing the pubic symphysis!
- Avoid intense stretching!
- Limit overhead workout and rolling exercises.
- Prone position may be uncomfortable, but is not contraindicated.

Guidelines for the second trimester:

- As the prone position becomes increasingly uncomfortable, training in side-lying or on all fours position is recommended, with limited periods supine.
- Avoid adductor training!
- Avoid intense stretching!
- Avoid overhead workout and rolling exercises!
- Gentle stretches for the lower back are recommended, for example, in quadruped: cat stretching (not illustrated).
- Perform supine stretches over a fitness ball, coordination and balance exercises in standing.

Guidelines for the third trimester:

- Do not exercise for more than a few minutes supine.
- Avoid adductor training!
- Avoid intense stretching.
- Avoid the prone position!
- Hormonal changes during pregnancy loosen the ligamentous structure, which may cause problems in the sacroiliac joint (SIJ), lower back, and hips.
- Training focus: place more emphasis on strengthening of the extremities, rather than of the trunk. Work on hip strength while side-lying, sitting, or in standing.

(▶ Sect. 4.1.6, Clinical Disorders and Contraindications)

A birth is traumatic for the **pelvic floor**: It will stretch to more than triple its normal length. Traumatic damage and tears may functionally disable entire muscles. Up to 80 % of the work performed by the pelvic floor muscle takes the form of **tonic static support** (slow twitch fibers), in cocontraction with the lower fibers of the TrA. To regain motor control following pregnancy, specific training on a daily basis is essential (Junginger 2009a,b).

Warning

Abdominal exercises that place pressure on the pelvic floor, specifically abdominal training with upper body raised (trunk flexion), should be avoided initially.

Tip

Abdominal **training without a raised head or flexion** is recommended:
Place the hands beneath the sitting bones (palms down), or a wedge cushion under the pelvis, to produce a slight posterior pelvic tilt. Modified versions of "Hundred", "Single / Double Leg Stretches", and even "Side to Side" can be performed in this position (► Chap. 11, Instruction and Specialized Instruction).

Overview 6.9 Prenatal Pilates Mat Program

Exercise	Chapter	Figure
Supine		
Mountain Pose	► Sect. 5.3.1	
Breathing	► Sect. 5.1.1	
Pelvic Clock	► Sect. 5.1.2	
Assisted Roll Up/Roll Down	► Sect. 5.1.9	
Shoulder Drops	► Sect. 5.1.3	

Exercise	Chapter	Figure
Arm Arcs		
Windmill		
Dead Bug with regression “Femur Arcs”	► Sect. 5.1.5	
Dead Bug with regression “Leg Lowers” and “Bicycle”*		–
Dead Bug		
Single Leg Circles	► Sect. 5.2.4	
Bridging I with progression “Stabilization”	► Sect. 5.1.7	

Exercise	Chapter	Figure
Book Opening	► Sect. 5.1.10	
Side Kick-Series I	► Sect. 5.1.11	
Side Lift	► Sect. 5.1.12	
Spine Stretch I or II (possibly sitting on a raised surface)	► Sect. 5.1.13	
Scarecrow (1st trimester)	► Sect. 5.1.15	
Dart (1st trimester)	► Sect. 5.1.17	
Quadruped, all variations	► Sect. 5.1.18	

Exercise	Chapter	Figure
V-Stretch	► Sect. 5.3.1	
Knee Bends single leg		
Knee Bends both legs	► Sect. 4.3	
Heel Raise with hold		

Exercise	Chapter	Figure
Standing Roll Down against a wall Extra for back strength: Keep the buttocks on the wall, spine parallel to the ground, hold for several breaths. Depending on back strength, arms can stay alongside the pelvis, reach to the side in T-position at shoulder level, or extend forward alongside the ears *	► Sect. 5.1.19	
Standing Balance	► Sect. 5.1.20	

*Not illustrated

6.8 Pilates Mat Program for Osteoporosis

More than 40 % of women and 13 % of men over the age of 50 suffer fractures as a result of osteoporosis (federation of German-speaking self-help groups and patient-orientated osteoporosis organizations; http://www.osteoporose-dop.org).

As the average age of the population increases, incidences of this disease also increase, so that age-related **decrease in bone mass** is an increasingly common disease in Europe and beyond. A 50-year-old woman today has the same risk of dying as a result of a femoral neck fracture as that of breast cancer (news report from the *Darmstädter Echo* on the European Orthopaedic Congress "Porous Bone: A Widespread Disease", Vienna, 2009). Exercise and sports are not only important in terms of prevention, but can also effectively supplement other therapy.

Strong forces acting on the muscles and bones are required for prevention. Therapeutically, however, and depending on the severity of the disease, **exercises to develop strength** are recommended, particularly those exercises which provide an additional challenge to (palms down) coordination and balance (fall prevention) (German Society for Sports Medicine and Prevention, German Sports Medical Association eV 2011).

The National Osteoporosis Foundation (USA) states that upright posture and good alignment of the head, shoulders, spine, hips, knees, and ankles in relation to each other can play a crucial part in minimizing unnecessary loading and strain on the spine.

Pilates may be the optimal preventative and therapy-supportive movement program for osteoporosis! A selection of beneficial Pilates exercises are shown in ► **Overview 6.11**, Contraindications ► **Overview 6.10**.

Overview 6.10 Contraindications for Osteoporosis

- Avoid compressive forces on the vertebral bodies: no flexion of the spine! Moderate rotation, but always avoid combined flexion/rotation! Encourage axial length and stability!
- No Roll Ups!
- No pressure on the ribs and rib cage!
- No forced external rotation of the hips, either on the floor (Pigeon Pose) or standing!
- Avoid group classes in cases of bone density loss exceeding 20 %!

(► Sect. 4.1.6, Common Clinical Disorders and Contraindications)

Overview 6.11 Pilates Mat Program for Osteoporosis

Exercise	Chapter	Figure
Supine		
Mountain Pose	► Sect. 5.3.1	
Breathing	► Sect. 5.1.1	
Hundred with regression: Lift arms and perform pumping movements, following the rhythm of the breath	► Sect. 5.2.1	
Dead Bug, all variations	► Sect. 5.1.5	
Single Leg Stretch with regression	► Sect. 5.2.6	
Bridging I	► Sect. 5.1.7	

Exercise	Chapter	Figure
Book Opening (moderate range of motion!)	► Sect. 5.1.10	
Side Kick-Series I, all variations	► Sect. 5.1.11	
Side Lift	► Sect. 5.1.12	
Spine Twist with regression	► Sect. 5.2.11	
Swan	► Sect. 5.1.16	
Single Leg Kick	► Sect. 5.2.13	
Scarecrow	► Sect. 5.1.15	

Exercise	Chapter	Figure
Dart	► Sect. 5.1.17	
Swimming with regression	► Sect. 5.2.15	
Quadruped	► Sect. 5.1.18	
Leg Pull Front with regression	► Sect. 5.2.16	
Transition via Quadruped/All Fours into V-Stretch	► Sect. 5.3.1	
Knee Bends, single leg		

Exercise	Chapter	Figure
Knee Bends, both legs	► Sect. 4.3	
Heel Raise with hold		
Standing Balance	► Sect. 5.1.20	
Standing Single Leg Balance	► Sect. 5.2.18	

6.9 Pilates Exercises and Functional Groups

Selected exercises for the individual, functional groups of the body are listed in ▶ **Overview 6.12**.

Overview 6.12 Pilates Exercises and Functional Groups

Functional groups	Exercise suggestions	Chapter
Cervical Spine/ Head/ Shoulder	**Pre-Pilates**	
	Shoulder Drops	▶ Sect. 5.1.3
	Chest Lift	▶ Sect. 5.1.4
	Book Opening	▶ Sect. 5.1.10
	Scarecrow	▶ Sect. 5.1.15
	Swan	▶ Sect. 5.1.16
	Dart	▶ Sect. 5.1.17
	Quadruped	▶ Sect. 5.1.18
	Program for Progression	
	Hundred	▶ Sect. 5.2.1
	Criss-Cross	▶ Sect. 5.2.7
	Mermaid II	▶ Sect. 5.2.9
	Spine Stretch	▶ Sect. 5.2.10
	Swimming	▶ Sect. 5.2.15
Thoracic Spine/ Shoulder/ Arm	**Pre-Pilates**	
	Chest Lift	▶ Sect. 5.1.4
	Side to Side	▶ Sect. 5.1.6
	Bridging I	▶ Sect. 5.1.7
	Roll Over I	▶ Sect. 5.1.8
	Assisted Roll Up	▶ Sect. 5.1.9
	Book Opening	▶ Sect. 5.1.10
	Side Lift	▶ Sect. 5.1.12
	Spine Stretch I	▶ Sect. 5.1.13
	Mermaid I	▶ Sect. 5.1.14
	Scarecrow	▶ Sect. 5.1.15
	Swan	▶ Sect. 5.1.16
	Dart	▶ Sect. 5.1.17
	Quadruped	▶ Sect. 5.1.18
	Program for Progression	
	Hundred	▶ Sect. 5.2.1
	Criss-Cross	▶ Sect. 5.2.7
	Spine Twist	▶ Sect. 5.2.11
	Mermaid II	▶ Sect. 5.2.9
	Swan Dive	▶ Sect. 5.2.12
	Swimming	▶ Sect. 5.2.15
Core/Pelvis/Leg	**Pre-Pilates**	
	Pelvic Clock	▶ Sect. 5.1.2
	Dead Bug	▶ Sect. 5.1.5
	Side to Side	▶ Sect. 5.1.6
	Bridging I	▶ Sect. 5.1.7
	Bridging II	▶ Sect. 5.2.8
	Roll Over I	▶ Sect. 5.1.8
	Assisted Roll Up	▶ Sect. 5.1.9
	Side Kick Series	▶ Sect. 5.1.11
	Side Lift	▶ Sect. 5.1.12
	Spine Stretch I	▶ Sect. 5.1.13
	Mermaid I	▶ Sect. 5.1.14
	Quadruped	▶ Sect. 5.1.18
	Standing Roll Down	▶ Sect. 5.1.19
	Program for Progression	
	Hundred	▶ Sect. 5.2.1
	Roll Up	▶ Sect. 5.2.2
	Roll Over II	▶ Sect. 5.2.3
	Single Leg Circles	▶ Sect. 5.2.4
	Single Leg Stretch	▶ Sect. 5.2.6
	Criss-Cross	▶ Sect. 5.2.7
	Mermaid II	▶ Sect. 5.2.9
	Spine Stretch II	▶ Sect. 5.2.10
	Swan Dive	▶ Sect. 5.2.12
	Single Leg Kick	▶ Sect. 5.2.13
	Swimming	▶ Sect. 5.2.15
	Leg Pull Front	▶ Sect. 5.2.16
	Side Bend	▶ Sect. 5.2.17
Upper Extremity	**Pre-Pilates**	
	Shoulder Drops	▶ Sect. 5.1.3
	Book Opening	▶ Sect. 5.1.10
	Mermaid I	▶ Sect. 5.1.14
	Scarecrow	▶ Sect. 5.1.15
	Swan	▶ Sect. 5.1.16
	Quadruped	▶ Sect. 5.1.18
	Program for Progression	
	Side Kick Series	▶ Sect. 5.2.14
	Leg Pull Front	▶ Sect. 5.2.16

Functional groups	Exercise suggestions	Chapter
Lower Extremity	**Pre-Pilates**	
	Side Kick I and II	► Sect. 5.1.11
	Standing Balance	► Sect. 5.1.20
	Program for Progression	
	Single Leg Circles	► Sect. 5.2.4
	Side Kick-Series	► Sect. 5.2.14
	Single Leg Kick	► Sect. 5.2.13
	Leg Pull Front	► Sect. 5.2.16
	Standing Leg Balance	► Sect. 5.2.18

References

Hamilton C (2009) Lokale Stabilität der Gelenke. Handout Hamilton, Regensburg

Junginger B (2009a) Presentation, Physiotherapist Congress 2009, Fellbach

Junginger B (2009b) Dysfunktion und Training des Beckenbodens. Uro-News. http://www.physiotherapiejunginger.de. Cited December 2009

Korsten-Reck U, Marquardt K, Wurster KG (2009) Schwangerschaft und Sport. Dt Zeitsch für Sportmedizin 60(5):117–121

Van Wingerden B (1998) Bindegewebe in der Rehabilitation. Scipro, Frankfurt

Therapeutic Pilates: Fundamental Principles

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_7, © Springer Berlin Heidelberg 2014

7

Introduction

The methods, procedures, and structure of rehabilitation and therapy in Europe have changed dramatically during the last two decades.

With advances in minimally invasive surgical techniques, outpatient surgery, and new surgical indicators, fresh demands have been placed on aftercare and early functional rehabilitation. In addition, increasing financial pressures and demand for evidence of efficiency and sustainability have led to a focus on early functional treatment approaches. The active pillars of health have taken on increasing significance, as personal responsibility has been demanded from patients, and long-term health maintenance programs have been promoted.

In the field of **chronic diseases,** the changing age distribution in society and substantial rise in sedentary occupations that negatively impact health have increased demand in the areas of health promotion, prevention, and therapy. The following chapter addresses the ways in which Pilates can make an important contribution to rehabilitation and therapy in this evolving environment.

7.1 ICF Classification and Therapeutic Pilates

TS-Note: Bitte Erscheinungsjahr prüfen

The WHO International Classification of Functioning, Disability and Health (WHO 2001) has been used since 2001 to classify symptoms in the fields of orthopedics, postsurgery, neurology, and internal medicine within a logical framework for reference.

Osteoarthritis of the hip joint, with decreased extension and rotation of the affected leg, represents a greater functional limitation for a competitive athlete than for someone in a sedentary occupation. On the other hand, a painful movement restriction of the shoulder and arm represents a significantly greater occupational impairment for an office worker than, for example, an irritation of the Achilles tendon.

Modified ICF Model (Fig. 7.1)

The elements of the ICF model that are most relevant to training and therapy will be applied to Pilates Rehabilitation, using the following definitions.

Impairment As far as possible, all symptoms resulting from a disease (such as pain, movement limitations, swelling, loss of strength, etc.) should be assessed using standardized measuring procedures (neutral zero method, muscle function testing according to Janda, pain scale).

Functional Disorder The symptoms identified are assessed in terms of function. Therefore a Painful Arc when lifting the arm above the head is an impairment when taking things in and out of a high cupboard, for example, but not while working at a PC workstation.

Disability The current degree of disability is evaluated, taking into account both professional and leisure activities. This can facilitate an estimate of projected costs for health care providers, among other things.

7.2 The Phases of Rehabilitation

Following the model of Porterfield and DeRosa (1991), procedures and therapeutic interventions are divided into four Phases of Rehabilitation, as shown in Table 7.1.

7.2.1 Acute Phase

Impairments during this phase primarily consist of inflammatory symptoms. Resulting from acute injury or surgical intervention, the classic inflammatory reactions (pain, swelling, disability movement, redness, heat) occur in specific tissues and can be reduced.

! In the acute phase, Pilates intervention should not affect the injured area.

An acute problem usually prohibits exercise therapy at the site of the injury, particularly if pain occurs during exercise. **Therapeutic Pilates** may focus on:

- Improving the organization of the body
- Isolating joint movements to protect the injury
- The accompanying therapeutic effects, such as improved circulation due to breathing exercises

! Pilates interventions at the site of the injury are generally passive; however, they may be either active or assistive in the area of nontraumatized structures (body posture, breathing, overflow, isolation).

The fundamental approach of Pilates to physical ailments becomes clear during this phase: to engage the body as a whole, to restore the individual to their full, healthy capability, and to encourage patients to take personal responsibility for their own health.

7.2.2 Subacute Phase

Depending on the nature of the injury and condition of the affected tissue, as well as surgical technique and individual circumstances, patients enter the second phase of rehabilitation at different points in time.

Once inflammatory reactions subside, functional training stimuli can be provided at the site of the injury, using movement exercises. The injured structure "needs" a tissue-specific training stimulus, (Table 7.2), but is generally only able to receive the stimulus in a controlled, assisted form. This phase is therefore referred to in therapeutic Pilates as "assisted execution."

Assisted execution is characteristic of the subacute phase of rehabilitation.

The specialized **Pilates equipment** (Reformer, Cadillac, Chair, Spine Corrector and others; ▶ Chap. 8, Figs. 8.1–8.4) is ideally suited for use in therapeutic Pilates, and easily adapted to different needs and abilities. **Movement factors** such as:

- Range of motion
- Resistance
- Starting position and
- Complexity

can be precisely adjusted for specific injuries, and integrated into functional movement chains. **Pain-free, harmless movements** are facilitated, which support and accelerate the healing process.

7.2.3 Active Rehabilitation Phase

If functional movement patterns within the preceding, limited and supportive framework were completed without difficulty, the therapeutic Pilates program can now be expanded to include **active stabilization.** Within this context, the term **neutral zone** takes on significance, primarily in terms of the spine, but also the joints of the extremities.

The term neutral zone refers to the actively supported movements of a motion segment (spine) or joint (extremities), in both concentric and eccentric motion sequences (▶ Sect. 7.5, Fig. 7.2).

The combination of mobility and stability during movement execution is referred to as **dynamic stability**, whereby the active components of the musculoskeletal system are sufficiently engaged to support the passive components, during all movements.

Modified ICF Model by Brent Anderson

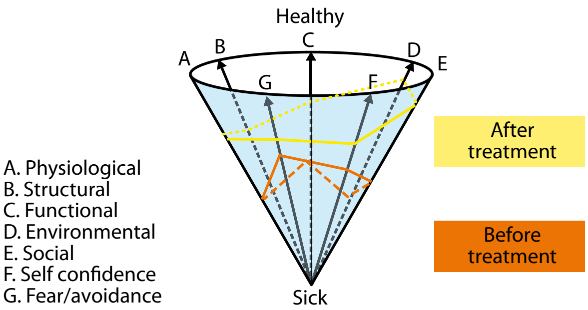


Fig. 7.1. Modified ICF Model by Brent Anderson

Therapeutic Pilates has an active character in the Active phase of rehabilitation, however, within specific, selected ranges of movement, and restricted to movements of limited complexity, with the aim of avoiding overloading or re-injury.

7.2.4 Postrehabilitation Phase

Depending on the functional requirements of the patient, this phase focuses on **sport- and occupation-specific movement sequences**. As simpler movement chains become automatic, training can be **intensified** through the introduction of complex, reactive movement sequences.

Pilates training during the Postrehabilitation Phase is active and complex. Resistance can be introduced, and functional issues addressed. The Pilates equipment in particular allows movement sequences to be practiced in an exceptionally functional and variable manner.

While paying attention to the mechanism that originally gave rise to the injury, training strategies can be implemented at a local as well as whole body level, with the goal of preventing re-injury

7.2.5 Pain and Rehabilitation

The process of rehabilitation is characterized by changes in the accompanying symptoms, or guiding parameters such as mobility, strength, and pain. During the rehabilitation phase, **pain** is a function of various processes and therefore requires detailed interpretation.

As early as 1986, Brügger postulated a functional relationship between pain and the recovery of physical capabilities. The **nociceptive threshold**, i. e., the subcortical

Table 7.1. The phases of rehabilitation

Phase	Acute	Subacute	Rehabilitation	Postrehabilitation
Problems	Irritation/pain	Loss of movement and function	Decline in performance	Sport-specific resilience
Type of training	Passive at site of injury	Assistive	Active, limited	Complex
Main focus	Isolation, stabilization	Selective movement	Dynamic stability	Injury prevention

Table 7.2. Physiological training stimuli

Body tissue	Training stimulus
Muscle tissue	Dynamic movement stimuli
Bone tissue	Pressure
Tendon tissue	Movement stimuli with a stretching component
Ligament tissue	Hardly any changes through active movement stimuli
	Requires protection from further damage
Nerve tissue:	
– Peripheral nerve structures	– Stimulation by peripheral movement stimuli
– Central nerve structures	– Physiological learning stimulus

processing of disturbance stimuli at an unconscious level, is a useful and effective mechanism. In response to stimuli that have the potential to damage tissue, signals are passed by means of nociceptors (noxious stimuli detectors found in all tissue), along afferent pathways to the spinal cord and from there, to subcortical centers. Both at the spinal cord and subcortical levels, the signals of disturbance are answered with **physical responses**.

Pain Responses

No Direct Pain **Physical reactions** are visible externally, for example:

- An evasive movement
- A weakness
- The loss of active stability during a movement

The patient will usually only notice an **evasive movement** after he/she has been made aware of it, for example, because it is **unconsciously** made, in order to continue movement without experiencing direct pain.

Pain During Movement If unconsciously triggered responses do not compensate sufficiently for the disturbance, pain will be triggered **consciously** by the body, as an additional warning signal. This physical reaction serves primarily to immobilize a body part, or consciously avoid or modify a movement, in order to reduce stress on this part. This is referred to as movement pain.

Rest Pain In serious cases, **conscious and unconscious strategies** are not sufficient to generate an adequate physical response to a problem, or there may be a severe, general physical disorder (generalized inflammation). In this case, the patient complains of pain at rest.

Night Pain The most severe conditions may even cause extreme **night pain**, which is usually a sign of serious pathology (such as a fracture, cancer). Immediate medical investigation is essential.

Pain Research

Despite knowledge of the causes of pain, temporary pain often occurs during rehabilitation. The dynamics of tissue healing are subject to a variety of influences, therefore the interpretation of pain is as vital as the effort to avoid incurring pain where possible.

Over the past 10 years, pain research has revolutionized the understanding of pain and as a consequence, therapeutic options. Researcher Ronald Melzack, well known since the 1960 s through his definition of the so-called **Gate Control Theory**, coined a new term in 1999: the **Neuromatrix**. This model incorporates the cortical processing of pain and interprets pain perception as an individually generated, subjectively experienced and complex phenomenon (Melzack 1999).

This new approach facilitates a better understanding of the processes relevant to therapy and rehabilitation. Pain is a **multifocal occurrence**, influenced by the following systems:

- Sensory input (all somatic receptors)
- Visual input, that influences the cognitive interpretation of the situation
- Phasic and tonic, cognitive and emotional input from other brain regions
- Internal motor adaptation process
- The activity of stress-processing body systems (hormones, cell reactions, immune system) (Melzack 1999)

When Is Pain Normal?

In the context of primary wound healing, temporary **hypersensitivity** often occurs, due to the reorganization of sensory areas. In the proliferative phase of tissue healing, the patient may feel a mild, **not uncomfortable ache** under pressure, which could be a result of easily irritated nociceptors in the tissue, and the subjective interpretation of the patient. The crucial factor is the immediate and sustained **abatement of pain once stress is relieved**.

A specific type of pain occurs following injury to the peripheral nerve structures, e.g., following severe radicular symptoms resulting from a herniated disc. The revascularization of nerve tissue follows several different phases, and is characterized by **painful hypersensitivity** in the nerve area (dermatome, sclerotome, and myotome). However, in this case, pain should be interpreted as **normal pathophysiological healing**.

When Is Pain Not Normal?

Any pain that **revives the inhibition response** should not be interpreted as either normal or helpful. Inhibition in this case refers both to direct organic functions (circulation, muscle tone, strength, sensitivity) and indirect reactions (compensatory posture, evasive movements and fear). These reactions to pain will slow down, interrupt, or lead to setbacks in rehabilitation.

7.3 Strength and Pilates Training

As shown in ▶ Chap. 4, increasing strength requires a specific training concept. Pilates training focuses primarily on the underlying mechanism of improving **intra- and intermuscular coordination** and thereby developing increased strength. The exercises will **affect:**

- The timing and spatial organization of muscle systems to one another (intermuscular)
- The activation of specific muscle parts within a muscle (intramuscularly)

Pilates Hypertrophy Training

Training for hypertrophy using Pilates is possible if sufficiently strong training stimuli are introduced by means of:

- Gravity (body weight, and orientation)
- Order of exercises
- External resistance
- In combination with the requisite number of repetitions and tempo, the summation of stimuli can lead to hypertrophy.

Example

Hypertrophy Training

- Footwork on the reformer with strong resistance (3–4 springs) single leg or
- 10–15 repetitions of the push-up movement during the Pilates exercise "Push Up"

Pilates Strength Endurance Training

Those exercises that place increased and prolonged demands on the phasic portions of the musculature are most effective in improving strength endurance performance.

Example

Strength Endurance Training

- In the **Mat program**, the smooth transition between the exercises "Leg Pull Front" and "Star", practiced with a high number of repetitions (more than 2 repetitions per side), provides an opportunity for training endurance of both the trunk muscles and the supporting muscles of the extremities
- On the **Pilates equipment**, endurance can be developed by increasing the number of repetitions and series of exercises, focusing on the same muscle groups in different ways, e.g., "Feet in Straps" in parallel, narrow, wide, circles, etc.

Pilates Speed-Strength Training

Pilates training for **speed strength** requires a series of exercises in which strength can be rapidly and explosively generated from a prestretch (e.g., supine "Jumping" on the Reformer).

Therapeutic Pilates Strength Training

In most cases a **loss of strength** can be observed following injury, as a result of immobilization or protecting. However, if relative strength is disrupted, the mechanism responsible should be considered before training begins. In the case of **chronic spinal issues**, for example, one segment in a key location can severely disrupt the entire active functional chain; mobilization therapy would therefore be a prerequisite before strengthening both the local stabilizing muscles and the global muscle systems.

Following **injury or surgery**, for example, on an extremity, strength training should be targeted and address the affected side specifically, in order to generate increased strength where it is required.

7.4 Flexibility and Pilates Training

Joseph Pilates considered **flexibility** to be a very important factor:

> » If your spine is inflexibly stiff at 30, you are old. If it is completely flexible at 60, you are young! (*Return to Life* 1945, in Gallagher and Kryzanowska 2000)

Unimpaired, physiological flexibility is an essential component of efficient movement. However, flexibility requires sufficient **stability**; otherwise mobility can easily lead to instability. It is primarily the inert structures that suffer in this event, as a result of absorbing and compensating for unrestrained movements.

The following **key locations** in the body are of particular significance:

- **Atlanto-axial and atlanto-occipital joints, in rotation and flexion/extension:** the key movements of the cervical spine are rotation and flexion/extension; amongst other things, the rotational element adjusts responses of the head in space, and flexion/extension regulates the relationship of the spine to the head. Flexor restrictions inhibit the activation of the physiological chain during trunk flexion, and a pronounced flexed posture results in an inhibition of active upright trunk posture.
- **Cervical–thoracic junction (CTJ) in extension/flexion:** in most cases, the CTJ is fixed in flexion, which impedes the transfer of trunk movements to the cervical spine and encourages hypermobility at C3/C4.
- **Hip joints in extension:** sufficient hip extension is essential, in order to protect the lumbar spine from stress.
- **Ankle joints in dorsal flexion:** if a lack of mobility at the ankle joints prevents weight from shifting forward (insufficient dorsiflexion), hind foot loading occurs, causing the entire body to be loaded dorsally.

If these four key locations can be mobilized through Pilates training, the first crucial degrees of freedom are established.

7.5 Neutral Zone and Dynamic Stability

The term “neutral zone” was coined by Panjabi (1992).

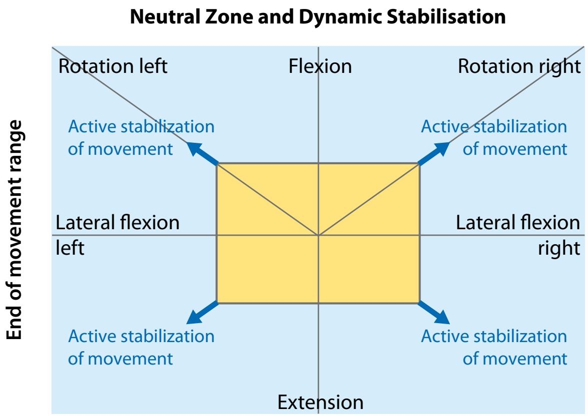


Fig. 7.2. Neutral zone and dynamic stabilisation

Panjabi (1992) defined the neutral zone as the mid-range position of a joint in which the active and passive tissues have a minimal stabilizing function (Fig. 7.2).

Is the Neutral Zone More Vulnerable to Injuries?

The functional aspect must be considered when debating whether a neutral zone is more vulnerable to injury. The two principles of “neutral zone” and “dynamic stability” can be brought together in order to answer this question in terms of Pilates training.

Stability, Dynamics, and Dynamic Stability

- **Stability** usually describes a snapshot at one point in a movement, and is therefore of limited use for Pilates training [Vleeming A, Mooney V, Stoeckart R (2007): “We are not stable!”].The joint parts remain in the same spatial relationship to each other during stabilization.
- The word **dynamics** itself describes an unspecified movement; the joint parts move in space.

Dynamic stability can be defined as movement that is actively stabilized at all times. The joint parts are not fixed in space, but remain in a stable relationship to each other.

This definition is particularly appropriate for Pilates training, as Pilates exercises are **dynamic** in nature, therefore static definitions are of limited use to trainers/therapists.

Neutral Zone in Pilates Training

The following statements can be made regarding the neutral zone:

- **The neutral zone is the middle, dynamically stabilized part of a movement.**

Table 7.3. Hypomobility, hypermobility, generalized hypermobility, and dynamic stability

Stability/mobility	Function	Pilates training
Dynamic Stability (Fig. 7.3)	Full function	Complex training
Hypomobility (Fig. 7.4)	Reduced function	Opening or widening training
Hypermobility (Fig. 7.5)	Increased, latently unstable function	Contained or limited range, stabilizing training
Generalized Hypermobility (Fig. 7.6)	Above average unstable function	Cognitive, physically contained stabilization

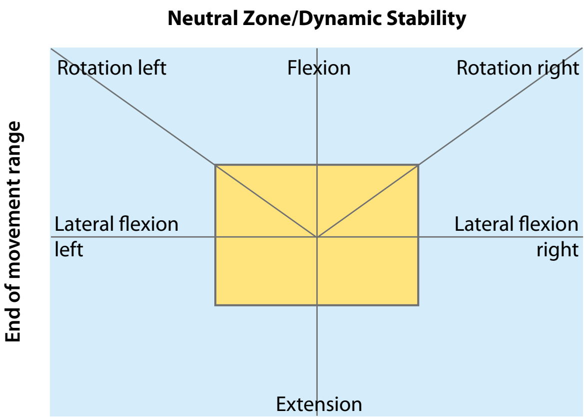


Fig. 7.3

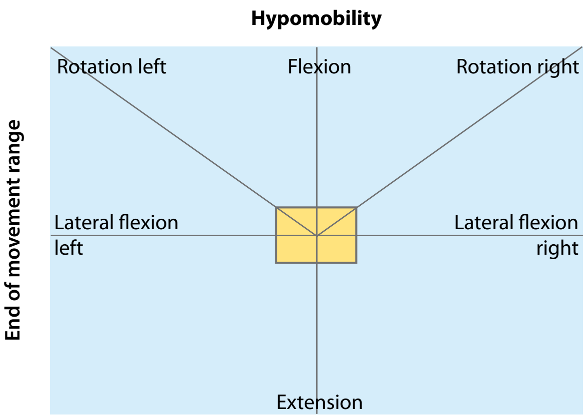


Fig. 7.4 Hypomobility

- **Outside the neutral zone the risk of overloading and instability increases.**
- **The goal of Pilates training is to expand the dynamically stabilized neutral zone.**

Mobility and Instability

- **Hypermobility** describes above average mobility in a defined area of the body, or specific joint. **Compensatory** and **causal hypermobility** can be differentiated: for example, compensatory hypermobility in motion segment L5/S1 may be a result of limited unilateral or bilateral hip extension; the lumbar spine must compensate for the lack of hip extension when walking or running.
- **Generalized hypermobility** is above average mobility of multiple joints. There is usually a genetic predisposition, such as weak connective tissue, but generalized hypermobility can also be developed through excessive stretching.
- **Hypomobility** is below average mobility in a defined area of the body, or specific joint. It is important to note any left/right asymmetric mobility during Pilates training, and also any limitations which may affect specific activities or sports. Hypomobility in extension or rotation of the thoracic spine is a limitation with serious consequences for a swimmer or tennis player, for example. It will prevent functional positioning of the shoulder joint for overhead movements, which is vital to avoid pressure on tendons in the subacromial space. Hypomobility can therefore be a source of secondary, hidden disorders, particularly in sports or during loaded exercises that require freedom of movement at the end of range.
- **Instability** is insufficiently stabilized movement in a joint. Existing hyper- or hypomobility only play an indirect role, if present. While the tendency toward instability certainly increases where hypermobility exists, instability may also occur where hypomobility is present.

Functional loading, training in cases of hypo-/hypermobility, and dynamic stability are outlined in Table 7.3.

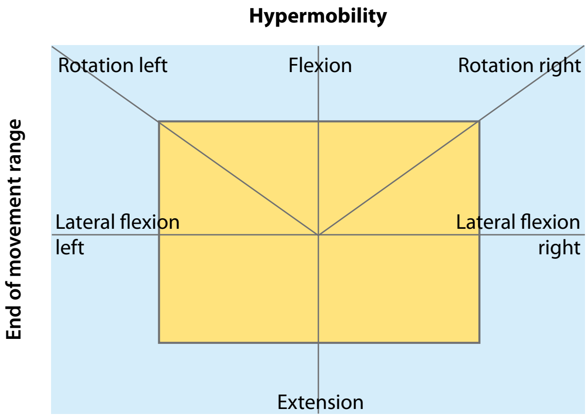


Fig. 7.5 Hypermobility

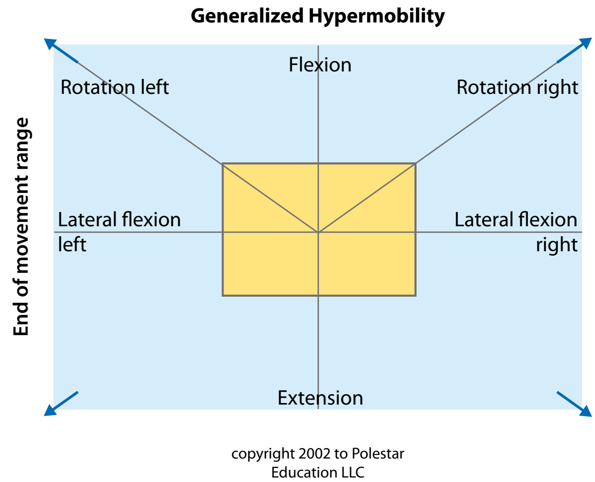


Fig. 7.6 Generalized hypermobility

7

References

Brügger A (1986) Die Erkrankungen des Bewegungsapparates und seines Nervensystems. Urban & Fischer, Frankfurt/Main

Gallagher S, Kryzanowska R (2000) The complete writings of Joseph H. Pilates: Your HEALTH 1934 – Return to life through contrology 1945, The authorized editions. Bainbridge Books, Philadelphia (PA)

Melzack R (1999) From the gate to neuromatrix. Pain Suppl 6:121–126

Panjabi M (1992) The stabilizing system of the spine, Part I: function, dysfunction, adaption and enhancement. J Spinal Disc Techn 5(4):383–389

Porterfield JA, DeRosa C (1991) Mechanical Low Back Pain: Treatment of Lumbopelvic Disorders. WB Saunders, Philadelphia (PA)

Vleeming A, Mooney V, Stoeckart R (eds) (2007) Movement, Stability und Lumbopelvic Pain. Churchill Livingston Elsevier, Toronto

WHO (2011) Global Recommendations on Physical Activity for Health. http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/index.html. Cited 21 May 2011

Therapeutic Pilates: Applications

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_8,

8.1 The Pilates Equipment

The following are **characteristics** of the Pilates equipment:

- Guided movements
- Support
- Multiple levels of intensity and challenge
- The difficulty of any Pilates exercise can be **increased** or **decreased** by means of the following options:
- Altering **resistance by means of the springs**:
  - Concentric muscle work is usually increased by adding resistance, eccentric muscle work the by reducing resistance.
- **Changing the base of support:**
  - Increasing the base of support will always make the exercise easier to perform.
- **Altering the path of movement:**
  - A larger range of motion will usually increase challenge, as more dynamic stability is required.
- **Adjusting the length of lever:**
  - Increasing lever length adds load to the lever arm at the pivot point, but may also facilitate an exercise (e.g., if passive support is thereby created).
- **Altering planes of movement:**
  - Moving in only one movement plane decreases difficulty; movement in multiple planes increases the difficulty of an exercise
- **Altering the speed of movement:**
  - Reducing movement speed may increase or decrease the challenge of the exercise.
- **Changing instruction:**
  - Detailed exercise instruction facilitates the correct control and execution of an exercise. Deliberately limited or modified instructions (e.g., for the breathing pattern, which has a supportive function) lead to increased demands on the unconscious/conscious and automatic execution of an exercise correctly.

Without the assistance of the equipment, a role for Pilates training in rehabilitation is inconceivable (▶ **Overview 8.1**). Joseph Pilates himself used the apparatus to make the demands of specific exercises accessible to the client, and to facilitate training in a way that would enable the eventual execution of the exercises without assistance, and using correct form (for transfer of mat exercises to the Pilates equipment, see below). We generally find many of the Pilates exercises in modified form, on both the Pilates equipment and the mat. This makes it easier to decide between execution of a particular exercise, on a particular piece of apparatus.

! The Pilates equipment differs from conventional training equipment, in that it is usually employed assistively (supporting) and not resistively.

The unique design of the Pilates equipment serves a specific purpose. By means of special **steel springs** that generate resistance and provide guidance, the practitioner experiences a surprisingly different quality of movement to that experienced with conventional exercise equipment.

Overview 8.1. Pilates Equipment

- Reformer
- Cadillac
- Chair
- Spine Corrector
- Pilates small apparatus:
  - Pilates Circle
  - Pilates Balls
  - Pilates Roller
  - Pilates Band
  - Pilates Arc

8.1.1 The Reformer (Fig. 8.1)

According to legend, Joseph Pilates developed the prototype for the main piece of Pilates equipment, later to be known as the "**Universal Reformer**", using a bed and its springs. Characteristic of the Reformer is the **horizontal movement of its carriage**, which is controlled by the gradually increasing length of the attached springs. A wide range of exercises are possible using the Reformer, due to the wide variety of starting positions available (supine, sitting, kneeling, standing, on and off the apparatus) and range of accessories (Box, Standing Platform, Jump Board), some of which were developed at a much later date.

Fig. 8.1 Reformer, shown here is the so-called Clinical Reformer

8.1.2 The Cadillac (Trapeze Table, Fig. 8.2)

The fundamentally simple design of this piece of equipment, in the form of a table with a metal frame and various integrated components, facilitates the performance of fundamentally complex exercises, with less demand on movement control. The **trapeze** acts as an unstable suspended surface, the **tower bar** guides movements around its pivot point. Springs of differing tension or strength are used during exercises, which are performed on or off the Cadillac itself, and can be selected to increase or decrease difficulty, or to guide an exercise movement.

Fig. 8.2 Cadillac, also known as the Trapeze Table

8.1.3 The Chair (Fig. 8.3)

Developed by J. Pilates as an early form of home gymnasium, the Chair could also be used as a piece of furniture (a chair), as well as being a versatile, space-saving piece of exercise equipment. In a few simple steps, the Chair could be inverted and springs attached. It could then be used to support exercises for the trunk, arms, and legs. Owing to a misunderstanding over language, the apparatus that Pilates referred to as the "Wunda Chair" was later also known as the "**Wonder Chair**", a name that truly does justice to its diversity and uniqueness.

Fig. 8.3 Chair, the model shown is known as a Combo Chair

8.1.4 The Spine Corrector (Fig. 8.4)

To correct various spinal movement issues, Joseph Pilates developed this small piece of floor equipment, which also proved useful for those of small stature, due to the dimensions of its original form.

Tip

Because of acceleration, only modern Spine Correctors with a wider diameter and a larger arc of motion for the spine are recommended.

8.1.5 Traditional Pilates Small Apparatus (Fig. 8.5)

Pilates worked ceaselessly to develop new ideas for exercise equipment, designing additional apparatus such as the "Toe Corrector", the "Foot Corrector", the "Pin Wheel", and many more. Today, only a few of these continue to be used regularly in training.

Fig. 8.4 Spine Corrector

Fig. 8.5a–d Pilates small apparatus. **a** Pilates Arc, **b** Pilates Balls, **c** Pilates Roller, **d** Pilates Circle

8.2 Exercises Using the Pilates Equipment

8.2.1 Reformer

■ Footwork

■■ General

The **supine** starting position unloads the spine, making the exercise ideal for working on the following **principles**:
- Control: all spinal areas, but particularly the lumbar spine and pelvis with axial elongation
- Organization of the head/shoulder/neck complex, in a neutral position
- Functional alignment of the leg axes during all exercise series
- The compressive force of spring resistance facilitates joint congruence and challenges eccentrically activated trunk organization and dynamic stabilization of lower extremity movements simultaneously, when performed correctly.

■■ Indications

The **Footwork** series is ideal for the assessment, analysis and treatment of all dynamic stability disorders of the lower extremity. Due to the stable position of the leg axis in a closed chain, training in all movement planes is possible.

The series is also beneficial for all **disorders of the spine**. With a solid foundation through the legs, both stability and active axial elongation can be developed.

Table 8.1 lists indications and objectives for the "Footwork."

Table 8.1 Footwork: indications and therapeutic objectives

Pathologies	Objectives
Lower extremities	
Degenerative/ arthritis	– Improved metabolism, mobilization – Dynamic stability, decompression
Following surgery / injury	– Facilitation of muscle chains, increased strength – Circulation, dynamic stability
Spine	
Degenerative/ chondropathy	– Circulation, decompression – Axial elongation, dissociation
Spondylolisthesis / sacroiliac joint (SIJ) instability	– Symmetric stabilization – Mobilization of the hip joint
Disc pathology	– Training of segmental impaired leg muscles – Neutral stabilization during dynamic leg movements, axial elongation

■■ Exercise Series

Parallel, Heels, Legs Closed (Fig. 8.6) Emphasis on dorsal leg muscles, with simultaneous activation/action of the inner and outer muscle systems connecting the pelvic girdle and lower extremities. Trunk stabilization with dissociated movement at the hip and knee joints.

Parallel, Forefoot, Legs Closed (Fig. 8.7) Extending the movement chain from the ankle joint, with corresponding slight transfer of activity to the ventral muscle system. Also, dynamic stabilization distally from the upper ankle joint: active structure of the transverse and longitudinal arches of the foot.

Hip Width, Heels (Fig. 8.8) In an open leg position, bilateral symmetry and coordination are challenged. Imbalances can be recognized and adjusted. Increased base of support facilitates control of trunk and pelvis.

Hip Width, Forefoot (Fig. 8.9) Separating the ankles reduces reciprocal support. The challenge to stability is increased, particularly in the frontal plane.

Fig. 8.6a,b Footwork: Parallel, heels, legs closed. **a** Starting position: knee and hip ca. 90°, **b** midway position

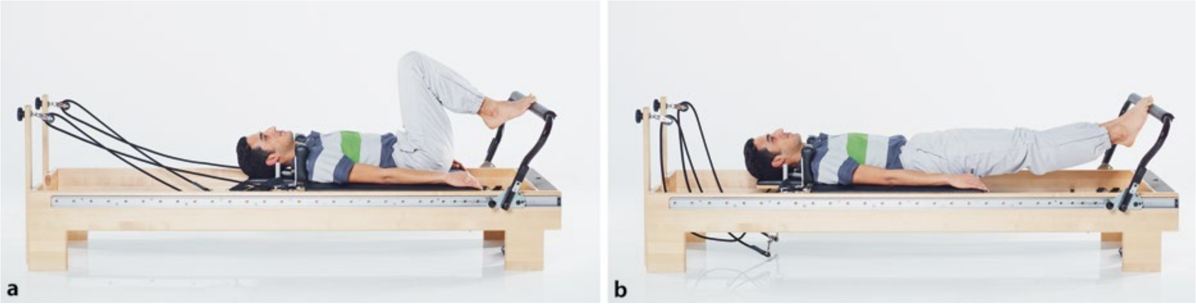


Fig. 8.7a,b Footwork: parallel, forefoot, legs closed. **a** Starting position: toes holding the footbar, **b** midway position

Fig. 8.8a,b Hip width apart, heels. **a** Starting position: hip/knee/ foot in one axis, **b** midway position

Fig. 8.9a,b Footwork: hip width, forefoot. **a** Starting position: heels raised to mid-position, **b** midway position

Lowering Heels (◘ Fig. 8.10) Dynamic stabilization and eccentric control as heels lower; concentric control as heels are raised.

Running (◘ Fig. 8.11) Reciprocal, dynamically stabilizing movement of the upper ankle and knee joints. Movements are stabilized during functional loading of passive structures.

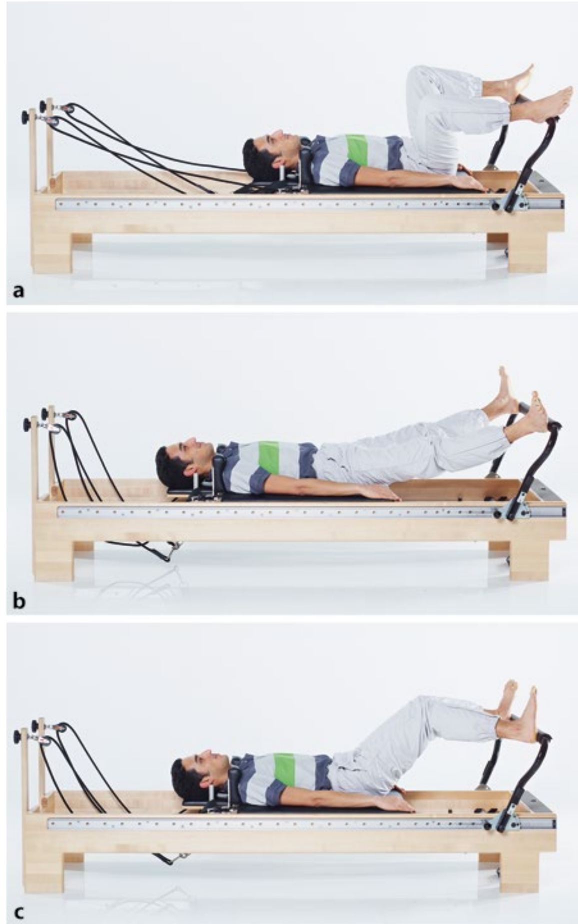
Outward Spirals (◘ Fig. 8.12) Alternating dynamically between hip extension combined with external rotation, and hip flexion with internal rotation. Particularly challenges movements in the transverse plane (rotation). Has a strong effect on circulation and stabilization of the leg axis.

Faulty Movement Patterns

- Lack of axial elongation of the spine
- Incorrect organization of shoulder/cervical spine
- Insufficient connection between pelvis and rib cage
- Poor alignment in a closed chain
- Movement restrictions in the lower limb
- Lack of active stability during the movement
- Dysfunctional transfer of movement to the trunk

■ **Fig. 8.10a,b** Footwork: Lowering heels. **a** Heels raised, **b** heels lowered (Lowering Heels)

■ **Fig. 8.11** Footwork: Running. Alternate raising and lowering of the heels



■ **Fig. 8.12a–c** Footwork: Outward Spirals. **a** Starting position, **b** midway position, **c** end position

Feet in Straps

General

As with “**Footwork**”, the spine is unloaded in the starting position; however the organization of the axes of motion and trunk control are more challenging. The long lever of the extended leg and greater range of motion demand alternate stabilization of the dorsal and ventral muscle chains.

The posterior muscles of the legs are challenged eccentrically through a large range of motion. Dynamic stability of the leg alignment during abduction and adduction is required, as well as during dissociated movement of the lower limbs toward and away from the trunk.

Indications

- Symptoms caused by compression in the joints of the lower extremities (e.g., osteoarthritis, which is painful when placed under pressure)
- Injuries to musculotendinous junctions, which require a stimulus to lengthen
- Muscle disorders with a negative effect on the spine, e.g., hypertonic shortening of the hamstrings
- Stabilization of the leg axis
- Mobilization exercise for pseudo-radicular symptoms

Table 8.2 lists indications and objectives for the exercise “Feet in Straps”.

8

Table 8.2 Feet in Straps: indications and therapeutic objectives

Symptoms	Objectives
Lower extremity	
Tendinosis	Strengthening/lengthening training
Osteoarthritis	Decompressive training
Instability of the leg axis	Stabilization in an open chain
Spine / others	
Contracture of the hip, pelvis or leg muscles	Mobilization
Pseudo-radicular syndrome	Neural mobilization
Chronic lumbar syndrome	Stabilization with axial elongation

Exercise Series

Arcs, Parallel, Legs Closed (Fig. 8.13) Closed leg position increases ease of symmetrical movement execution, and trains the inner stability of the leg axis. The leg lever facilitates the engagement of the trunk.

Arcs, Hip Width (Fig. 8.14) Hip width position of the legs highlights asymmetries and imbalances more clearly (legs, trunk).

Circles Outward/Inward (Fig. 8.15) The circling motion challenges core stability in all planes, and dynamic stabilization of the legs during abduction and rotation. The focus is on functional stability in an open chain.

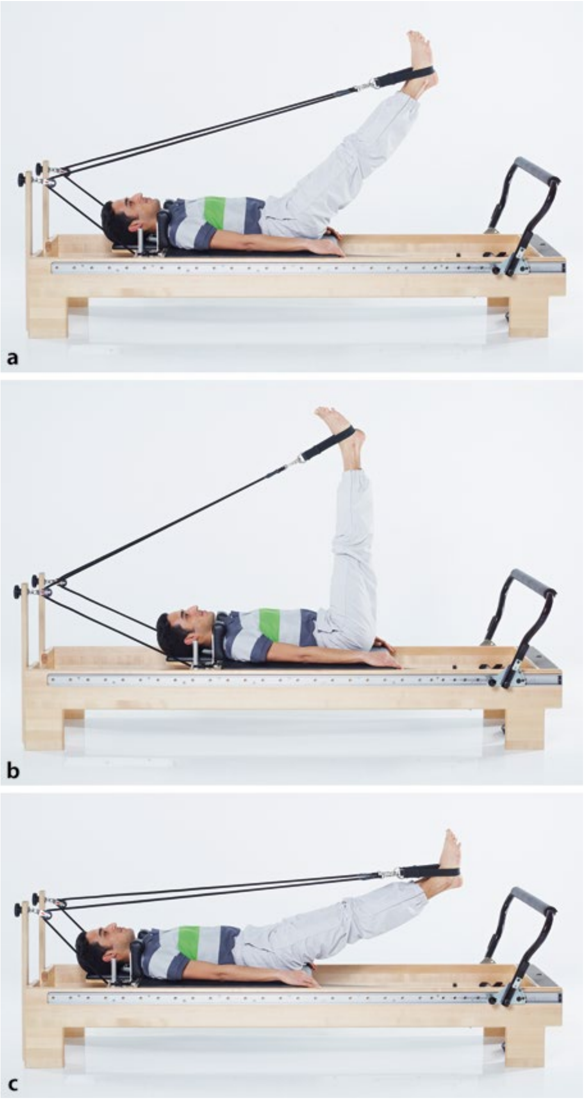


Fig. 8.13a–c Feet in Straps: Arcs, parallel, legs closed. **a** Starting position ca. 60°, **b** midway position ca. 90°, **c** transitional position ca. 20°

Fig. 8.14 Feet in Straps: Arcs, hip width. Starting position: Legs separated at varying widths

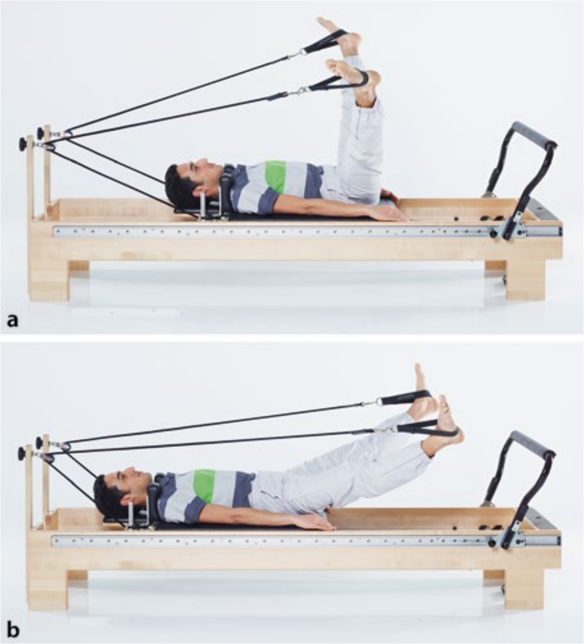


Fig. 8.15a,b Feet in Straps: Circles outward/inward. **a** Starting position, **b** smooth, circling motion in both directions

Walking on the Ceiling (◘ Fig. 8.16) This asymmetric leg movement challenges coordination and alternate stabilization of hip and knee motion; the knee movement is particularly challenging, demanding simultaneous stabilization during extension or flexion, coupled with rotation. Functional alignment of the leg axes must be actively maintained during all phases of movement (center of hip joint, patella and, second toe).

Neural Mobilization (◘ Fig. 8.17) This exercise mobilizes the neural structures. It is appropriate if there are signs of neural restriction (e.g., radiating pain) in the lower quadrant (pelvic and leg region), without acute symptoms (inflammation). The trunk is held in flexion, and movement of the legs creates distal sliding motions of the nerve tissue. The success of the exercise can be directly measured by a decrease in signs of neural restriction.

Faulty Movement Patterns

- Lack of axial elongation in the lumbar spine
- Insufficient connection of the pelvis to the legs
- Poor alignment in an open chain
- Movement restrictions in the lower limb
- Lack of active stability during the movement
- Dysfunctional transfer of movement to the trunk

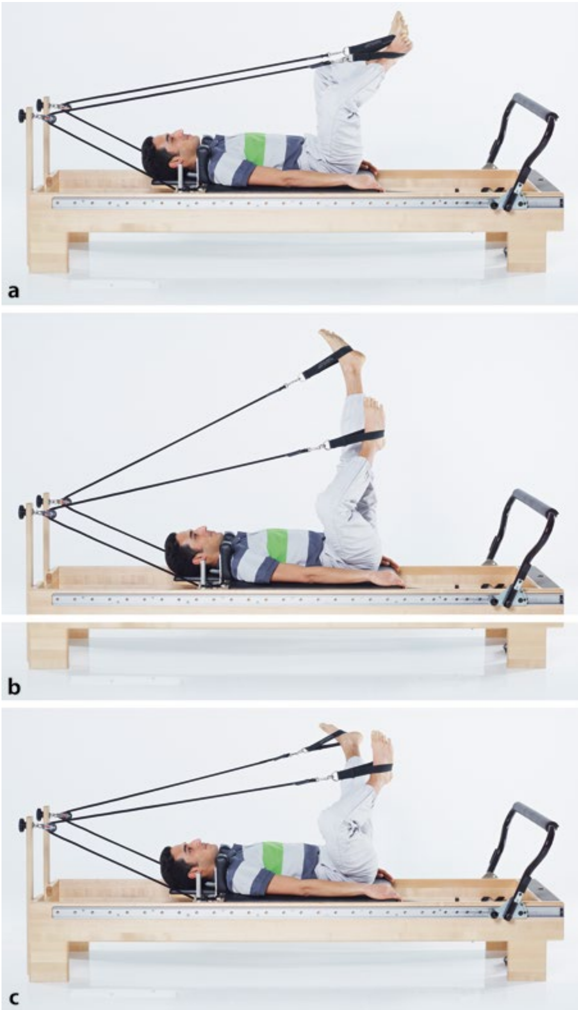


Fig. 8.16a–c Feet in Straps: Walking on the Ceiling. **a** Starting position: heels closed, **b** alignment: parallel, **c** alignment: abducted

Fig. 8.17a,b Feet in Straps: Neural Mobilization. **a** Starting position: legs and trunk converge, **b** furthermost position: legs and trunk distant

Arm Work

General

This exercise series focuses on the active integration of the arms on the trunk, and dynamic stabilization of the shoulder and surrounding joints. Maintaining legs in table top position challenges the active connection between trunk and legs; the activated starting position provides a significant training stimulus in itself. In cases of limited trunk strength, it is essential to observe whether the client is able to maintain stabilization of the lumbar spine for the duration of the exercise. It is also important to avoid exerting pressure forcefully through the hands, in order to facilitate more balanced muscle activation.

Indications

In the upper extremity, compression syndromes (Impingement, Carpal Tunnel Syndrome) and congruence disorders (instability) predominate. This series of exercises is appropriate for such conditions, for the following reasons:

- The open chain provides sufficient active stimulus without overstraining.
- The pull of the reformer's ropes provides resistance (eccentric) for the muscles which draw the arms downward, thereby relieving the most hypertonic and painful muscles, which lift the arms.
- The range of motion of the arms can be varied with arms positioned (one dimensionally) close to or (three-dimensionally) farther away from the body.

Table 8.3 lists indications and objectives for the exercise "Arm Work."

Table 8.3 Arm Work: indications and therapeutic objectives

Symptoms	Objectives
Impingement syndrome	– Opening up constricted spaces – Activating the muscles of decompression
Instability	– Dynamic stabilization, as specifically required
Carpal tunnel syndrome	Functional stabilization of the wrist joint – Improvement of circulation

Exercise Series

Arcs, Parallel (Fig. 8.18) In the sagittal plane, the anterior and posterior portions of the rotator cuff are strengthened, and momentum of the arms is transferred linearly to the trunk. The eccentric movement of the arms cranially, trains the connection of the shoulder blades caudally. The upper quadrant (thorax, neck, and arm region) is activated functionally as a stabilizer of the thoracic and cervical spine.

Circles Outward/Inward (Fig. 8.19) During the circling motion of the arm, the shoulder joint is supported muscularly, and dynamically stabilized three-dimensionally. Good intra- and intermuscular coordination of the connecting muscles of the arm to the trunk, and to the shoulder, is reflected in smooth sequences of movement. If capsuloligamentous stability is impaired, significant functional imbalances are discernible in the loss of stable fixation or alignment of the arm axis.

Tricep Press (Fig. 8.20) Through isometric stabilization of the trunk and the proximal portion of the upper limb, the exercise strengthens the weight-bearing function of the arms, and engagement of the trunk musculature in a neutral position. The radioulnar joint is functionally stabilized, through end range extension of the elbow joint with dorsal orientation of the palm. The wrists should be actively positioned in the center.

Lower Arm Circles (Fig. 8.21) In addition to the motion of the "Tricep Press" exercise, shoulder rotation (particularly external rotation) can be isolated and strengthened. Due to the positioning of the upper arms close to the trunk, the following potential errors need to be avoided:

- Compensatory movement of the thoracic spine into extension
- Loss of connection between ribs and pelvis

Faulty Movement Patterns

- Faulty organization of the shoulder/cervical spine area
- Insufficient active connection of the arm motion to the trunk (shoulder blades)
- Insufficient opening of the ventral structures (chest muscles, joints, sternum)
- Movement restrictions in the upper extremity
- Poor alignment in an open chain

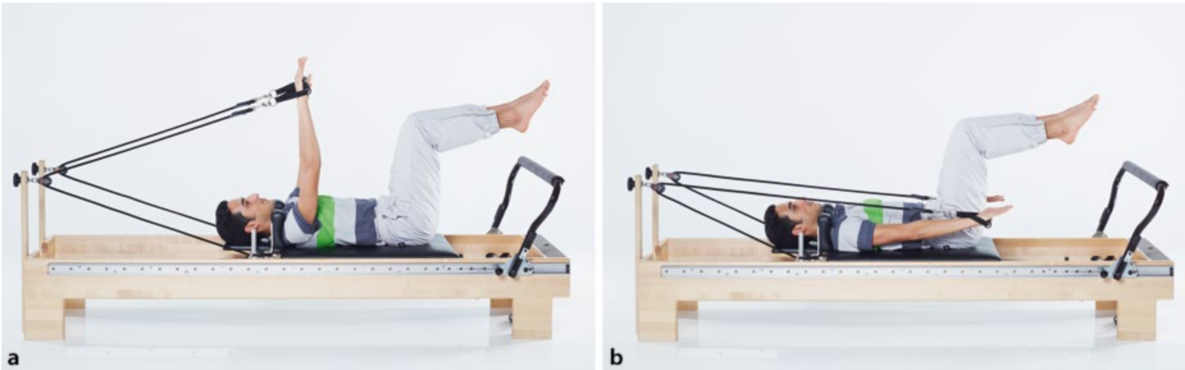


Fig. 8.18a,b Arm Work: Arcs, parallel. **a** Starting position, **b** midway position

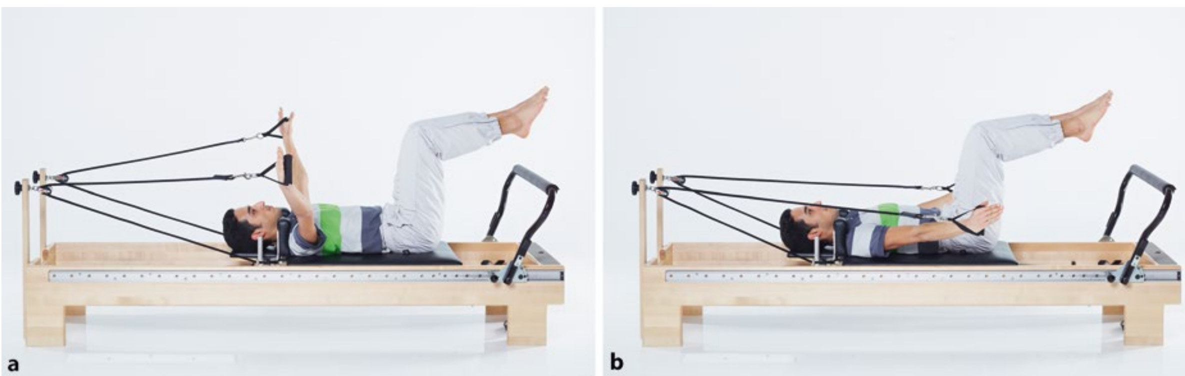


Fig. 8.19a,b Arm work: Circles outward/inward. **a** Starting position: arms slightly wider than shoulder, **b** midway position: arms down

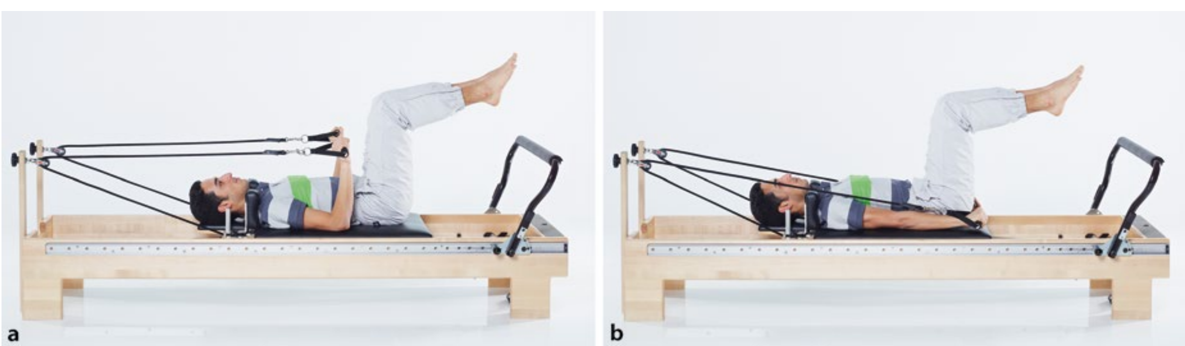


Fig. 8.20a,b Arm Work: Tricep Press. **a** Starting position: whole arm resting, **b** intermediate position: upper arm resting

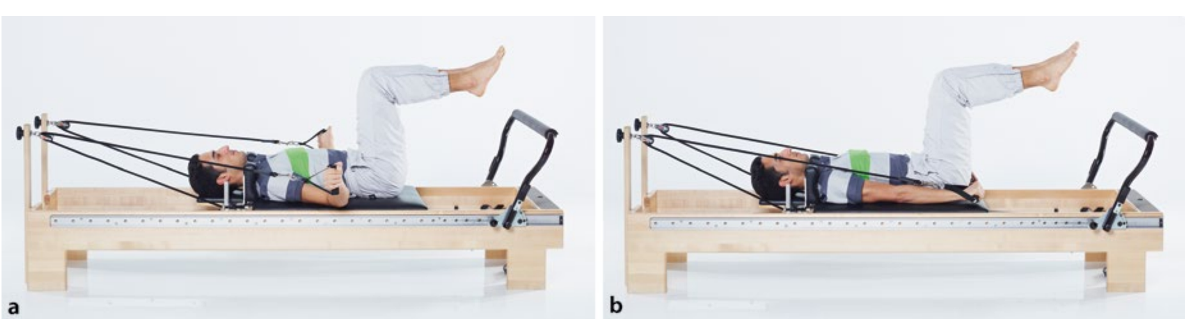


Fig. 8.21a,b Arm Work: Lower Arm Circles. **a** Starting position: external rotation, **b** intermediate position: neutral

Abdominals Supine

General

This series is far more challenging, due to the combination of spinal articulation (thoracic, cervical spine) and arm movement. Coordination, developing strength concentrically and eccentrically, stabilization of the head, and smooth motion are emphasized.

Indications

This exercise can be used to analyze and train the integration of movements initiated from the upper extremities, on to the trunk. Disorders may include blockages of the mid and upper thoracic spine, or weakness of the connecting musculature. Disorders of the atlanto-occipital joint (C0/C1), the cervicothoracic junction (CT junction), or an elevated diaphragm, can be improved effectively. The ventral pelvic/ rib connection is also activated, together with static integration of the weight of the legs (lumbar instability syndromes).

Table 8.4 lists indications and objectives for the exercise “Abdominals Supine.”

Table 8.4 Abdominals Supine: indications and therapeutic objectives

Symptoms	Objectives
Restrictions of thoracic spine, cervicothoracic junction in flexion	– Mobilization – Dynamic stabilization
Weak inner muscle system, muscle imbalances	– Muscular balance
Lower trunk instability	– Active stability
Poor arm-trunk coordination	– Improvement of functional coordination

Exercise Series

Preparation for Hundred (Fig. 8.22) Raising the upper body as far as the shoulder blades challenges the muscles connecting ribs and pelvis concentrically. Lowering the arms to a midway position places equal demand on the inner and outer muscle systems during the exercise. Maintaining the upper body in this position, and lowering down, requires slow, eccentric control. Focus should be placed on positioning of the head, as it leads the movement.

Hundred (Fig. 8.23) If the raised position of the upper body can be maintained and legs extended, lever length and endurance are increased. The repetitive striking movement of the arms also triggers a reflex, which challenges stability when combined with the breathing pattern. A variety of leg positions can create different demands.

Coordination (Fig. 8.24) This exercise emphasizes smooth performance of a complex sequence of movements, which alternate between stabilizing and dynamic elements. The trunk remains in a raised position, whilst the arms and legs move dynamically in the sagittal and transverse planes. Connection of the extremities to the trunk in a variety of positions, as well as alignment of the movement axes of both arms and legs, are practiced.

Faulty Movement Patterns

- Loss of a stable connection between head and trunk
- Faulty organization of the shoulder/cervical spine area
- Compression of the cervicothoracic junction
- Limited flexion of the cervical and thoracic spine
- Loss of axial elongation of the thoracic spine during movement
- Reduced opening of the ventral structures (chest muscles, joints, sternum)
- Inadequate connection between thorax and pelvis
- Poor body coordination

Fig. 8.22 Abdominals Supine: Hundred Preparation. Intermediate position: bent legs

Fig. 8.23 Hundred. Intermediate position: legs extended

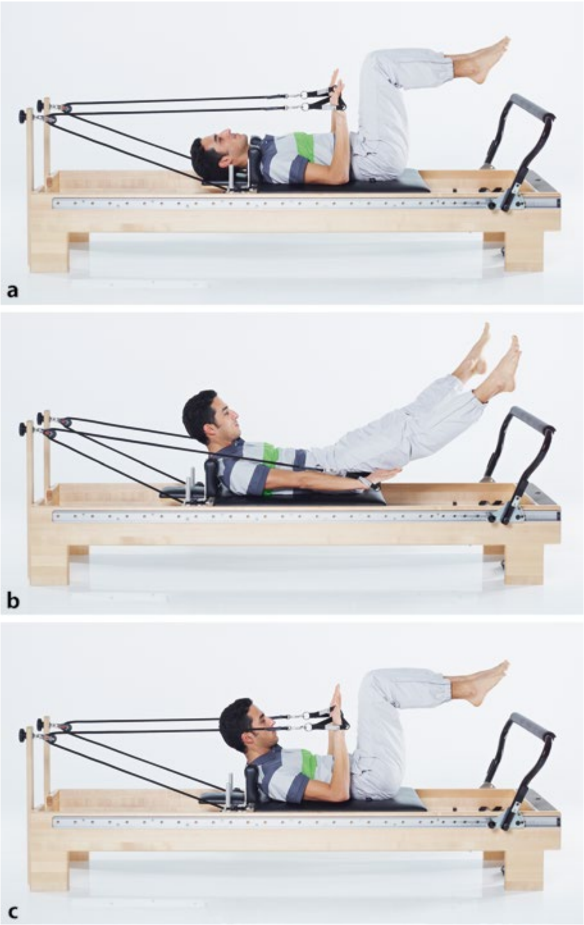


Fig. 8.24a–c Abdominals Supine: Coordination. **a** Starting position, **b** intermediate position: open legs briefly, **c** intermediate position: upper body stays lifted

Bridging/Leg Press

General

The exercise series "Bridging" brings together a number of different movements. Articulation of the lumbar spine into flexion with axial elongation reduces the base of support for alignment of the leg axes. The floating pelvis functions as a bridge between trunk and legs; the active leg lever providing additional support to functional organization. Straightening the legs requires full hip and knee extension to the end of range (no hyperextension). Even articulation of the lumbar- and lower to mid-thoracic spine, demands eccentric control of the local, stabilizing back muscles and even lengthening of the global stabilizers.

Indications

Most pathologies of the lumbopelvic hip complex have their roots in faulty articulation and stabilization. The **symptoms** can be generated by passive or active structures:

- In the case of hip, sacroiliac joint (SIJ), or lumbar spine degeneration, the passive structures are affected
- In the case of instability of SIJ, lumbar spine, knee or hip joints, primarily the active structures

The exercise series "Bridging/Leg Press" offers a variety of starting points for improvement of these disorders.

Table 8.5 lists indications and objectives for the exercise "Bridging/Leg Press."

Table 8.5 Bridging/Leg Press: Indications and therapeutic objectives

Pathologies	Goals
Chronic lumbar syndrome	– Dissociation of the hip joint/lumbar spine – Decompression – Articulation with axial elongation
Limited hip extension	– Mobilization
Functional instability	– Dynamic stabilization
SIJ issues	– Activate muscle systems of the pelvis
Pelvic floor issues	– Activation during movement

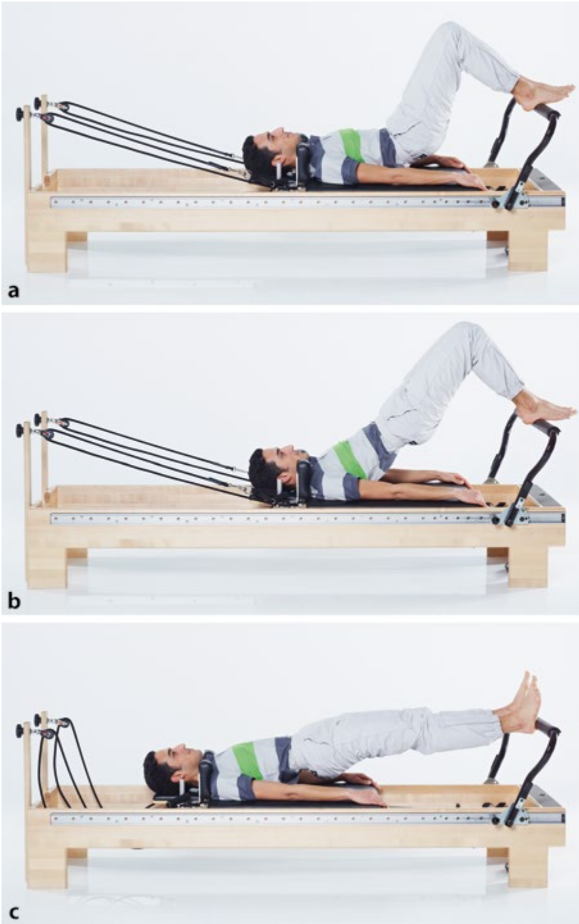
Exercise Series

Bridging – Double Leg (Fig. 8.25) During "Bridging / Leg Press" with both legs, the pelvis and lumbar spine are stabilized symmetrically in the sagittal plane. The reaction of all the stabilizing muscles of the pelvic girdle, leg axes and trunk is important. Light support from the arms and shoulder region allows the cervicothoracic junction to remain in the active neutral position.

Single Leg (Fig. 8.26) Performing the single leg version of the exercise opens the possibility of trunk rotation or lateral flexion. The supporting leg is challenged in a closed chain, whilst the free leg works in an open chain and stabilizes the movement. Any disbalances between the two halves of the body can be clearly observed.

Faulty Movement Patterns

- Movement restrictions in the lower extremities
- Poor alignment in the closed chain
- Lack of active stability during the movement
- Lack of axial elongation through the lumbar spine
- Dysfunctional transfer of movement to the trunk
- Poor body coordination



■ **Fig. 8.25a–c** Bridging – double leg. **a** Starting position: articulation, **b** Intermediate position, **c** leg extension

■ **Fig. 8.26a,b** Bridging – single leg. **a** Intermediate position: pelvis stabilized, **b** leg extended

Up Stretch Series

General

Standing on the carriage with hands in a supporting position on the footbar, closed chain activity is devolved to the arms. The alignment of the arm axes is challenged, and the demand for trunk control is greater, due the increase in lever length. The emphases for this exercise series are weight-bearing through the upper extremities, and trunk control, starting from a variety of positions..

Indications

The starting position of trunk flexion or neutral position is suitable for all patients, whose symptoms decrease or are relieved in this position. In the case of chronic spinal syndromes, limited flexibility and eccentric strength of the posterior muscle chains is common, coupled with a lack of ventral stability.

Weight-bearing through the arms in a flexed position increases the challenge for patients with poor integration of the arms on the trunk. In this position, the inner muscle system of the shoulder girdle is more strongly activated than the outer system.

Table 8.6 summarizes the indications and objectives for the exercise series "Up Stretch."

Table 8.6 Up Stretch series: indications and therapeutic objective

Symptoms	Goals
Chronic lumbar syndrome	– Decompression – Axial elongation – Ventral stabilization
Pseudoradicular symptoms	– Neural mobilization
Lumbar instability	– Dynamic stabilization
Functional instability of the shoulder girdle	– Stabilization

Exercise Series

Elephant (Fig. 8.27) The "Elephant" is performed with the spine aligned in flexion over a long arc. This posture results in trunk stabilization, and variable activation of the pelvic-leg connection, in addition to the leg axes. The dorsal leg and trunk structures are actively lengthened, whilst the trunk is stabilized in flexion. The effect on neural structures is reinforced by the dynamic leg movement, and the positioning of the head and cervical spine.

V-Stretch (Fig. 8.28) Ventral trunk stability and the supporting function of the arms are challenged, and the exercise results in intensive strengthening. The trunk remains stable to enable selective movement of the extremities, alternating hip flexion or extension, and shoulder flexion or neutral positioning of the shoulder. Working in a closed chain provides the advantage of increased stability, but also necessitates strong activation of dynamic tension to neutralize acting forces. The dorsal leg and trunk muscles are actively stretched.

Jack Rabbit (Fig. 8.29) To begin, remain in push up position and initiate dynamic leg movement. Alignment of the legs during flexion and extension movements requires stabilization, primarily in the sagittal plane. However, other potential movement patterns are made possible by the pseudo-open chain. The trunk serves as a stable anchor for movement of the legs.

Faulty Movement Patterns

- Faulty organization of the shoulder/cervical spine
- Loss of active movement stability
- Limited active connection of arm movement to the trunk (shoulder blades)
- Insufficient connection between thorax and pelvis
- Lack of axial elongation
- Poor alignment in the closed chain
- Lack of active stabilization during the movement
- Poor coordination in space
- Poor body coordination

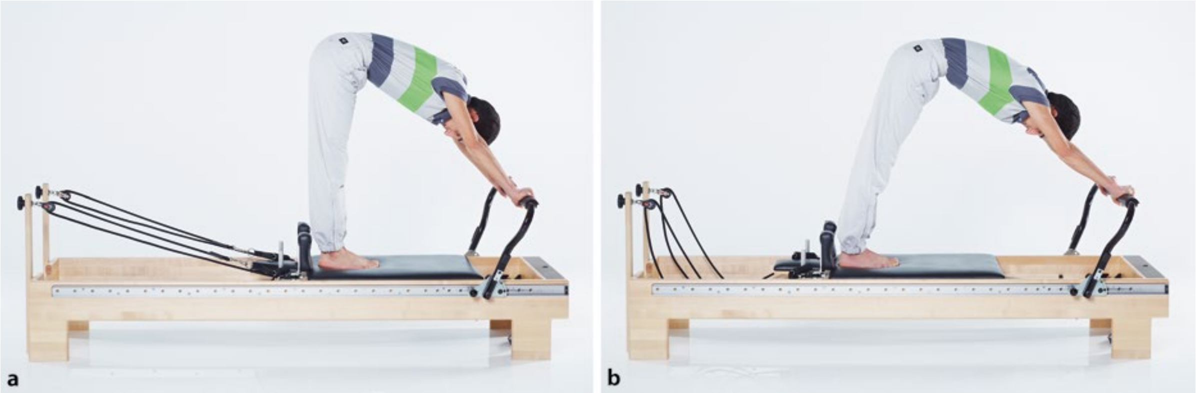


Fig. 8.27a,b Up Stretch series: Elephant. **a** Active starting position, **b** midway position: elongated flexion

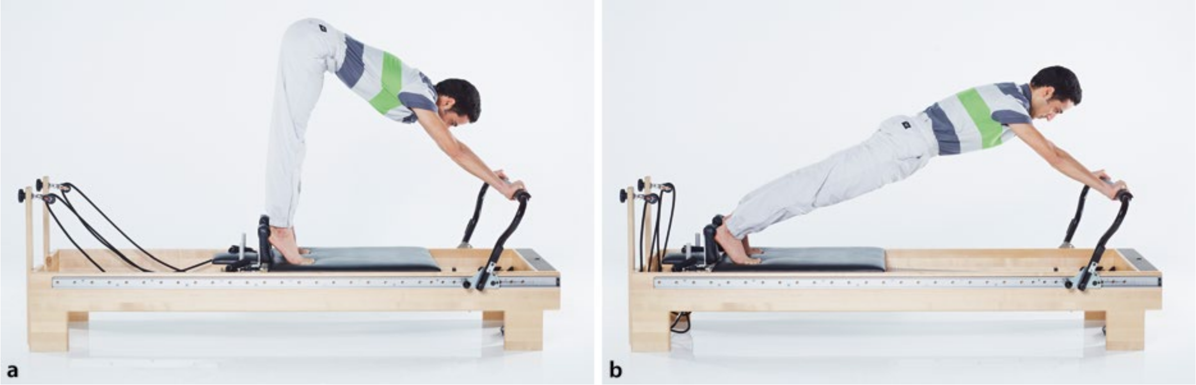


Fig. 8.28a,b Up Stretch series: V-Stretch. **a** Active starting position, **b** intermediate position: extended

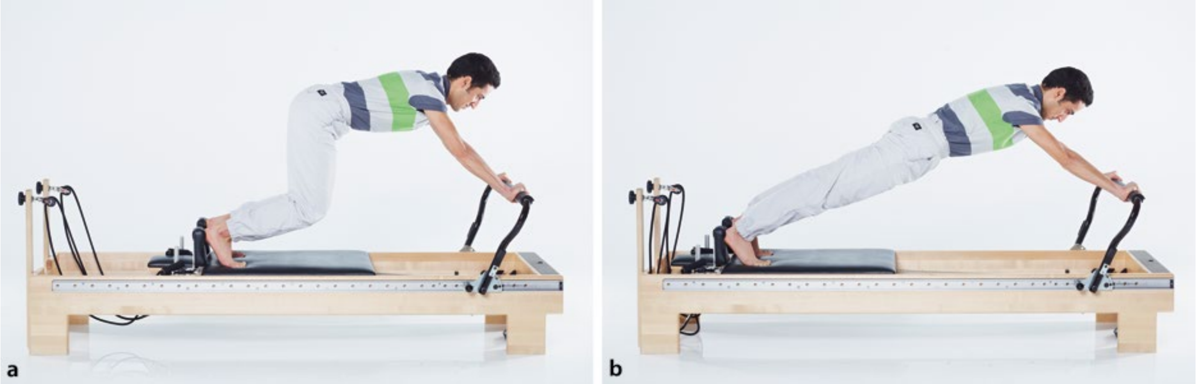


Fig. 8.29a,b Up Stretch series: Jack Rabbit. **a** Starting position: stabilized, **b** intermediate position: extended

Standing Hip Stretch

General

When standing alongside the reformer, the body experiences a new orientation in space, which has functional significance due to the contact with the ground. The standing leg is either assisted by the arms, or challenged in its organization due to the moving leg; the body must adapt to the changing demands for stabilization, whilst maintaining dynamic stability of the leg axis.

Indications

This series of exercises focuses on **misalignment of the leg axis**, often a result of the following syndromes:

- **Standing leg:** muscular insufficiency of the foot arch, valgus/varus misalignment of the knee joint, lack of lateral stability in the hip joint.
- **Moving leg:** Extension deficit at the hip or knee, and insufficient dynamic stabilization.

The angle of the trunk (leaning forward) trains the ability to maintain a physiological, neutral spine position.

Table 8.7 lists indications and objectives for the exercise "Standing Hip Stretch."

Table 8.7 Standing Hip Stretch: indications and therapeutic objectives

Symptoms	Objectives
Unstable knee and leg axes	Stabilization
Limited extension of the hip or knee joint	Mobilization
Chronic Spinal Syndrome	Functional orientation of the spine in space

Exercise Series

Both Arms Supporting (Fig. 8.30) Coupled with extension of the leg, partial weight-bearing through the arms generates dynamic tension in the moving leg. Bending the standing leg allows the trunk to be stabilized and brought into alignment with the moving leg. The exercise improves opening of the ventral hip structures, develops synergy of the deep abdominal and trunk muscles, and active alignment of both leg axes.

Standing Leg Straight (Fig. 8.31) The stretching component is increased by straightening the standing leg. The axial elongation of the spine in a neutral position must be maintained.

8

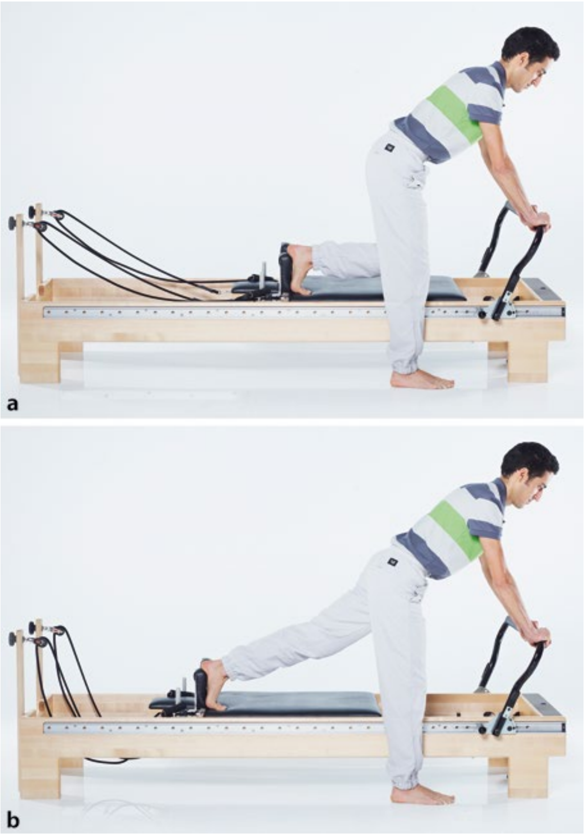


Fig. 8.30a,b Standing Hip Stretch: Both arms supporting. **a** Starting position, **b** Intermediate position

Fig. 8.31a,b Standing Hip Stretch: One arm supporting. **a** Starting position: increased length, **b** intermediate position: front leg extended

Scooter (Fig. 8.32) Removing the hands from the footbar opens the movement chain completely at the top. This increases the challenge to the standing leg and trunk, to absorb the transfer of forces arising from the dynamic motion of the moving leg.

Hands Behind the Body or Neck (Fig. 8.33) Depending on the positioning of the arms, more emphasis is placed on the organization of the upper or the lower body. In addition, altering the position of the arms activates the connecting muscles of the other lever; the trunk requires more static stabilization and the leg axis increased active control.

Arm Swings (Fig. 8.34) Swinging the arms produces a reflex engagement stimulus in all movement planes. In addition, the movement of the leg is assisted by the powerful forward swinging motion of the arm. The result is intensified axial elongation through the length of the body. Functionally, this exercise generates a stable trunk, as a basis for dynamic movement of the extremities.

Faulty Movement Patterns

- Poor alignment in the closed chain
- Lack of active stability during movement
- Lack of axial elongation
- Dysfunctional transfer of movement to the trunk
- Impairment in standing, balancing and reactive stability
- Poor body coordination
- Poor coordination in space

Fig. 8.32 Standing Hip Stretch: Scooter. Intermediate position

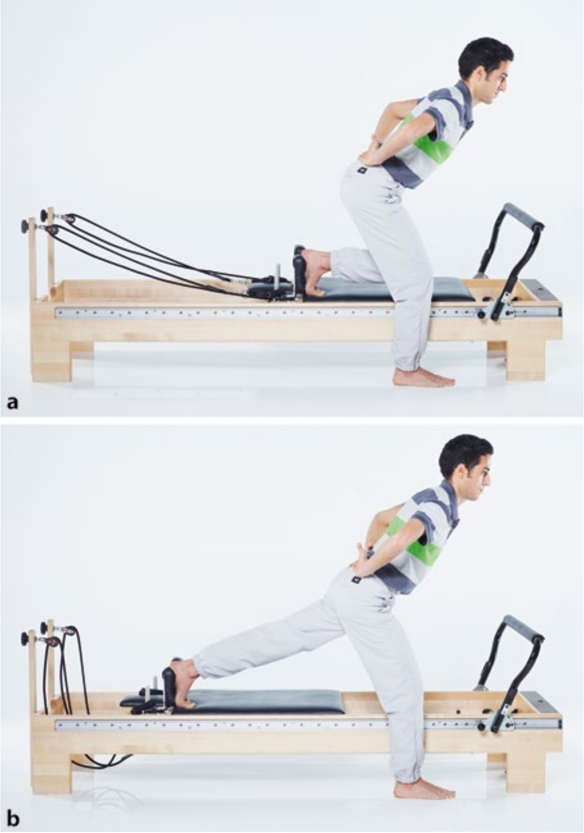


Fig. 8.33a,b Standing Hip Stretch: Hands behind the body or neck. a Starting position, b intermediate position

Fig. 8.34a,b Standing Hip Stretch: Arm Swings. a Intermediate position, b reciprocal swinging motion

Quadruped

General

When kneeling on all fours on the reformer, a bridging tension is generated through the trunk. The exercise differs from the version performed on the mat, as the moving surface of the carriage creates a pseudo-open chain, which can be advantageous for a variety of purposes. Weight-bearing through the arms requires simultaneous activation of both muscle systems of the shoulder girdle.

Indications

Some patients experience symptoms which have a negative impact on the supporting function of the arms. This exercise series will focus on establishing functional support, to alleviate compression pathologies. Patients with acute and subacute spinal conditions can also exercise in this basic position.

Table 8.8 lists indications and objectives for the exercise “Quadruped.”

Table 8.8 Quadruped: indications and therapeutic objectives

Symptoms	Objectives
Shoulder instability (subluxation)	Stabilization with support
Flat spine	Organization of the physiological position of the spine
Ventral / segmental instability	Strengthening of ventral / segmental muscle chains

Exercise Series

Facing Front (Fig. 8.35) The pushing away and controlled return motion of the carriage strengthens the shoulder flexors, both concentrically and eccentrically. In contrast, controlled extension takes place at the hip joint. A corresponding engagement of the trunk counteracts the movement of the legs; selective movement challenges coordination and dissociation.

Backward Correspondingly, pulling the carriage (with correct positioning of the trunk and a stable connection between the ribs and pelvis) emphasizes the flexor muscle chains of the trunk and hip.

Faulty Movement Patterns

- Insufficient connection of the pelvis and rib cage
- Poor alignment in the closed chain
- Loss of active stability during movement
- Lack of axial elongation
- Poor body coordination

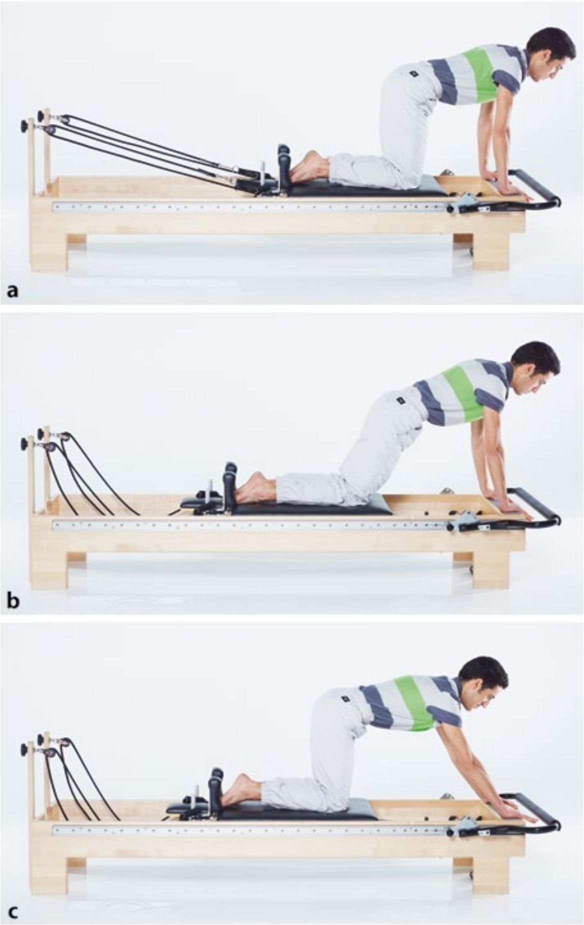


Fig. 8.35a–c Quadruped: Facing front. **a** Starting position, **b** intermediate position: hip movement, **c** intermediate position: shoulder movement

Side Splits

General

Standing on the Reformer in itself, provides a challenge to balance and stability. The objectives of this series are organization of the trunk and head, static or dynamic alignment of the leg axis, and the integration triggered by the unaccustomed alignment in space. Attention should be paid to the lever action of the hip adductors during larger movements, as these movements may cause pelvic instability.

Indications

Axial misalignments or movement restrictions, primarily in the frontal plane (ab-/adduction), but also the transverse plane, (rotation) become noticeable due to the orientation of the body on the Reformer. Disorders such as contractures or arthritis of the hip joint, poor stabilization of the pelvis during movement, or misalignments of the leg axis, can be addressed during this series. Balance and coordination can also be improved.

Table 8.9 summarizes indications and therapeutic objectives for the exercise "Side Splits."

Table 8.9 Side Splits: indications and therapeutic objectives

Symptoms	Objectives
Osteoarthritis at the hip joint	– Improved joint gliding – Circulation – Mobilization
Contractures of the hip muscles	– Concentric and eccentric training
Instability of the lumbopelvic-hip region	– Dynamic stabilization

Exercise Series

Leg Isolations (Fig. 8.36) Abduction in the frontal plane increases the strength and control of the medial and lateral muscle groups. Additional emphasis is placed on maintaining the center of gravity equally over the leg levers. The concentric phase of abduction demands an accompanying stabilization of the leg spiral. The longitudinal and transverse foot arches are actively connected to the carriage.

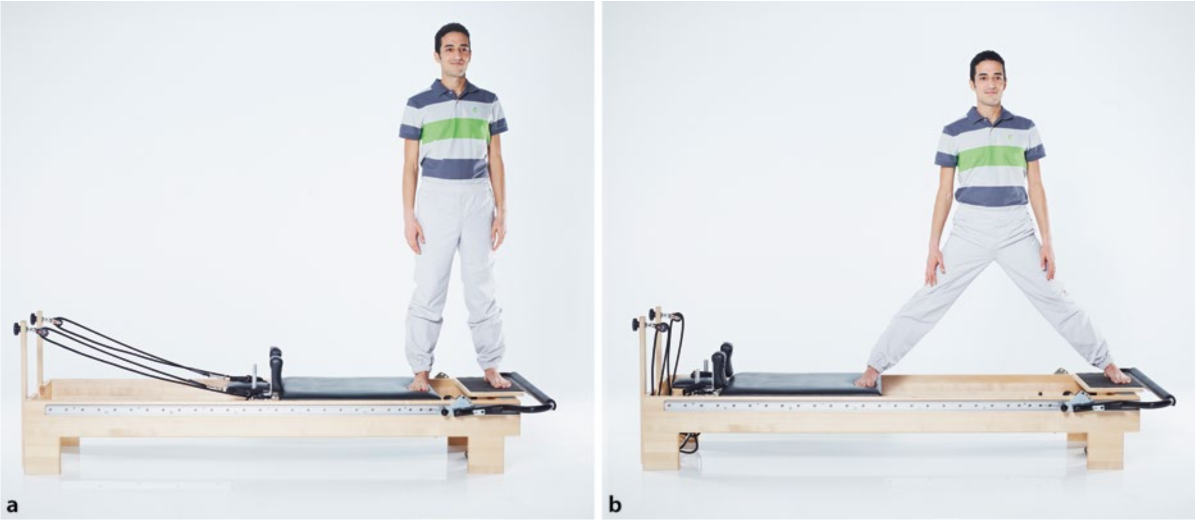
Legs and Arms (Fig. 8.37) Moving arms and legs simultaneously increases the challenge to coordination during the exercise. Moving the arms necessitates increased stabilization of the trunk. The inner muscle systems of the pelvis and shoulder girdle are engaged synergistically to support the movement.

Scooter Splits (Fig. 8.38) Leaning forward with the upper body increases the length of the lever acting on the legs. The increase in active trunk organization, coupled with the dynamic movement of one or both legs, represents a complex challenge for the patient. Constant dynamic stabilization of the leg axis is demanded throughout the exercise.

Rotation (Fig. 8.39) Adding rotation of the upper body increases the rotational component for the entire body. The leg that presses the carriage away from the foot plate, works in extension and external rotation. The moving leg performs eccentric, controlled flexion. Functionally, rotation of the thoracic and cervical spine is combined, with minimal rotation of the lumbar spine and pelvis.

Faulty Movement Patterns

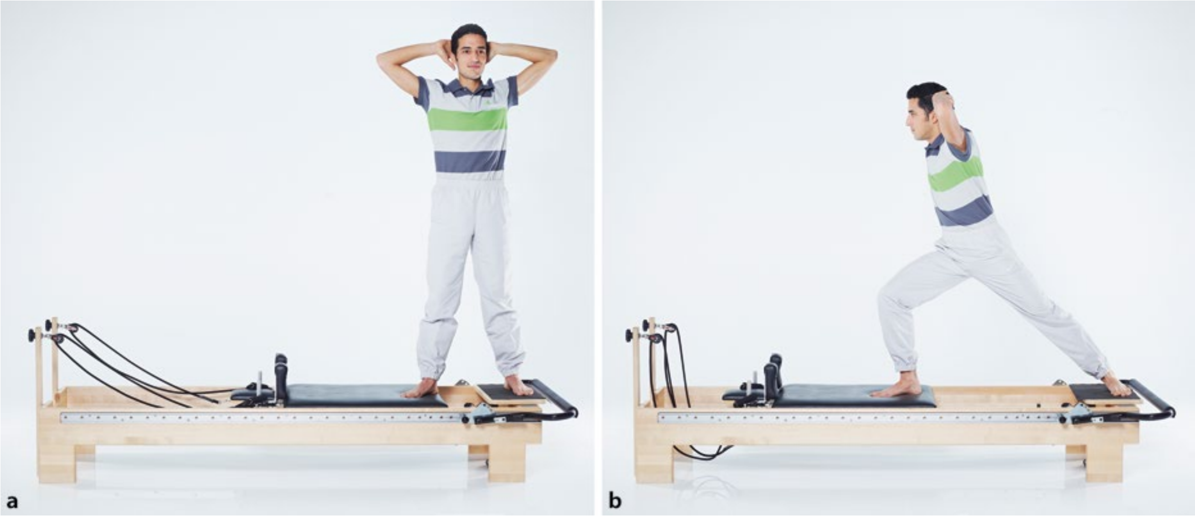
- Poor alignment in a closed chain
- Movement restrictions of the lower extremities
- Lack of active stability during the movement
- Dysfunctional transfer of movement to the trunk
- Impairment in standing, balancing and reactive stability
- Poor coordination in space
- Poor body coordination



■ **Fig. 8.36a,b** Side Splits: Leg isolations. **a** Active starting position, **b** midway position

■ **Fig. 8.37** Side Splits: Legs and arms. Intermediate position: stabilization in the frontal plane

■ **Fig. 8.38** Side Splits: Scooter Splits. Starting position: axial stability of the trunk and legs



■ **Fig. 8.39a,b** Side Splits: Rotation. **a** Starting position, **b** intermediate position: rotation

8.2.2 Cadillac

■ Roll Down Series

■■ General

The ability to dynamically stabilize the spine during flexion is essential for both spinal function and health. This exercise focuses on even spinal articulation with axial elongation in an assisted form, as well as connection of the movement to an engaged shoulder girdle.

■■ Indications

An inability to actively articulate the spine from sitting to the supine position and vice versa, adversely affects everyday movement. Painful, blocked spinal segments, or subacute disc pathologies, require assistance during articulation, to facilitate triggering of the local segmental stabilizers. Axial elongation plays a vital role during spinal flexion.

Table 8.10 lists indications and objectives for the "Roll Down" series.

Table 8.10 Roll Down series: indications and therapeutic objectives

Symptoms	Objectives
Blockages motion segments in thoracic / lumbar spine	– Mobilization – Dynamic Stabilization
Status following prolapse surgery	Phase 3: – Supported articulation – Local stabilization in flexion
Lumbar instability	– Stabilization

■■ Exercise Series

Legs Straight or Legs Bent (Fig. 8.40) The exercise is initiated in the sagittal plane, by transferring weight to the back, with slight extension at the hip joint. The eccentric activation of the hip muscles is accompanied by strong connection of the anterior, lateral and posterior trunk muscles. The head and shoulders should be appropriately positioned in space throughout the movement.

Rotation (Fig. 8.41) Beginning the movement with added rotation of the upper body on a stabilized pelvis and hip area increases the functionality of the exercise. Combining rotation with flexion teaches a motion which reduces stress on the passive structures of the spine. In conjunction with axial elongation, the rotational muscle corset is strengthened.

■ Breathing

■■ General

Articulation of the spine in an unloaded position can be practiced, together with breathing. With legs extended, active eccentric lengthening of the dorsal leg muscles and trunk muscles is trained synergistically. The shoulder girdle and arms facilitate a deep connection between the trunk, spine and pelvis.

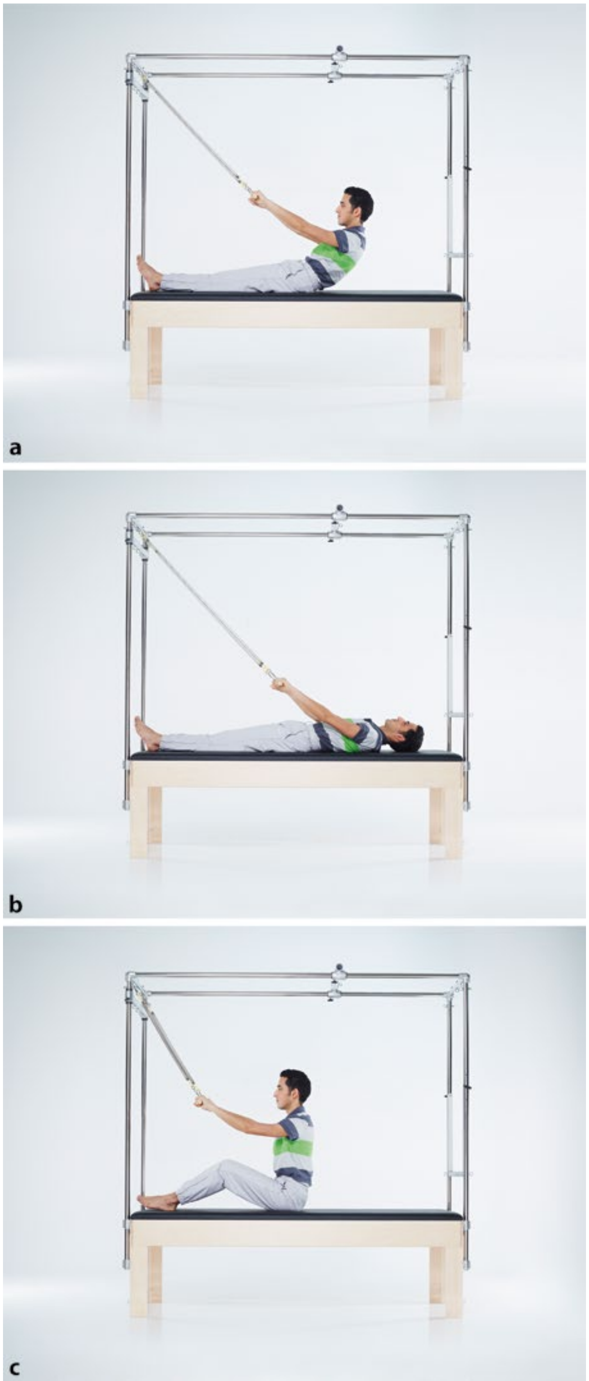


Fig. 8.40a–c Roll Down series: Legs straight or legs bent. **a** Starting position, **b** midways position: supine, **c** variation: legs bent

Fig. 8.41a,b Roll Down series: Rotation. **a** Starting position: rotation left, **b** intermediate position

Exercise Series

Up and Down (Fig. 8.42) In the dynamic phase of the exercise, the effective lever is evenly activated by means of articulation, the pulling motion of the arms, and deep respiration. The objective is to diagonally align all sections of the body during the concentric phase of the exercise, and then to maintain length and openness during the controlled return motion. The breath plays a supportive role.

Arms (Fig. 8.43) Maintaining the body on a diagonal, arm movement can be added; firstly, to add stability to the position, and secondly, to broaden the upper body. The alignment of the upper extremities as well as positioning of the head and shoulders are trained.

Faulty Movement Patterns

- Limited mobility in physiological flexion
- Loss of active stability during movements
- Lack of axial elongation

Fig. 8.42a,b Breathing: Up and Down. **a** Starting position, **b** intermediate position: pelvis lifted

Fig. 8.43a,b Breathing: Arms. **a** Starting position, **b** intermediate position: stable trunk

Push Through

General

The Tower Bar on the Cadillac is used during this series, to guide and support the upper body and spine during pseudo-open chain movement. During this exercise, the forces from the muscle and joint chains of the upper body must be integrated, along with opposing forces created by the positioning and connection of the pelvis and legs.

Indications

A disturbance in the flow of movement through the different sections of the spine and adjoining limbs is typical of many conditions. Guiding movement through the arms allows extension deficits caused by thoracic/cervical spine syndromes, as well as movement restrictions of the shoulder joint, to be addressed. By sitting and standing in front of the Cadillac, the series can be adapted for patients with chronic symptoms in the lumbar spine and /or shortening of the posterior leg muscles.

Table 8.11 summarizes indications and objectives for the exercise "Push Through."

Table 8.11 Push Through: indications and therapeutic objectives

Symptoms	Objectives
Thoracic kyphosis or blocked motion segments in the thoracic spine	– Mobilization – Articulation – Dynamic stabilization
Shoulder-arm syndrome	– Organization of the cervical spine/shoulder area
Frozen shoulder	– Assistive mobilization
Flat spine	– Active articulation
Chronic lumbar syndrome	– Dissociation – Mobilization

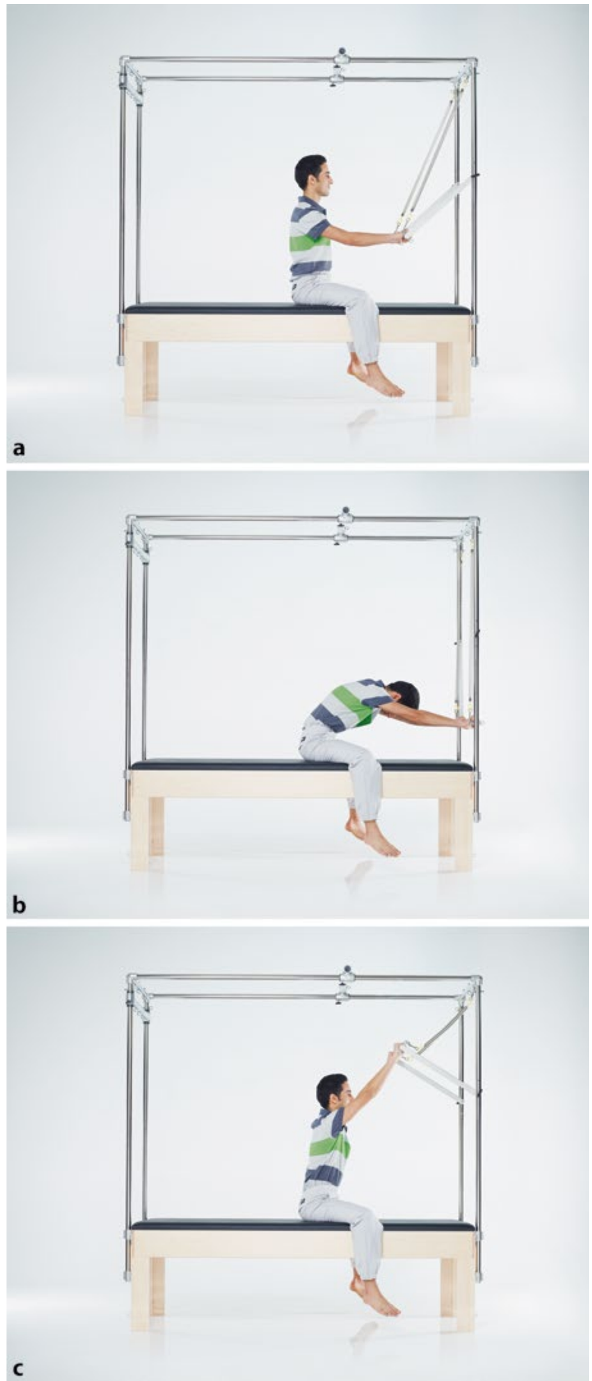
Exercise Series

Sitting in Front of Cadillac (Sagittal/Transversal, Fig. 8.44) In this starting position, the lever length of the legs is reduced. The focus of the movement is well- organized motion of the thoracic spine into flexion and/or rotation, with a stable pelvis. The inner and outer muscle systems of the shoulder girdle ensure congruence and stability of the shoulder joints.

Sitting on Cadillac/Riding (Sagittal/Transversal, Fig. 8.45) The sitting position requires pre-stretching of the hip abductor muscles and increases mobility in this area during practice. Restrictions in the hip and pelvic area may therefore limit range of motion during the exercise.

8

■ **Fig. 8.44a–c** Push Through series: Sitting in Front of Cadillac. **a** Starting position, **b** intermediate position: elongated flexion, **c** intermediate position: extended



■ **Fig. 8.45a–c** Push Through series: Sitting on Cadillac/Riding. **a** Starting position, **b** intermediate position: elongated flexion, **c** intermediate position: extended

Sitting on Cadillac: Bent/Straight Legs (Sagittal / Circumduction, Fig. 8.46) The dorsal leg muscles are stretched during this exercise; selective movement and dissociation from the pelvis are required. Releasing one arm through a three-dimensionally open movement in space leads the spine into flexion, rotation and side bending and demands dynamic tension, in order to stabilize the movement.

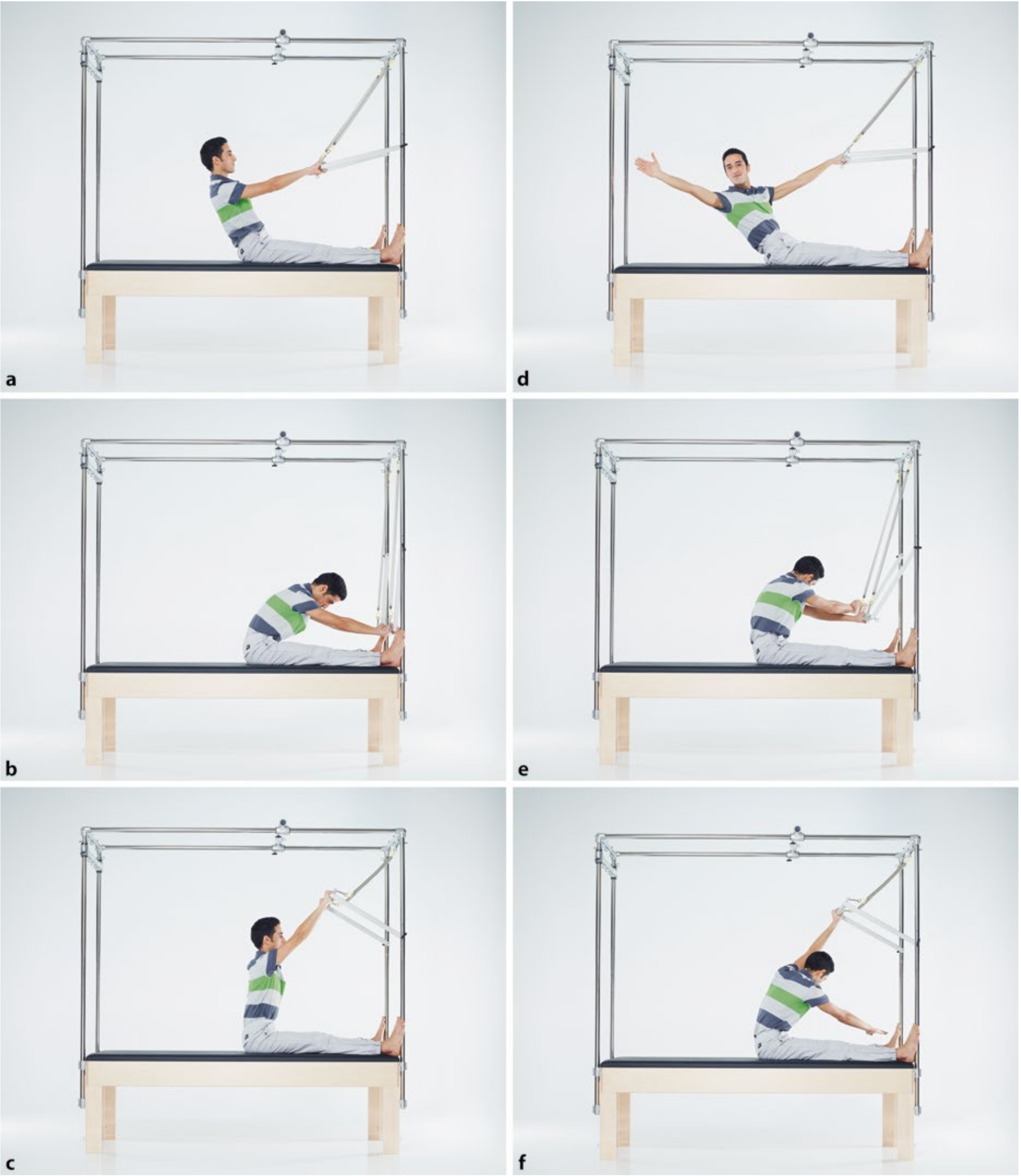


Fig. 8.46a–f Push Through series: Sitting on Cadillac (bent / straight legs). **a** Starting position, **b** intermediate position: elongated flexion, **c** intermediate position: extended, **d** intermediate position: extension / rotation, **e** intermediate position: high flexion / rotation, **f** Intermediate position: low flexion / rotation

Standing in Front of Cadillac (Sagittal/Transversal, Fig. 8.47) The standing position challenges weight-bearing through the lower extremities, and full proprioception. The pseudo-open chain created by the Tower Bar enhances the dynamic character of the upper body movement, which takes place on the stable foundation of pelvis and legs.

Faulty Movement Patterns

- Loss of a stable connection between head and trunk
- Incorrect organization of shoulder/cervical spine area
- Compression of the cervicothoracic junction
- Loss of active stability during movements
- Insufficient active connection of arm movement to the trunk (shoulder blades)
- Lack of axial elongation
- Movement restriction of the upper extremity

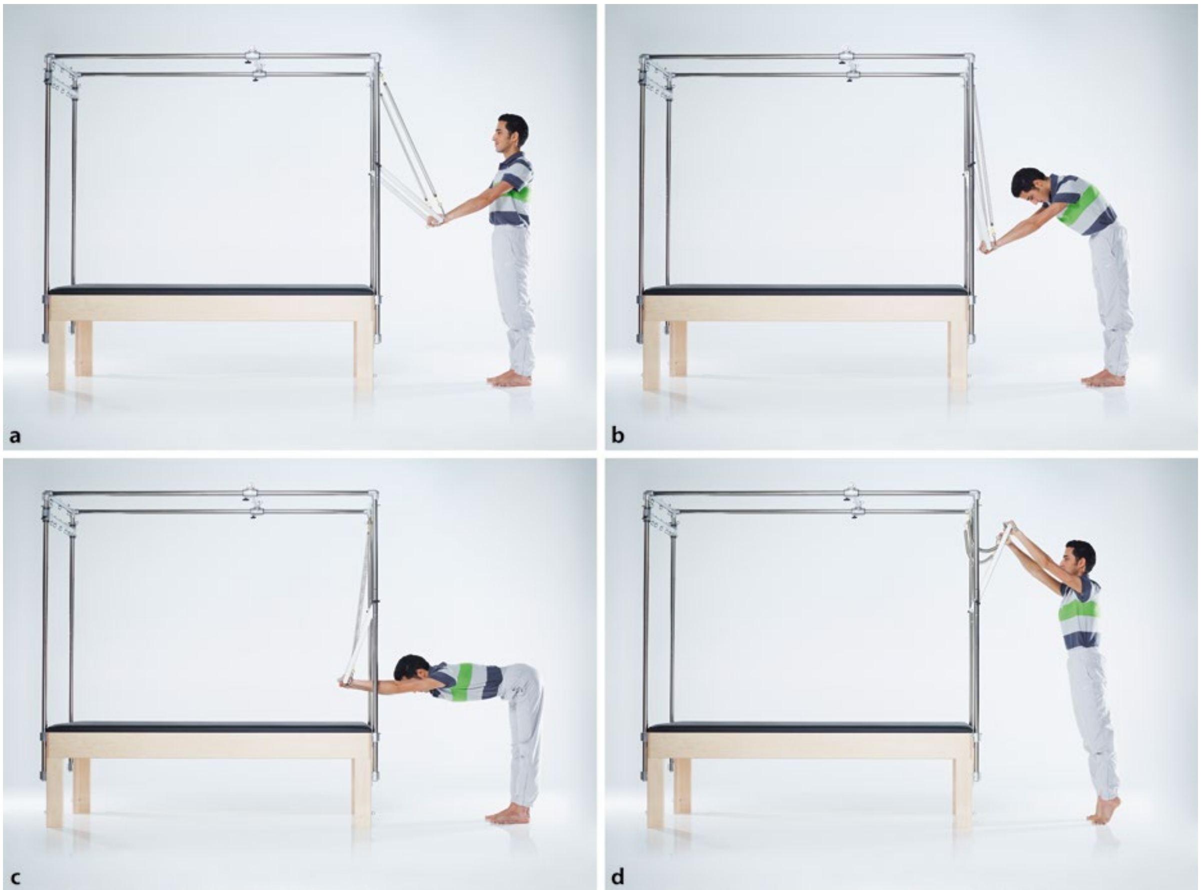


Fig. 8.47a–d Push Through series: Standing in front of Cadillac. **a** Starting position, **b** intermediate position: elongated flexion, **c** intermediate position: extended, **d** intermediate position: stand on tiptoes

Shoulders with Tower Bar

General

The connection of the shoulder girdle to the upper body and cervical spine is of key significance in avoiding functional disorders in this region. During this exercise, the Tower Bar is used to create dynamic congruence. The joint of the upper arm bone and the shoulder socket, as well as the adjoining smaller joints of the shoulder girdle (acromioclavicular and sternoclavicular) can be positioned correctly and supported by the musculature.

Indications

Disturbances to scapulothoracic rhythm lead to overloading, which may cause impingement syndromes, a bursitis or instability. The muscles in the region may also be subject to disorder as a result of disbalances, inhibition or reflexogenic causes. In addition, blocked motion segments of the spine, contractures of the chest muscles and nerve irritation, may disturb balance.

Table 8.12 lists indications and objectives for the exercise “Shoulders with Tower Bar.”

Table 8.12 Shoulders with Tower Bar: indications and therapeutic objectives

Pathologies	Objectives
Cervicobrachialgia	Balanced scapulothoracic movement
Contracture of the shoulder joint	Motion pathways of the glenohumeral joint
Pseudoradicular symptoms	Release and mobilization of restrictions

Exercise Series

Pro-/Retraction (Fig. 8.48) Assisted pro-and retraction against resistance trains the stabilizing dorsal muscle chain of the shoulder girdle. The neutral position of the spine remains unchanged.

Arcs (Fig. 8.49) The goal of the exercise is movement of the arms in the sagittal plane, with the upper body still and partially relieved of the weight of the arms. The space-opening and stabilizing components of the glenohumeral joint, and the scapulothoracic rhythm, are emphasized.

Fig. 8.49a,b Shoulders with Tower Bar**:** Arcs. **a** Intermediate position: arms parallel, **b** intermediate position: arms overhead

Fig. 8.48a–c Shoulders with Tower Bar**:** Pro-/Retraction. **a** Starting position, **b** intermediate position: protraction, **c** intermediate position: retraction

Chest Lift (Fig. 8.50) Raising the upper body trains the dorsal and ventral connections between ribs and pelvis. In the sitting position, it results in articulation of the spine into flexion, and upright upper body posture with the arms raised. Simultaneously, the shoulder joints are guided to end of range elevation, without loss of organization in the shoulder and neck area.

Neuromobilization (Fig. 8.51) Moving the head and the upper body away from each other creates a mobilizing movement in the upper quadrant (thorax / neck / arm region). Rolling onto one side and back intensifies the effect.

Faulty Movement Patterns

- Movement restrictions of the upper extremity
- Poor alignment in the open chain
- Poor body coordination
- Incorrect organization of the shoulder and neck

Fig. 8.50a,b Shoulders with Tower Bar: Chest Lift. **a** Starting position, **b** intermediate position: upper body raised

Fig. 8.51a,b Shoulders with Tower Bar: Neuromobilization. **a** Starting position, **b** intermediate position: m

8.2.3 Chair

Swan Series

General

This exercise facilitates guided, assisted extension and rotation of the trunk. The pedal of the Chair functions as a support for the upper body, whilst the forces generated by the pedal are transferred through aligned arms.

Indications

This series may be used with patients who have limited extension and rotation in the thoracic spine. Disbalances between the inner and outer muscle systems of the shoulder girdle become apparent and can be retrained. Any ventral instability of the lumbar spine can be improved in various planes of movement.

Table 8.13 lists indications and objectives for the "Swan" series.

Table 8.13 Swan series: indications and therapeutic objectives

Symptoms	Objectives
Protracted shoulders	– Mobilization – Stretching
Swayback	– Assisted articulation – Dynamic stabilization
Chronic spinal syndrome	– Dissociation – Decompression

Exercise Series

Shoulders (Fig. 8.52) At the beginning of the series, the active connection of the shoulder blades to the trunk can be practiced. Supported retraction and protraction against resistance emphasizes strengthening of the inner muscle system of the shoulder girdle. To facilitate even activation of both muscle systems, differing levels of resistance may be used.

Swan Dive (Fig. 8.53) Maintaining congruence in the shoulder joint, motion is transmitted to the thoracic and the lumbar spine. Alignment and positioning of the arms remain unchanged, and the force of movement is transferred through the arms to the spine. The exercise focuses on organization of the head, neck and shoulders, the transfer of forces and dynamic stability during spinal extension.

With the trunk stabilized and isolated movement of the arms at the elbow (flexion and extension), increased control and axial elongation can be developed.

Fig. 8.52 Swan series: Shoulders. Upper body stabilized, isolated movement of shoulder blades

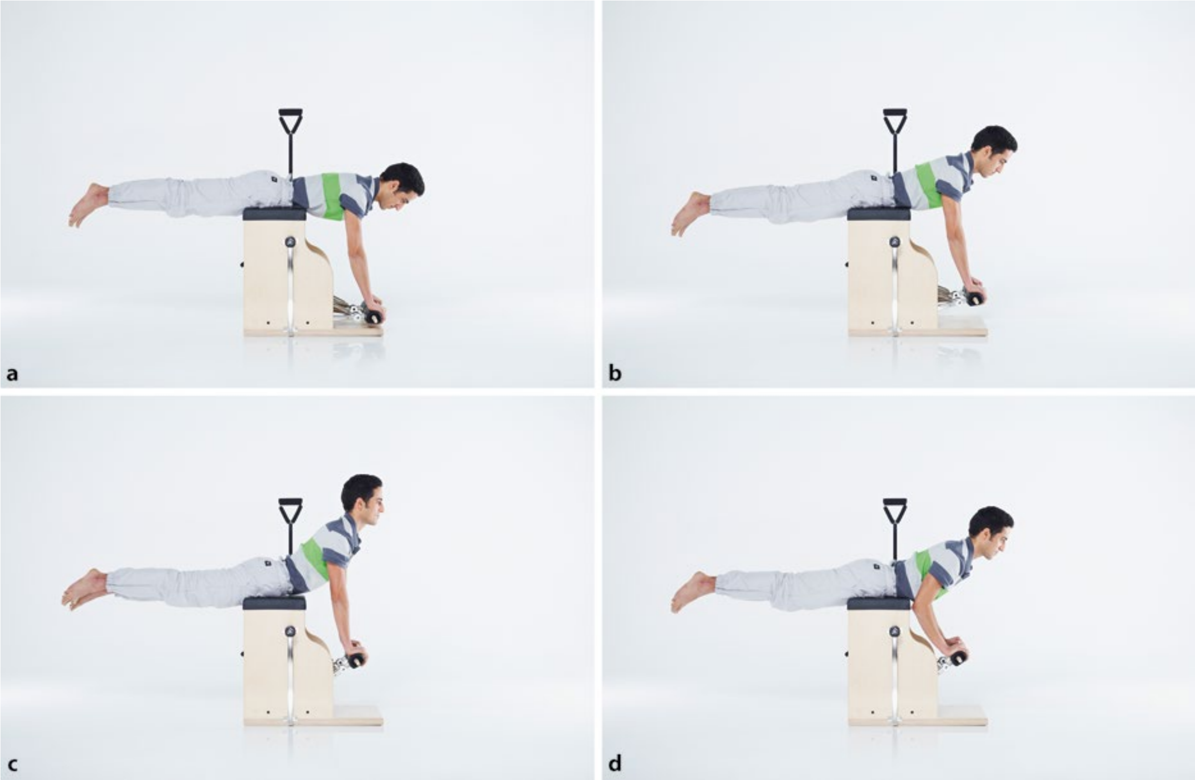


Fig. 8.53a–d Swan series: Swan Dive. **a** Starting position, **b** intermediate position: slight extension, **c** intermediate position: stable, elongated extension, **d** intermediate position: isolated arm movement

Arms/Rotation (Fig. 8.54) With the pedal split into two parts, the demand for coordination and stabilization during the movement is increased. The additional rotation can be used to mobilize the thoracic spine in rotation, or to stabilize dynamically in rotation. Increased stability of the lumbar spine in axial elongation is required, as well as organization of the head, cervical spine and shoulder area during the movement.

Reverse Swan (Fig. 8.55) Due to the altered position of the body in relation to gravity, emphasis shifts to strengthening of the anterior portion of the trunk. The anterior shoulder muscles are pre-stretched, due to the position of the hands on the pedal; whilst stability of the lumbopelvic region is maintained, the upper body is used as a lever. The thoracic spine moves into extension and returns to slight flexion, whilst preserving a stable connection between thorax and pelvis, and open, well-organized shoulders.

Side Arm Twist (Fig. 8.56) Raising one arm toward the ceiling initiates spinal rotation. The actively rotating trunk must be stabilized dynamically, in order to strengthen the diagonal trunk muscle chains more effectively. Due to the position of the body in space, the cervical spine must be functionally stabilized.

Faulty Movement Patterns

- Poor organization of the neck and shoulder area
- Limited physiological rotation
- Limited physiological extension
- Loss of active stability during the movement
- Insufficient active integration of arm movement onto the trunk (shoulder blades)
- Inadequate connection between rib cage and pelvis
- Lack of axial elongation

Fig. 8.54a,b Swan series: Arms/Rotation. **a** Intermediate position: rotation left, **b** intermediate position: rotation right

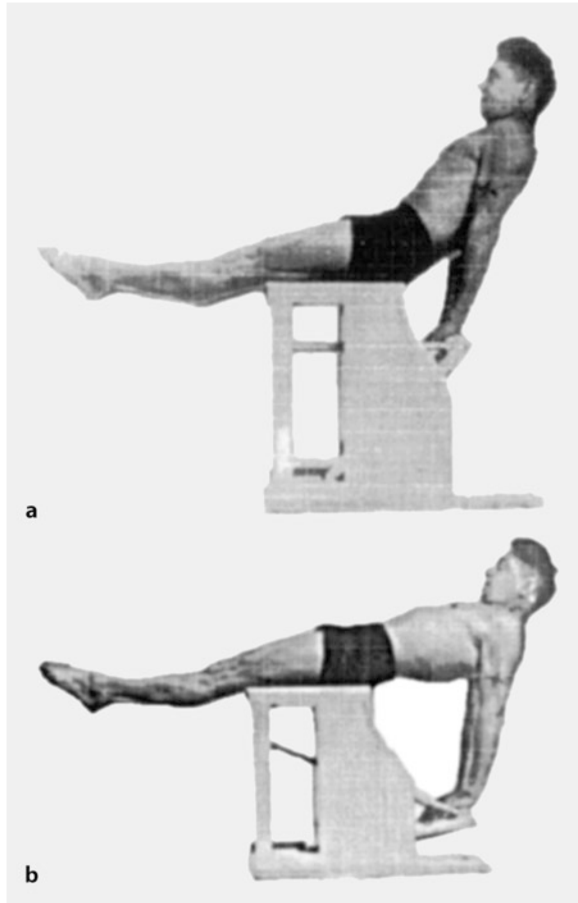


Fig. 8.55a,b Swan series: Reverse Swan. **a** Starting position, **b** end position

Fig. 8.56 Swan series: Side Arm Twist

Hamstring I

General

From a mechanical perspective, forward bending from a standing position is a significant challenge and strain. However, it is a vital component of everyday movement, and should therefore be actively and efficiently organized. Learning to actively elongate the dorsal muscle chains eccentrically is immediately beneficial. In addition, the sections of the spine involved in the movement must also be dynamically stabilized.

Indications

In cases of degenerative change, training everyday movement patterns is essential. Whether symptoms arise in the lower extremity or the trunk itself, the pivot and fulcrum points of continued movement are found in the lumbar spine and SIJ.

8

Warning

If acute symptoms are present (acute prolapse, rehabilitation phases I and II), trunk flexion with a long lever is contraindicated! In rehabilitation phases III or IV, trunk flexion with a long lever can be integrated, for mobilization and stabilization.

Table 8.14 summarizes indications and objectives the exercise "Hamstring I."

Table 8.14 Hamstring I: indications and therapeutic objectives

Symptoms	Objectives
Degenerative spinal syndrome	Decompression, dynamic stabilization
Spondylolisthesis	Assisted articulation
Flat spine	Organization
Contractures of the posterior leg musculature	Mobilization

Exercise Series

Kneeling (Fig. 8.57) Beginning the exercise in a kneeling position places the emphasis on the thoracic spine and the organization of the head, cervical spine and shoulder girdle. If the center of gravity does not shift, moving the upper body forward with the guiding resistance of the pedal creates dynamic stabilization. Placing the hands at one end of the pedal facilitates rotation combined with flexion.

Standing (Fig. 8.58) In standing the lever is lengthened, and the more distal sections of the body must perform a stabilizing function. The knee and ankle joints must be stabilized in the sagittal plane, and placing the hands at one end of the pedal facilitates rotation combined with flexion. The deep abdominal and trunk muscles must stabilize the trunk against the acting forces.

Faulty Movement Patterns

- Lack of axial elongation
- Limited flexion
- Insufficient connection between thorax and pelvis
- Loss of active stability during the movement
- Poor alignment in a closed chain

Fig. 8.57a–c Hamstring Kneeling. **a** Starting position, **b** intermediate position: slight flexion, **c** flexion

Fig. 8.58a,b Hamstring standing. **a** Intermediate position: slight flexion, **b** intermediate position: elongated flexion

Leg Pump

General

Upright posture when standing or sitting can be practiced in this series. Improved weight-bearing through the standing leg, and mobilizing elements of the moving leg can are emphasized. Balance and proprioception are challenged throughout the body.

Indications

Deviations from axial alignment of the foot, knee and hip can be treated in a stable position.

One of the most prevalent everyday postures, sitting plays an important role in rehabilitation following disc problems and chronic degenerative diseases, and the upright standing position is vital for disorders of the entire musculoskeletal system. Neurological disorders can also be addressed.

8

Table 8.15 lists indications and objectives for the exercise "Leg Pump."

Table 8.15 Leg Pump: indications and therapeutic objectives

Symptoms	Objectives
Instability of the hip, knee or ankle joints	Dynamic stabilization, alignment
Poor posture in sitting/standing	Conscious correction, stabilization
Muscle disbalances in the standing/moving leg	Alignment, stability, dissociation
Vestibular disorders, loss of equilibrium	Training of the peripheral and central systems

Exercise Series

A-sitting (Fig. 8.59) The handles can be used initially to provide light support when sitting. The dynamic movement of the legs produces a stabilizing response in the trunk; the leg axis must be aligned during pseudo-open chain movement. The position of the arms can be adjusted, to change the emphasis of organization.

Standing (Fig. 8.60) In standing, the supporting leg is trained in a closed chain and the moving leg is trained in a pseudo closed chain. As the leg moves downward, active axial elongation of the trunk in the opposing direction occurs. The pelvis actively counterbalances the standing leg and the moving leg. Altering the position of the arms changes the center of gravity and activation; the difficulty of the exercise can be increases by changing the standing surface (mat, balance pad etc.).

Faulty Movement Patterns

- Poor alignment in a closed chain
- Lack of axial elongation
- Loss of active stability during the movement
- Loss of the stable connection between head and trunk
- Dysfunctional transfer of forces to the trunk
- Impaired standing, balance and reactive stability
- Poor coordination in space

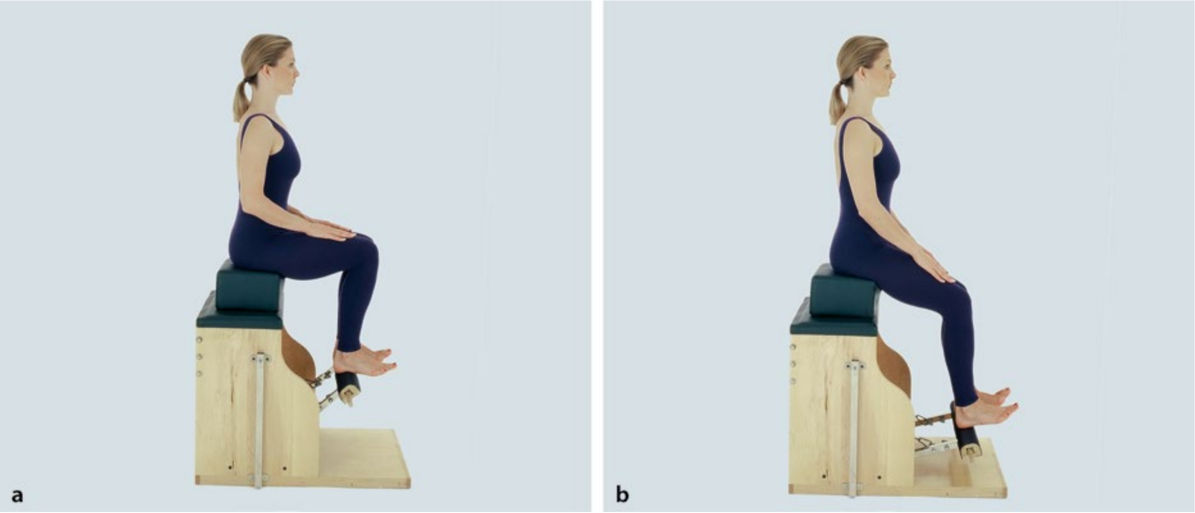


Fig. 8.59a,b Leg Pump: A-sitting. **a** Starting position, **b** end position

Fig. 8.60a–d Leg Pump: Standing. **a** Starting position: pedal up, **b** intermediate position: pedal down, **c** intermediate position: hands behind head, pedal up, **d** intermediate position: hands behind head, pedal down

8.3 Therapeutic Exercises on the Mat

The selection of **mat exercises during therapy** follows the objectives of the relevant phase of rehabilitation (▶ Sect. 7.2). Corrections received during an exercise session should be consolidated with exercises at home.

The selection of mat exercises corresponds to the character of the respective phase of rehabilitation.

Rehabilitation Phase I

Objectives Dissociation, static stability.

Mat Exercises (▶ Overview 8.2)

Overview 8.2 Mat Exercises for Rehabilitation Phase I

Exercises	Chapter
Pre-Pilates Exercises	▶ Sect. 5.1
Breathing	▶ Sect. 5.1.1
Shoulder Drops	▶ Sect. 5.1.3
Dead Bug	▶ Sect. 5.1.5
Book Opening	▶ Sect. 5.1.10
Side Kick Series	▶ Sect. 5.1.11
Quadruped	▶ Sect. 5.1.18

Rehabilitation Phase II

Objectives Supported mobility, mobility in a single movement plane.

Mat Exercises (▶ Overview 8.3)

Overview 8.3 Mat Exercises for Rehabilitation Phase II

Exercise	Chapter
Hundred (modified)	▶ Sect. 5.2.1
Pelvic Clock	▶ Sect. 5.1.2
Chest Lift	▶ Sect. 5.1.4
Single Leg Stretch	▶ Sect. 5.2.6
Single Leg Circles	▶ Sect. 5.2.4
Single Leg Kick	▶ Sect. 5.2.13
Swimming (modified)	▶ Sect. 5.2.15

Rehabilitation Phase III

Objectives Dynamic stability, mobility in multiple planes.

Mat Exercises (▶ Overview 8.4)

Overview 8.4 Mat Exercises for Rehabilitation Phase III

Exercise	Chapter
Side to Side	▶ Sect. 5.1.6
Bridging	▶ Sect. 5.1.7
Assisted Roll Up/Roll Down	▶ Sect. 5.1.9
Side Lift	▶ Sect. 5.1.12
Spine Stretch I	▶ Sect. 5.1.13
Mermaid I	▶ Sect. 5.1.14
Scarecrow	▶ Sect. 5.1.15
Swan	▶ Sect. 5.1.16
Dart	▶ Sect. 5.1.17
Standing Roll Down	▶ Sect. 5.1.19
Standing Balance	▶ Sect. 5.1.20
Hundred	▶ Sect. 5.2.1
Criss-Cross	▶ Sect. 5.2.7
Bridging II	▶ Sect. 5.2.8
Mermaid II	▶ Sect. 5.2.9
Spine Stretch II	▶ Sect. 5.2.10
Spine Twist	▶ Sect. 5.2.11
Swan Dive	▶ Sect. 5.2.12
Side Kick Series	▶ Sect. 5.1.14
Leg Pull Front	▶ Sect. 5.2.16
Side Bend	▶ Sect. 5.2.17

Rehabilitation Phase IV

Objectives Integration.

All exercises can be intensified, by **alterations** to:
- Tempo
- Movement path
- Lever length
- Base of support
- Instruction

That is, all exercises from the first three phases of rehabilitation can be made more difficult in Phase IV, and three new exercises have been added.

Mat Exercises (▶ Overview 8.5)

Overview 8.5 Mat Exercises for Rehabilitation Phase IV

Exercise	Chapter
Roll Up	▶ Sect. 5.2.2
Rolling Like a Ball	▶ Sect. 5.2.5
Standing Single Leg Balance	▶ Sect. 5.2.18

Table 8.16 Comparison: equipment vs. mat

	Mat exercises	Pilates equipment	Conventional training equipment
Resistance	Gravity	Steel springs	Weights
Orientation	Open	Guided	More difficult
Character	Complex	Assistive/active	Active/resistance
Learning effect	Challenging	Measured	Low

8.4 Aspects of Training

8.4.1 Comparison: Equipment vs. Mat

The fundamental difference between exercises with and without equipment is the ability to add **resistance**. Resistance provides sufficient stimuli to the muscles, resulting in increased strength. Some conventional training equipment also allows for the development of strength in an eccentric direction, with a lengthening stimulus, in addition to concentric development.

For designing an **exercise session on the mat,** the options include:

- Orientation in space
- Acting force of gravity
- Exercise choreography

The main difference between **Pilates equipment** and conventional training equipment is that it can be used to support a **learning process**.

Whilst increased strength and flexibility are also objectives, they are primarily fulfilled through the training of **inter**- and **intramuscular coordination.**

The **assistive** use of Pilates equipment supports the transfer of learning and training effects, between the mat, equipment and functional daily life. The Pilates equipment can be used for **strength training against resistance**, but without neglecting the fundamental principles of Pilates training.

Ideally **mat exercises for home** should be instructed during every training session, usually toward the end of the hour. The benefits of the exercises are consolidated, and the client/patient can prepare for increasingly challenging exercises, during the next session.

Table 8.16 summarizes the comparison equipment vs. mat.

8.4.2 Movement in Muscle Chains

Important biomechanical changes can be made to a movement, by adjusting the relationship of the body to the supporting surface and gravity. To understand these changes, a few important concepts are introduced below.

Fig. 8.61 Example of an open chain

- **Open Chain (Fig. 8.61)**

A movement in which the movement path is not connected to a solid surface at the distal end is referred to as an open chain.

Biomechanically, the center of movement is not connected with a solid base, and therefore depends on itself for stabilization and execution of the movement. The motion is usually more exhausting and unstable. An open chain is typical of certain movement sequences and joint functions.

Example
Open Chain

- Throwing a ball or
- Swinging the leg when walking.

These movements are stabilized by structures nearer to the trunk.

If the structures nearer to the trunk are not adequately stabilized, deviations from the ideal line of movement can arise, resulting in inaccurate movements and nonphysiological loading of the passive structures.

- **Closed Chain (Fig. 8.62)**

In a closed chain, the active structures (muscles) benefit from the stability of a supporting surface.

The movement lever is connected with a stable base, at the distal end of the movement path. The resulting bridging activity is characterized by stability, and co-contraction of multiple muscle groups.

Fig. 8.62 Example of a closed chain

Fig. 8.63 Example of a pseudo-closed chain

Example
Closed Chain
- Footwork on the reformer or
- A simple standing squat.

Pseudo-closed Chain (Fig. 8.63)

In a pseudo-closed chain the moving lever has contact with a surface, which is also moving. However, movement takes place in defined planes, providing partial stabilization.

Example
Pseudo-closed Chain
- Leg Pump, seated on the Chair or
- Cycling, with the feet connected to the pedals which move in a fixed path.

Therapeutic Pilates: Clinical Conditions/Patient Examples

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_9,

Options for integrating Pilates training in treatment and rehabilitation will be presented in this chapter, using examples of symptomatic patterns, typical of those encountered in our treatment centers. The effectiveness of the Pilates method, and its intelligent application through a structured process, will be illustrated, along with the benefits for those experiencing health issues.

9.1 Orthopedic (Chronic/Acute)

9.1.1 Chronic Lumbar Syndrome

Patient Example

Case History

Mr. M. complains of persistent back pain, dating back over a period of 4 years. He is a 52-year-old chemist and takes part in some sport (soccer or swimming weekly). His symptoms are not triggered by overloading, but started slowly and become worse with prolonged standing and sitting. Mr. M. has suffered recurring episodes of "low back pain", which have increased in frequency during the last 12 months.

Findings

- In standing, presents with an overall flat back and slight posterior pelvic tilt. Knees are hyper-extended, feet and legs are externally rotated.
- During forward bending, weight shifts strongly over the heels, middle and lower lumbar spine move into strong flexion. Mr. M. complains of a slight pulling pain in the lower back. Distance from fingers to floor is 3 cm.
- The Safety Test (Laségue – straight leg raise test, for nerve irritation) shows no involvement of the disc or other severe pathology.
- Muscle testing and the Pilates screening reveal weak abdominal muscles, strong contractures in the hip and pelvic area, and poor segmental segmental stability of the lumbar spine.

Therapeutic Pilates Program

Mr. M. is currently in the subacute phase (phase II), ready to move into the rehabilitation phase (phase III). The Pilates exercises selected should therefore be active/assistive, with a focus on mobilization of the lumbar spine incorporating axial elongation, and dissociation, to relieve stress on the lumbar area. In addition, freedom of movement in the hip/pelvic area should be increased, and trunk strength improved, particularly in areas of segmental instability.

Exercises

1. **Reformer:**
   - Footwork in all positions (particularly spiraling movements – i to improve mobility in the hip/ pelvic area)
   - Abdominals supine
   - Feet in Straps: parallel and closed
   - Quadruped
   - Standing Hip Stretch
2. **Chair:**
   - Swan
   - Hamstring I
3. **Cadillac:**
   - Roll Down Series
   - Breathing
4. **Mat exercises:**
   - Hundred
   - Single Leg Stretch
   - Bridging
   - Dart
   - Assisted Roll Up

Results

The Pilates program above was performed twice a week, for a period of 6 weeks. Afterwards, Mr. M. continued his mat exercises with appropriate progressions at home, and joined a Pilates group session once a week. Due to gains in segmental articulation and dynamic stability, and alterations in posture and everyday movements, Mr. M. no longer suffers from back pain.

9.1.2 Impingement Syndrome

Patient Example

Case History

Mr. S. is 42 years old, runs an insurance firm. He has complained for several months of pain in the right shoulder, which is aggravated by lying on the side for long periods, and by overhead movements. Mr. S. jogs twice a week and plays tennis occasionally.

Previous Therapy: Mr. S's doctor has diagnosed a subacromial impingement, and slight inflammation of the supraspinatus tendon. He was given a cortisone injection, and anti-inflammatory drugs to be taken if needed.

Findings

- Mr. S. has an excessive thoracic kyphosis when standing, and is slightly overweight.
- An examination of active movement reveals a painful arc between 80° and 120° of flexion. The shoulder is raised, the end of movement range is 170°. Both shoulders are protracted.

Therapeutic Pilates Program

The thoracic spine provides the foundation for the shoulder. The organization of this area plays a key role and influences the mechanical function of the glenohumeral joint. Sufficient thoracic extension is essential during bilateral elevation of the arms, and unilateral rotation during single arm movements, in order for the joint surfaces to be aligned correctly in the plane of movement. Balanced strength relationships within the shoulder girdle muscle system are crucial. Breathing, and the motions associated with breathing, can have a strong influence on the shoulder region.

The **Therapeutic Pilates Program** focuses on mobilization of the thoracic spine and stabilizing exercises for the shoulder joint, taking these functional relationships (and the parameters of the subacute stage (Phase II) of rehabilitation) into account. Following successful dynamic stabilization over smaller ranges of motion, increasingly complex exercises can be added.

Exercises

1. **Cadillac:**
   - Shoulders with Tower Bar
   - Breathing
   - Push Through, Sitting in Front of Cadillac
2. **Reformer:**
   - Arm Work
   - Abdominals Supine
   - Standing Hip Stretch
3. **Chair:**
   - Reverse Swan
   - Side Arm Twist
4. **Mat exercises:**
   - Book Opening
   - Dart
   - Swimming

Result

After 8 weeks, during which time he also received manual therapy for the shoulder as well as functional taping for support, Mr. S. was able to move the unweighted arm without pain. A further 6 weeks were necessary before he was able to move the arm while remaining virtually free of pain during sports. He added occasional Pilates sessions to his other sporting activities, and regularly performed corrective stretches using the Pilates foam roller.

9.2 Neurology (Peripheral/Central)

9.2.1 Condition Following Discectomy with Partial Paralysis

Patient Example

Case History

A sequestrum was removed from Mrs. P.'s L4 area using microsurgery 5 weeks ago; this had been causing partial paralysis of the right calf muscle for a number of weeks. She is a business consultant, 46 years of age, enjoys intense sports and currently has light pain in the back under stress. However, she is unable to climb stairs easily or walk rapidly, due to the partial paralysis.

Previous Therapy: Postoperative physical therapy focused on isometric stabilizing exercises. She also received muscle-stimulating electrotherapy.

Findings

- Mrs. P. presents a sway-back posture when standing.
- She unloads her right side.
- She is unable to perform a Heel Raise standing on her right foot.
- The Lasègue Test is negative. Other, potentially stressful tests have been avoided.
- Medical guidelines recommend active rehabilitation for up to 3 months following surgery. Mrs. P. should avoid sitting for longer than 15 minutes, and avoid active flexion for the first 3 postoperative months.

Mrs. P. would like to complete her rehabilitation in our Therapy Center, and include Pilates training in her program.

Therapeutic Pilates Program

Mrs. P. is in the subacute phase (Phase II). Following medical recommendations, training focuses on stability of the back, and strengthening of the right leg. Mobilizing exercises at the site of the operation must be avoided, but adjoining vertebral segments are mobilized, to avoid movement deficits in the thoracic spine as a result of lumbar spine issues.

Exercises

1. **Reformer:**
   - Footwork: double leg for stabilization, single leg (right) for strengthening
   - Arm Work
   - Quadruped
2. **Cadillac:**
   - Shoulders With Tower Bar
3. **Chair:**
   - Swan (only thoracic spine)
   - Leg Pump, standing

4. **Mat exercises:**
   - Dead Bug
   - Side-lying
   - Dart
   - Leg Pull Front

Result

The program was followed 2 or 3 times per week, with gradual modifications and increased challenge. The strength of Mrs. P's right leg was restored to 80 % after 3 months, and she was feeling increasingly robust. Her intention was to begin swimming training, and continue to practice Pilates once a week, in private sessions or in group reformer classes.

9.2.2 Multiple Sclerosis

Patient Example

Case History

Mrs. W. is 51 years old, and was diagnosed with multiple sclerosis 4 years ago. The disease has an insidious pattern of progression. Mrs. W. complains of disturbed gait, feeling unstable when climbing stairs, and weakness throughout the body but particularly on her left side.

Previous therapy: So far, Mrs. W. has taken part in an inpatient rehabilitation program. She attends physiotherapy (PNF / Vojta) once a week, and is treated by a neurologist and a doctor specializing in holistic treatment.

Findings

- A slightly reduced level of tone can be observed on the left side of the trunk and shoulder when standing, and she also favors that side.
- When taking a step forwards from standing, her weight shifts strongly to the left in the standing phase of gait.
- Her gait is unsteady, and the length of step is asymmetric.
- A modified fitness test identifies decreased strength on the left side of the body, particularly the hamstrings.
- Trunk stability is noticeably reduced.

Therapeutic Pilates Program

Using Pilates exercise to support those suffering from neurological diseases, requires specialized knowledge and experience. As Multiple Sclerosis is caused by damage to the central nervous system, and only minimally affected by classical training principles, the therapeutic focus emphasizes those parts of the body as yet unaffected by the disease. Causing additional fatigue, exhaustion, disappointment or frustration during Pilates training must be avoided.

The trunk muscles and connections to the extremities must to be stimulated and stabilized, with particular emphasis on the functional muscle chains; the closed kinetic chain commonly provides the most appropriate starting point for this.

Warning

Avoid fatigue/exhaustion and frustration when working with patients suffering from multiple sclerosis!

Exercises

1. **Reformer:**
   - Footwork (double leg) using light springs (avoid hyper-extending the knees!)
   - Bridging with heavy springs
   - Combined Arm and Footwork
2. **Cadillac:**
   - Push Through, Sitting in Front of Cadillac
   - Breathing
3. **Chair:**
   - Leg Pumps: Sitting, followed by Standing Leg Pumps
4. **Mat exercises:**
   - Chest Lift
   - Bridging
   - Side-lying
   - Dart
   - Possibly Roll Down
   - Standing into Push Up

Result

Expectations must be modified from the start, due to the prognosis of the disease. The preservation of function, and both psychological and physical stabilization, are most important. Mrs. W continues with Pilates on a weekly basis, and has been delighted by the physical achievements which have been possible, due to the unique nature of this training method.

9.3 Other Medical Conditions

9.3.1 Oncological Issues

Pilates training can play an important role in supporting cancer patients, particularly if a positive perception of the body can be reinforced through movement. The underlying philosophy of the Pilates method emphasizes the development of both internal ("mind") and external ("body") facets of health. A number of projects corroborate the beneficial effects of exercise and sport in general (Dr.

Freerk Baumann, Sporthochschule Köln, http://innere1.uk-koeln.de/forschung/ag-sportonkologie). This applies particularly to **Pilates training**, which specifically emphasizes the whole body and the whole person throughout the training process.

Although positive findings and experiences have been associated primarily with training on an **individual basis up to now**, group training concepts have recently been developed in consultation with oncologists, with the goal of assisting those suffering from oncological diseases to stabilize their bodies and health.

9.3.2 Rheumatoid Arthritis

This chronic disease has a systemic nature, with two forms of progression.

Episodic Progression In this form of the disease, periodic episodes of inflammation alternate with periods of relatively little irritation. Periods of inflammation are characterized by the exaggerated response of the local mucous membrane, which may cause damage to parts of the joint. This may result in functional limitation, and partial destruction of joint structures causing loss of passive stability.

Warning
Pilates training is not advised during inflammatory phases, due to the generalized nature of the inflammation.

Once acute episodes have abated, Pilates sessions can emphasize gentle, active training within a stable and secure range. The objectives of training are dynamic and static stability of all joints, pain-free mobility and everyday functional stability.

Slow Progressive Development In these cases the inflammatory processes are insidious, gradually resulting in continuous pain and permanent damage.

Pilates sessions focus on gentle, active training. While fatigue should be avoided, a lack of challenge is not helpful. Both individual and group training are options, with an emphasis on maintaining strength, correcting misalignments, and functional training of all structures (▶ Chap. 4, ◘ Table 4.2, Functional Training Stimuli).

9.3.3 Fibromyalgia

Sometimes referred to as soft tissue rheumatism, Fibromyalgia is characterized by multiple trigger points in the musculoskeletal system, and painful irritation in other connective tissues of the body. A psychological component can sometimes be identified, with similarities to depression.

Depending on subjective symptoms, **Pilates training** emphasizes pain-free movement. It can improve the general circulation, help to balance the autonomic nervous system, and develop strength and dynamic stability.

9.3.4 Burn Out/Vegetative Dystonia

Burnout syndrome is a disease of modern civilization. Also known as exhaustion syndrome, the physical symptoms may include neck and shoulder pain, ringing in the ears, and indigestion. Similarly, **Fatigue syndrome** refers to the phenomenon of exhaustion and weakness which are not improved by recreation, rest and sleep. Instead, weakness is persistent and in severe cases, may lead to physical and mental breakdown.

Pilates training provides an opportunity to improve self-awareness through calm, steady exercise, thereby establishing a more stable relationship between external demands and internal resources. As an accompaniment to therapeutic intervention, Pilates training focuses on enjoyable exercises that encourage mindfulness and awareness.

9.4 Surgery

9.4.1 Condition Following Hip or Knee TEP (Total Endoprosthesis)

Following hip or knee joint replacement, Pilates training can be introduced, to develop physical capability, and alter and improve pathophysiological patterns of movement that preceded surgery. Conditions such as atrophy and movement inhibition, which may result from surgery, should be addressed in accordance with medical recommendations, and with reference to the appropriate phase of rehabilitation.

9.4.2 Ligament or Tendon Surgery

Following surgery (for example, suture of the supraspinatus tendon or replacement of the cruciate ligaments of the knee) the affected tendon or ligament represents the limiting structure. While following postoperative guidelines, these structures can be subjected to early functional stimuli through **Pilates training** (although usually only with use of the Pilates equipment). The surrounding structures can safely be reorganized and strengthened.

9.5 Summary

Table 9.1 summarizes clinical disorders and respective therapeutic Pilates programs.

9.6 Low-Risk High-Risk Model and "Novice to Expert"

The judgment of the therapist or trainer plays a decisive role when planning therapy, with the professional background and experience of the therapist/trainer providing important parameters for this evaluation.

In a **win-win situation,** the knowledge, expertise and experience of the therapist/trainer will match the issue the patient is dealing with. A situation where skills and knowledge of the condition at hand are insufficient may result in the therapist/trainer becoming overwhelmed.

Legal guidelines exist in the medical field, and must be observed when working with those suffering from medical conditions:

- Therapists, sports teachers and trainers are not qualified to provide diagnoses, and should therefore avoid defining the causes of a disease. They are dependent on the diagnosis provided by a physician, and must determine their therapeutic approach based on this diagnosis.
- Prevention means avoiding the development of symptoms. Preventative classes are not suitable for those suffering from medical conditions, as they may prove inappropriately challenging in the given circumstances. Individual instruction following consultation with the supervising doctor may be more appropriate.
- Specialized symptoms require specialized knowledge. There is an obligation to only work with those conditions for which sufficient knowledge and experience have been acquired.

In view of the above, the Low-Risk/High-Risk model can be used to clarify the appropriate level at which one can apply ones professional skills.

9.6.1 Low-Risk High-Risk Model

Low-Risk Patients/Clients

Stage 1

The majority of clients taking part in preventative Pilates are not currently receiving medical or therapeutic treatment, or experiencing **acute symptoms**. In the absence of limitations due to pre-existing conditions, a client can begin training at an appropriate level, after determining current physical capabilities (for example, using a Pilates fitness screening).

A qualified Pilates trainer who has completed a professional Pilates education can work successfully with clients at this stage, even with relatively little experience.

Stage 2

If there are no current, acute symptoms, but there is a **fundamental, physical issue**, certain movements may be prohibited and individual modifications necessary. This level of challenge for the trainer is increased.

Example

Conditions

- Chronic spinal disorders
- Temporary knee, hip and shoulder disorders
- Slightly decreased bone density (up to 10 %, age-compared)

In order to fulfill the needs of the client, the Pilates trainer requires **specialized knowledge** of, and experience in dealing with, the specific condition. He must also be prepared to adapt his teaching both didactically and methodically, particularly when teaching a group. It is important to avoid either overloading or underchallenging participants.

If the trainer is not sufficiently qualified, he may consult with a therapist or a qualified trainer for an analysis and training program.

High-Risk Patients/Clients

Stage 3

If clients who are currently experiencing **acute** or **subacute symptoms** (▶ Chap. 7) approach a trainer for support, professional knowledge and experience are vital. Decisions about the content, duration and form of Pilates training must be clearly documented, allowing any positive or negative effects to be observed, as conditions can vary greatly according to the individual.

Example

Conditions

- Acute and subacute spinal disorders
- Subacute tendonitis (shoulder, elbow, knee)
- Oncological patients, not currently undergoing therapy

Group classes can only be recommended for these clients under special circumstances; for example, a Pilates back care group led by a qualified physiotherapist or sport teacher.

Stage 4

Stage 4 demands extensive experience, coupled with an appropriate depth of professional knowledge. Only in this

Table 9.1. Overview: disorders and therapeutic programs

	Disorder	Therapeutic Pilates program
Relief	Shoulder impingement	– Shoulder/cervical spine organization – Shoulder girdle muscle system – Thoracic spine mobility
Mobility	Chronic lumbar syndrome	– Dissociation, decompression – Axial elongation – Segmental stability
	Prolapse (also postoperative)	– Elongation – Segmental stability – Static and dynamic stability
Strength and alignment of the extremities	Multiple sclerosis	– Facilitation – Integration
	Oncology	– Integration – Mobility – Endurance
	Rheumatoid arthritis	– Joint stability – Alignment
	Fibromyalgia	– Dynamic stability – Pain-free movement
	Burnout syndrome	– Awareness – Integration
	Hip/knee TEP	– Dynamic stability – Alignment
	Tendon/ligament operation	– Training stimuli – Reorganization – Alignment

way can **critical situations** be detected and thus avoided. The training program must constantly be reassessed, revised and restructured.

Example
Conditions
- Patients with unstable circulation
- Acute symptoms
- Oncological patients, who are currently undergoing therapy

Training programs in stage 4 should only be planned and conducted by **qualified therapists**.

Warning
Group training is precluded in stage 4!

9.6.2 "Novice To Expert"

The **competence** of therapists and trainers is dependent on the following factors:
- Basic vocational qualification
- Personal physical and cognitive competence
- The quality of their Pilates certification
- Experience in the work environment
- Continuing education and development
- Application and evaluation

Every therapist/trainer is required to demonstrate that he/she can meet the challenges presented by the working environment, through completion of continuing education and specialized courses. This is particularly important when working with patients, in the medical field. In the absence of a basic professional qualification, one has a responsibility to patients, to act within the boundaries of one's knowledge.

Pilates and Motor Learning

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_10,

This chapter summarizes a number of **motor learning concepts**, which can be applied to the Pilates method, and have proven successful in practice.

The most recent **findings from the field of sports science** necessitate a broadening of the methodological perspective, thereby facilitating more effective, sustainable results from Pilates training. The success of this is reflected firstly by the degree of implementation by teachers and clients; and secondly, by the extent to which the Pilates method has become increasingly accessible to potential clients with previously limited knowledge of it.

The authors consider the widely adopted approach to motor learning in Pilates training to be less than optimal, as it does not allow for individual, sport specific and gender specific distinctions to be considered.

10.1 Motor Learning and Prevention

Properly applied, the Pilates method is a holistic, fundamental education in motor skills: a functional training method which develops strength, flexibility, coordination and balance in equal parts. Whether performed in the traditional style or modified, the exercises developed by Joseph Pilates function effectively as a **program of preventive exercise**.

Beginning with young people growing up with insufficient levels of physical activity, to working adults suffering from a lack of movement due to pressures of work; even the elderly, who experience a significant decline in motor performance with age; regardless of the current physical level of participants, the Pilates method improves fundamental motor skills and performance.

Traditional Motor Learning

The following **key phrases** have been attributed to Joseph Pilates:

» The first lesson is how to breathe correctly (*Your Health*, 1934, in Gallagher and Kryzanowska 2000, p 36)

» You master one – you get the next. Grant K, Fletcher R (2001)

Underlying these statements is the suggestion that improved motor competence can be achieved through **structured progression**, and that movement goals can be met through **a structured series of exercises**, which range from easy to hard.

The **training effect** is primarily reinforced through consistent execution of a range of exercises, which follow the same movement principles.

The traditional Pilates movement principles can be reviewed once more (▶ **Overview 10.1**). They describe **movement qualities,** to be acquired systematically during separate stages of learning. These are universal, fundamental qualities of movement, applicable to all other forms of exercise, sports and daily activities, in addition to Pilates.

Overview 10.1. Pilates Movement Principles
- Whole Body Movement
- Breathing
- Balanced Muscle Development
- Concentration
- Control
- Centering
- Precision
- Rhythm

Attention Attention is vital for the successful process of motor learning. It can be guided by the instructions of the trainer, who draws the attention to specific aspects of an exercise. The question inevitably then arises, of where the attention should best be placed, to encourage the learning process.

Pilates himself believed that no exercise should be practiced incorrectly or without concentration, and that a minimum of 5 repetitions and a maximum of 10 were optimal. Movement may be corrected verbally, tactilely, or in a combination of both, allowing the trainer to affect the execution of a movement to a greater or lesser extent as required.

! Functional movement is not installed through endless repetition, but through the training of motor skills, facilitated by the Pilates equipment and small apparatus.

Food for Thought: New concepts in Training Theory and Sport Psychology

The current professional literature discusses a variety of methods for acquiring motor ability in sports. Variability in the uptake and implementation of movement tasks should be positively evaluated, acknowledged, and deliberately accommodated in a process of **differentiated learning**. Explaining every detail may hamper the learning of a movement, and should be avoided. Too much information and instruction can prove detrimental to the learning process (Wulf 2009, p 9).

Using:
- Appropriate wording
- Imagery
- Kinetic and verbal instruction

(Wulf 2009, p 88), participant's **attention** can be directed more toward the external effects of the movement on the body, than toward the inner movement of the body itself (Ehrlenspiel and Maurer 2007, p 114).

Applications for Pilates Training

The approaches to learning that have been tested and documented in the fields of complex sports and technical training also necessitate a review **of the trainer's approach,** if applied to the Pilates environment. A tendency toward cognitively driven over-correction is not unusual, and can cause participants to feel uncertainty or fear of "doing something wrong" – an experience that became common in back school classes during the 1990 s.

In the field of prevention, it is vital to:
- **Use precise and briefly worded instructions, to avoid interrupting the flow of movement.**
- **Structure sessions effectively, to provide participants with a varied movement experience.**
- **rovide helpful and specific corrections, sparingly.**

Applying current concepts in training theory and sport psychology to **Pilates training** can be particularly helpful in the following contexts:
- When working with **young people** from a perspective of differentiated learning (regardless of the individual level of athletic talent), **differences** in the performance of Pilates exercises should not immediately be dismissed as mistakes and corrected.
- By contrast, **adults** have already developed unbalanced motor patterns, and are seeking to correct or prevent further damage to the musculoskeletal system by **re-learning motor skills which have almost been lost** (due to lack of practice). The Pilates principles should therefore be systematically acquired, corrected and practiced in specific learning stages.
- **Athletes** with sophisticated but highly specialized motor skills can benefit from **learning more varied reactive patterns,** in different conditions, and using highly effective exercises on the Pilates equipment.

Positive Factors in Motor Learning

► **Overview 10.2** describes factors that enhance motor learning.

Overview 10.2. Positive Factors in Motor Learning

1. Internal and external focus
2. Learning curve
3. Levels of awareness
4. Retention of learning effects

1. Internal and External Focus

Wulf (2009) demonstrates impressively, how a lasting positive effect can be achieved by **instructing a motor task**:
- With an **external focus**, the movement system can automatically organize itself and work effectively.
- With an **internal focus**, the movement system is limited by conscious control ("con-strained"), and freedom of movement during performance becomes "frozen" (Wulf 2009, p 96).

Example

Pilates Instruction for External Focus

The **Roll Up** exercise is performed using a gymnastic stick, and the instruction given, to hold the stick parallel to the floor throughout the exercise. The cue can be provided, to follow an imaginary arc across the ceiling and continuing down the wall. → It is accepted that the distance from the point of focus should be wide, in order to develop the curve of the movement optimally.

Example

Pilates Instruction for Internal Focus

The focus is directed inward, using verbal cues for **body awareness**: e.g., "Feel the engagement of the pelvic floor", or other similarly anatomically focused tasks, requiring a high degree of sensitivity and body awareness.

2. Learning Curve

New movement tasks are explained and can be cognitively understood. To avoid mistakes, exercises are repeated until they become automatic. The initial **declarative** (explanatory) **approach** transitions into **procedural** (repetitive) **practice**.

As Pilates teaching progresses, the initial level of verbal instruction is reduced in favor of increased repetition and consolidation, as performance improves.

3. Levels of Awareness

Automation occurs in all areas of our lives and allows us to be efficient, as conscious processes are not required in order to act. **Strategies** are developed at a subconscious level, and influenced by a number of factors, which are not necessarily either useful or healthy.

The learning process during Pilates training follows the following steps:
- **In step one,** dysfunctional or unhealthy habits or routines are analyzed, and participants made aware of them.
- Making participants aware does not in itself assure that changes are made. **Step two** focuses on awareness of faulty performance during movement.
- Beginning in **step three**, altering movement through conscious competence becomes possible. An unnec-

Table 10.1. Rehabilitation and motor learning

Status of patient	Phase of rehabilitation	Strategy
Unconsciously incompetent	Acute/chronic	Increase awareness
Consciously incompetent	Subacute	Motivate
Consciously competent	Rehabilitation	Cognition
Unconsciously competent	Postrehabilitation	Challenge

essarily large number of resources are still required during this phase, in order to consciously perform correctly.

- The goal of the **fourth step** is automatic, correct performance of the exercise, or unconsciously competent behavior. Movement patterns and exercise performance are now established, sustained, and unconsciously controlled.

4. Retention of Learning Effects

Multiple levels of experience and a sufficient length of training ensure that the effects achieved can be permanently integrated and maintained.

During Pilates training, smooth exercise transitions (movement flow) and alternating between exercises with and without equipment, encourage the transfer of competence into everyday activities. This integration and consolidation of movement competence facilitates the retention of training effects.

10

10.2 Motor Learning in Rehabilitation

Many years ago, pathophysiological movement patterns were considered to derive from abnormal motion. The modern understanding of cause and effect, didactics and methodology allows us to view musculoskeletal disorders in a more complex way.

During **therapeutic Pilates training**, deeper mechanisms such as fear avoidance, pain inhibition, viscerosomatic reflexes and psychogenetic inhibition, play an important role.

! Pilates training invites attentive, conscious observation of one's self.

Breathing is a central element of training, and provides a profound emotional and energetic link to the internal self. Repeated performance of Pilates exercises can bring **subconscious movement strategies into conscious awareness,** at which point they can be observed and modified. Changes at all levels can be achieved in this way (Table 10.1).

The focus on **tactile instruction** in addition to **visual and verbal cues,** brings a new quality to the process of rehabilitation, and a new way of moving; as an expression of tranquility, strength, and balance.

Factors Affecting Motor Learning During Rehabilitation

The patient is influenced by a number of factors, when he finds himself in a rehabilitative or therapeutic process.

Pilates training can utilize experiences and techniques from physical therapy, rehabilitation and training theory; linking these elements with the concepts which underpin Pilates and Pilates exercise can create the optimal experience for the patient.

Physiological Factors

The **healing processes** the body passes through during the various phases of rehabilitation fall into this category (► Chap. 7). If healing proceeds optimally, progressive pathophysiological reactions in the damaged tissue can be limited, with reduced mechanical and postoperative inflammation as a result. The desire of the body for homeostasis (► Glossary) also has a far reaching impact on the process of motor regeneration.

During **Pilates training** it is vital to recognize and assess the ability to withstand loading correctly, in order to support the healing process with planned activity and an appropriate selection of exercises.

Structural Factors

The tissues involved in the injury mechanism demonstrate specific structural qualities that shape the rehabilitation process. An injury to the lower extremity, for example a ligament rupture in the knee joint, must be trained taking into account **constitutional factors**; any axial misalignment such as genu valgum (knock knees) would significantly affect rehabilitation and the choice of exercises. Modifications may also be required for injuries to the spine, for example, if there is pre-existing damage to the joint structures, which affects the overall stability of the trunk.

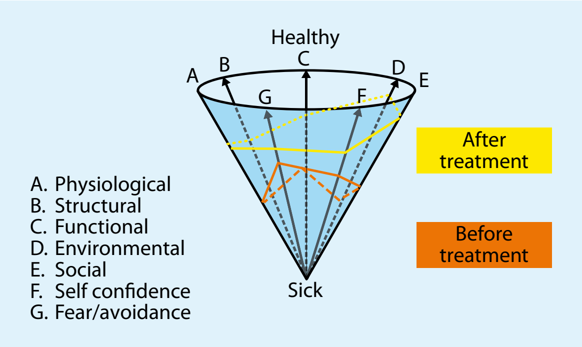


Fig. 10.1 Modified ICF Model by Brent Anderson

Functional Factors

Previous motor experiences and good physical condition in general, provide a good basis for a rapid healing process. One of the goals of **early functional mobilization** of patients following surgery or injury, is to ensure as little deterioration or loss of existing strength and function as possible.

The holistic approach plays a decisive role in **Pilates training**; involving all noninjured structures from the start, and injured structures as early as possible, to maintain function and stability, is an integral aspect of therapeutic training and rehabilitation.

Environmental Factors

Each specific working environment brings with it a corresponding pattern of mechanisms, situations and behavior, which can affect the rehabilitation process. **General environmental factors** such as stress have an influence, reducing adaptability and receptivity, and disrupting the healing process. **Specific environmental factors** such as awkward working posture or poor ergonomics in the workplace can affect recovery, and in combination with other factors, provide a breeding ground for further dysfunction and chronic issues.

Psychosocial Factors

In a situation of health crisis the extent to which a situation can be perceived as a temporary, a **problem that can be overcome,** is important, as is any expectation of sustained **negative consequences**. The actual facts of the disease only play a minor role; the psychological and social situations are decisive when assessing a problems severity. From the point of view of the authors, the following **strategies** can be useful:

- Information (be aware of all essential facts)
- Discussion (confer with experts and all those involved)
- Intuition (establish internal compliance)
- Decision (select a clear direction)
- Continuing commitment (monitor sustainability, strategic progress and results)

Self-confidence, trust in the therapeutic team, and the recognition and avoidance of anxiety-related behavioral strategies play important roles in this dynamic process.

Pilates training strengthens patient competence through a movement experience that is motivating, and reassures them that their own abilities hold the key to success (Fig. 10.1).

References

Ehrlenspiel F, Maurer H (2007) Aufmerksamkeitslenkung beim motorischen Lernen. Ztschr für Sportpsychologie 14(3):114–122

Gallagher S, Kryzanowska R (2000) The complete writings of Joseph H. Pilates: Your HEALTH 1934 – Return to life through contrology 1945, The authorized editions. Bainbridge Books, Philadelphia (PA)

Grant K (2001) Oral communication. Founding meeting of the PMA, Miami, 2001

Wulf G (2009) Aufmerksamkeit und motorisches Lernen. Elsevier, Munich

General and Specialized Instruction

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_11, © Springer Berlin Heidelberg 2014

11.1 General Instruction

In this chapter, instructions and cues for Pilates exercise will be presented, based on the preceding clarifications of motor learning in Chap. 10.

Instructional strategies are necessary, since:
- The titles of the exercises are not self-explanatory.
- The Pilates principles, which are designed to reestablish natural motion control, need to be internalized.

Four instructional options are available when teaching Pilates, to facilitate correct performance and lasting results (▶ **Overview 11.1**).

> **Overview 11.1. Instructional Strategies for Pilates**
> - Demonstration
> - Verbal instruction
> - Tactile instruction
> - Imagery (the use of metaphors)

General Guidelines for Exercise Instruction
- Instruction is vital to ensure **accurate performance** and optimal **effectiveness**, but it should also encourage and provide motivation, making the learning process enjoyable.
- The success of any instruction is seen in the quality of movement execution. The exerciser should appear **relaxed** yet **focused**. Pilates exercises can be challenging, if this is appropriate to the goals of training; however, **effort** should never cause a state of stress, exhibited in signs of vegetative tension, e.g., pale lips, shallow breathing, holding the breath, etc.
- Instruction should always reflect the needs and **capabilities of the participant**. Since individuals absorb information in different ways, the success of the instructions given should be assessed immediately.

11.1.1 Instructional Strategies

Demonstration
If the trainer chooses to demonstrate an exercise, it can have a number of effects.

Visual perception provides an overall impression of the exercise, which can facilitate the process of implementing the movement. This process is directed by an internal focus, and accompanied by external stimuli, an initial motor concept is derived. The student is able to compare himself with the external impression (demonstration) he has observed, e.g., by use of a mirror. If the exercise and demonstration have made an appealing, motivating impression, the student will strive to implement the movement well.

It should be noted that the **student's perception** is selective and limited; the trainer should therefore provide additional advice on specific aspects of performance. It is also possible that the demonstration may not leave the perfect, visual impression that was intended. The teacher inevitably becomes a role model for the students, and must therefore ensure that the external form of the exercise matches the intention of the demonstration.

Verbal Instruction

> **Exercises should be instructed as briefly and succinctly as possible, and with precision; avoid overloading students with information, which may obstruct their self-awareness!**

The style of any verbal instruction depends heavily on the personalities of both trainer and student. The general rule "As little as possible, as much as necessary" can be applied to the motor implementation of an exercise, and also to its verbal instruction.

The effect produced by a specific instruction should be noted, as stubborn repetition will not always lead to success. A variety of different approaches to a particular theme may be called for, as not every student is easily able to comprehend verbal instructions and implement them physically. The differing ways in which students interpret seemingly simple instructions can often be surprising (▶ Chap. 10, Pilates and Motor Learning).

The following **verbal formulations** have proven effective in the classroom; however, it should be remembered that verbal instruction is highly dependent on the individual nature of communication between student and trainer.

Breathing (Fig. 11.1)
- Exhale, allowing the abdominal wall to sink/fall
- Exhale fully
- Inhale keeping the abdominal wall flat
- Inhale, widening the back, keeping shoulders relaxed and down

Control and Strengthening of the Pelvic Floor (Fig. 11.1)
- Draw a sponge upward internally, without squeezing it
- Imagine drawing a bubble upward, but avoid bursting the bubble (do not activate the sphincter)
- Emphasize the anterior pelvic floor, rather than the dorsal (avoid the traditional instruction to "draw the sitting bones together")

Fig. 11.1 Verbal instruction: Breathing/supine/pelvic floor

Fig. 11.2 Verbal instruction: Prone

- First practice the above with exhalation, afterward with inhalation, then maintain the muscle tone with normal breathing for 10 seconds (Hamilton 2009)

- **Supine (Fig. 11.1)**

Abdominal Training
- Control of the (flat!) abdominal wall
- Draw the navel inward
- Separate the inner muscle corset from the skin
- Tighten a corset around the waist
- Create a wasp-waist
- Draw the navel toward the lumbar spine with a silk thread
- Anchor the center of the body, so that the ends (arms and legs) can work

Core Integration
- Active starting position (= dynamic tension): head away from the pelvis, pelvis away from the head
- Sacrum (SIJ) and thorax (especially the lower ribs) resting on the mat

- **Prone (Fig. 11.2)**

Strengthening of the Trunk
- Active starting position (= dynamic tension): head away from the pelvis, pelvis away from the head
- Draw sitting bones toward the heels / curl tailbone slightly – so that the pelvis is stabilized (counter nutation)
- Narrow the waist

- **Seated (Fig. 11.3)**

Upright Posture
- The sitting bones are the foundation
- Fight against gravity
- Push and pull: push down (into the mat), pull up
- Root down, grow taller

Fig. 11.3 Verbal instruction: Seated

Fig. 11.4 Verbal instruction: Side-lying

- Elongate the spine out of the pelvis
- Reach the head toward the ceiling

Organization of Head and Shoulders
- Shoulders wide and low
- Pull the head out of the neck, and the neck out of the shoulders
- Large space between shoulders and ears
- Relax arms, relax shoulders: arms like cooked spaghetti

Arm Work
- Pull arms out of the shoulders
- Support gently from the arm pits
- Middle fingers paint on the walls right / left

- **Side-Lying (Fig. 11.4)**

Stabilization
- Lift the waist off the ground
- Dynamic tension: head away from the pelvis, pelvis away from the head
- Narrow the waist

Legwork
- Lengthen the legs out of the pelvis toward the opposite mirror/wall

- **Side Support (Fig. 11.5)**

Weight-Bearing Through the Upper Extremities
- Hands and elbows are the foundation

Fig. 11.5 Verbal instruction: Side Support

Fig. 11.6 Verbal instruction: Standing

- Push away from the ground
- Lift the thorax toward the ceiling, the rest follows

Quadruped
- Muscle system arms/thorax: slide sternum between the shoulder blades
- Push and pull: push down, pull upward (think horizontally and vertically)
- Grow roots downward, grow upward

Standing (Fig. 11.6)
- Feet are the foundation
- Fight against gravity

Fig. 11.7 Verbal instruction: Full body integration during Roll Over

Fig. 11.8 Verbal instruction: Rolling movements

- Push and pull: push downward (feet), pull upward (crown of the head)
- Grow roots downward, grow upward

Full Body Integration and Overhead Organization (Inverted Position) (Fig. 11.7)
- Oppositional movement: "work in opposition"
- Push and pull: push down, pull up
- Grow roots downward, grow upward
- Anchor the center of the body so that the ends (arms and legs) can work
- Large space between pelvis and ribs

Rolling Movement (Fig. 11.8)
- Dynamic tension
- Roll through the biggest possible arc
- Big "C-curve" of the spine
- Large space between pelvis and ribs
- Roll vertebra by vertebra
- Maintain control of the abdominal wall

Tactile Instruction
Hands-on, tactile support can be meaningful in conveying the nature of a Pilates exercise and the quality of its execution; the use of touch has multiple, diverse effects. Here, we focus primarily on the mechanical aspects of physical instruction, and the effects on execution and understanding of the exercises.

Fig. 11.9a–d Positioning instruction (X): **a** Hundred, **b** starting position: bent legs, **c** Hundred, **d** Femur Arcs: supine position, legs bent

It should be noted that a targeted, skilled touch can have a fundamental effect on the student, which extends beyond the mechanical level.

There are three types of tactile instruction:
- Positioning instruction (P)
- Guiding instruction and (G)
- Instruction with resistance (R)

Positioning Instruction (Fig. 11.9)
The student is placed in position more or less **passively**, in order to perform the exercise successfully.

Example
Positioning Instruction (P)
- In the supine position, the shoulders can be placed in the center of the shoulder girdle muscle system.
- By stroking along the length of the neck muscles, the head can be positioned avoiding hyperextension of the cervical spine.
- Positioning aids (pillows, towels, sand bags, balls) can be placed at the start of an exercise, to improve alignment of the body.

It may also be appropriate to intervene **during a movement**, with manual positioning instructions:
- Firstly to prevent potentially dangerous misalignment
- Secondly, to clarify the correct alignment during a particular phase of an exercise

Guiding Instruction (Fig. 11.10) (G)
The lightest touch possible is used, to guide the direction and intensity of a movement. This type of instruction is appropriate for movements which are not powerful or dynamic enough. Guiding instruction usually assists axial elongation, width or direction of movement.

Instruction with Resistance (R) (Fig. 11.11)
This forceful, stabilizing instruction provides a clear, external stimulus. Instruction with resistance may be used **statically** (to clarify a position) or **dynamically** (to guide a movement with dynamic stability).

In addition, hold-relax techniques (= neurophysiological technique in physiotherapy, proprioceptive neuromuscular facilitation or PNF) can be used to increase range of motion by short-term inhibition of overactive muscle groups.

It should be noted that every individual experiences tactile instruction (contact) differently. By means of touch receptors in the skin and pressure receptors in subcutaneous tissue, signals from the periphery are conveyed to the brain via the spinal cord. The processing of stimuli is always subject to momentary, **subjective interpretation**, which should always be comfortable and clear.

Fig. 11.10a–c Guiding instruction (⇔): **a** Roll Down with rotation, **b** Mermaid II with rotation, **c** Single Leg Stretch: arms on the floor

11

Warning
Tactile instruction that is unclear, not appropriate to the exercise, performed too quickly or in too many places simultaneously will generate more confusion than guidance.

Imagery (Use of Metaphors)

Amongst other things, Joseph Pilates studied the movement of animals, and from his observations derived principles applicable to people, as well as ideas for exercises. Many of his exercises are **named after animals,** symbolizing the characteristics of the movement. The names of exercises such as “Kneeling Cat”, “Elephant”, “Swan”, and “Mermaid” are evocative of movement characteristics that can be utilized during practice.

The use of imagery in Pilates teaching has increased over the last 20 years, with inspiration taken from the work of Mabel Todd (1937/2001), André Bernard (1997), and later Erik Franklin (1998). The **advantage** of instruction using imagery reflects the complex nature of movement execution, which sees the quality of performance alter significantly as a result of accessing one’s internal resources,

Visual instruction may utilize
- **Direct imagery and/or**
- **Indirect imagery**

Some examples of instructions using imagery are provided below. Due to its allusive nature, an image can only be used or interpreted based on personal experience. For students who have never seen an elephant in their lives, instructions using this metaphor are of limited use. Images that are specific to certain people or experiences, for example, “make the legs slim as if you are putting on a pair of tights”, are not helpful for someone who has never put on a pair of tights. The words of a student can provide clues to his inner experience (e.g., “my back is as stiff as a board”, or “I feel like a tired horse”), which can then be used as a starting point for instruction using imagery.

Direct Imagery

Direct images refer directly to the body.

The student receives instructions for the performance of an exercise, which help him perceive the body in a different context or relationship to space.

Fig. 11.11a–d Instruction with resistance (⇒): **a** Swan Chair, **b** Superman, **c** Hamstring Stretch, **d** Goal Post

» Be proud of your chest, young man. (Lolita San Miguel, quoting Eve Gentry, 2011)

Breathing

- While inhaling, expand the lower posterior ribs
- While exhaling, grow toward the ceiling

Axial Elongation

- Reach the head toward the ceiling
- Draw the abdomen back and upward, toward the spine

Trunk Control

- The stomach and back support the spine, and create space between the vertebrae
- The shoulders are wide, the back long and the waist narrow

Mobility

- One vertebra slides down, the other slides up
- The hip joint glides in the pelvis

Tip

Figures 11.12–11.22 illustrate further suggestions for instruction using direct imagery.

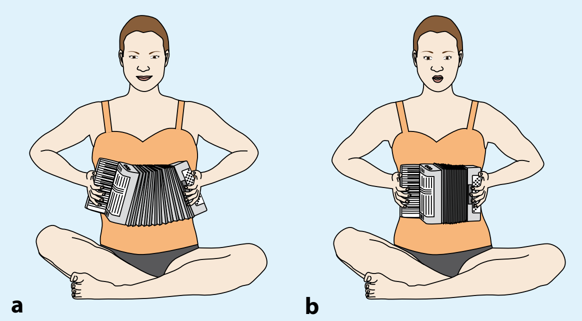


Fig. 11.12a,b Breathing: "The ribs open and close like an accordion." **a** "Breathe through the nose into the lower ribs", **b** "Exhale through the mouth"

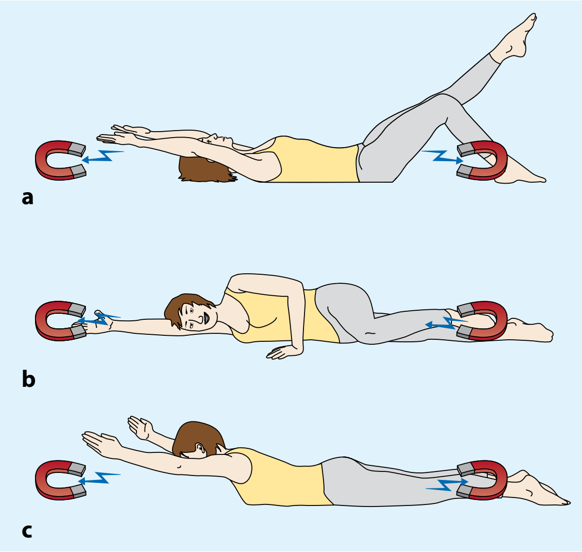


Fig. 11.13a–c Axial elongation: "Two magnets draw the spine apart in two directions." **a** Supine, **b** side-lying, **c** prone

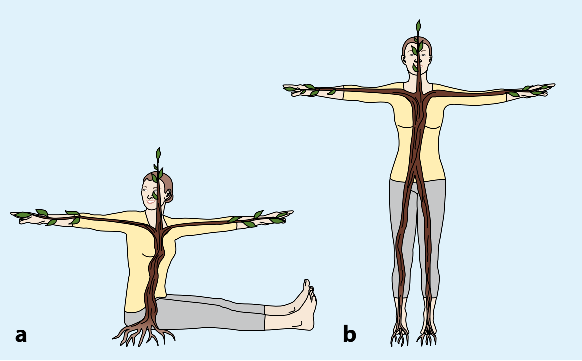


Fig. 11.14a,b Axial elongation: "Root downward, grow upward." **a** Seated, **b** standing

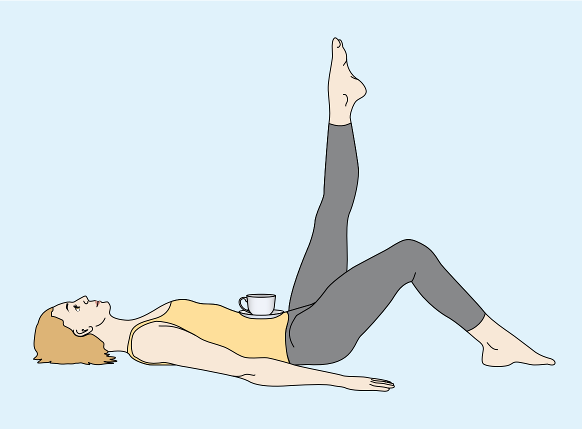


Fig. 11.15 Core control in supine: "The center is stable and still, so that a tea cup (resting on the stomach) does not spill"

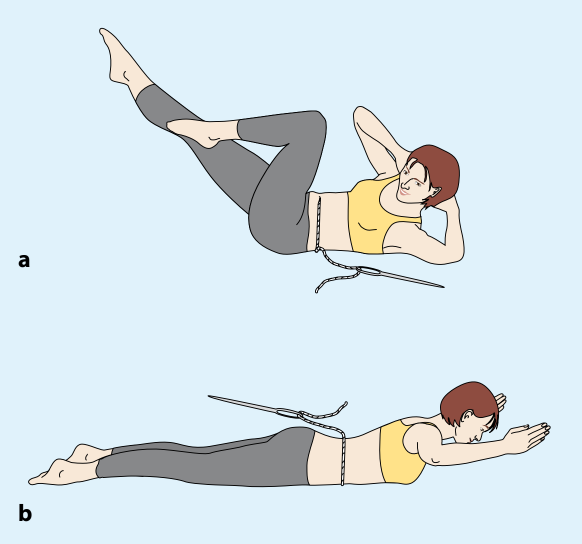


Fig. 11.16a,b Core control: "The distance between the navel and the spine remains the same, the navel is pulled to the spine with a fine thread." **a** Supine, **b** prone

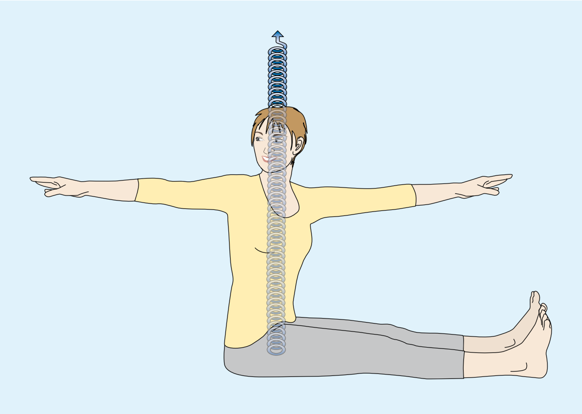
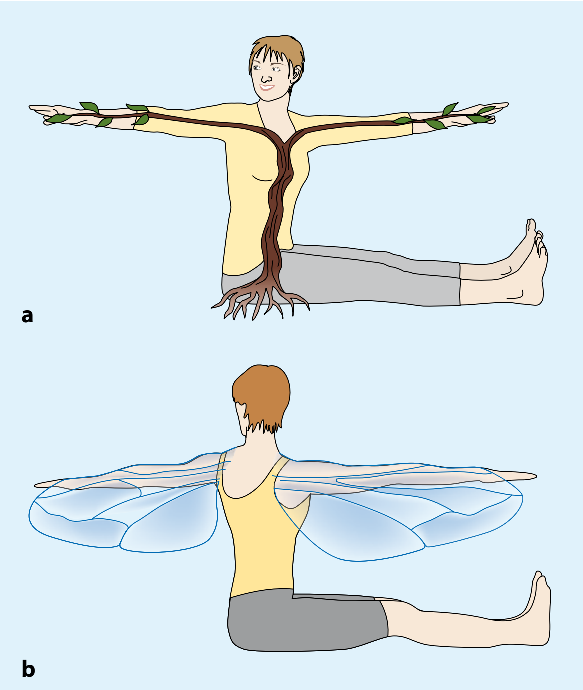
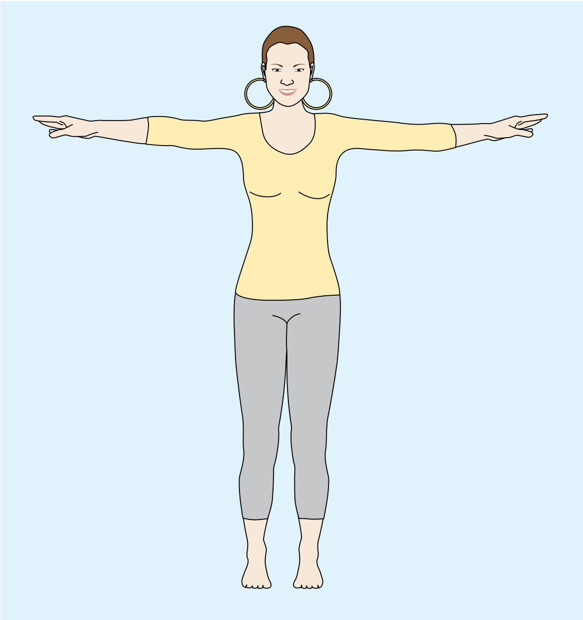


Fig. 11.17 Seated rotation: "Turn as if twisting a screw into the ceiling"

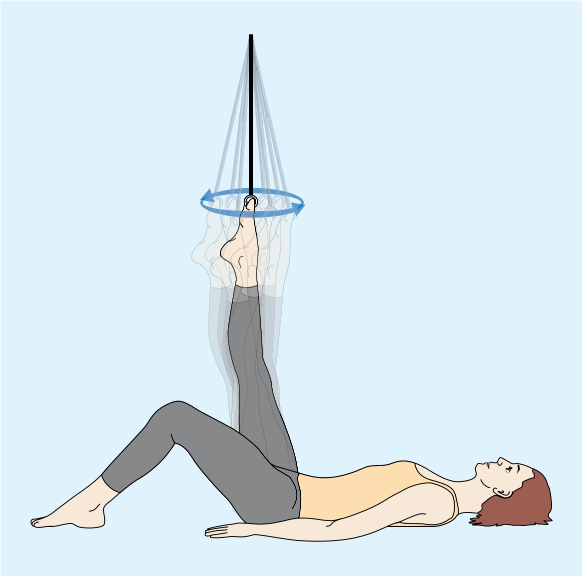
11



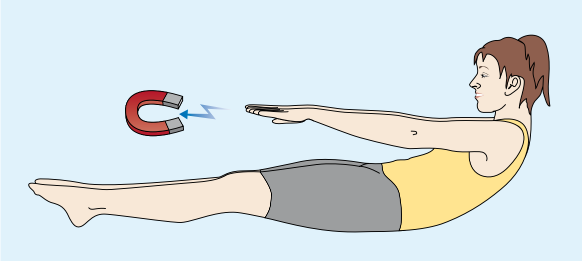
■ **Fig. 11.18a,b** Arm movement. **a** "Arms grow longer to the left and right." **b** "Arms float lightly and with ease, like wings"



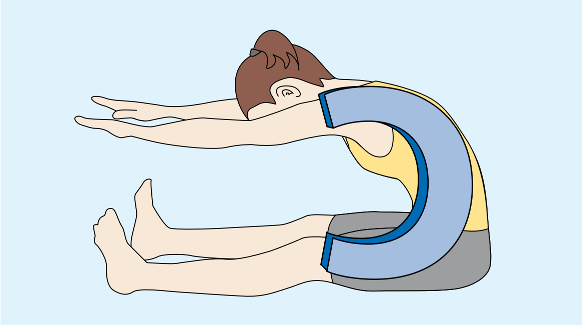
■ **Fig. 11.19** Movement of the arms and shoulder girdle: "The shoulders stay down – as if wearing large earrings that do not touch the shoulders"



■ **Fig. 11.20** Leg movement: "The leg hangs as if the big toe is connected to the ceiling, and circles freely in the hip joint"



■ **Fig. 11.21** Rolling movements: "Follow the hands – a magnet draws the hands toward the opposite wall" (when rolling up)



■ **Fig. 11.22** Spinal mobility (Spine Stretch): "The spine forms a big C"

Table 11.1. Instructional strategies

Instruction	Suitable for	Learning type	Problem
Demonstration	Positions, movements Group and individual training	Visual type	Own correct execution, selective perception
Verbal instruction	External connections Group and individual training	Cognitive type	Emphasis on cognitive execution, little physical feedback
Tactile instruction	Strong sensory input Individual training, smaller groups	Sensory type	Accuracy, broader impact
Imagery	Activation individuals own strategies Group and individual training	Metaphorical type	Individuality, difficult to transfer to everyday life

Indirect Imagery

We refer to indirect imagery when the body is transformed into "something else" in the mind of the practitioner.

Spatial Images Transfer the Body to a Different Environment
- Imagine you are lying on the beach
- Your body moves between two plates of glass

Parts or Areas of the Body Are Transformed Into "Something Else"
- Your pelvis is like a salad bowl
- Your leg is like a narrow, strong tree

Sensory Input
- Imagine that you are smelling a flower
- The wind is stroking your back

Complex Images
- The body is like a symphony orchestra
- We flow through life

The Benefits of Imagery
The **benefits** of imagery cannot be overestimated:
- Instructions that utilize images can **stimulate** students **mentally,** helping them to overcome physical limitations.
- Images can often create an **impact** during an exercise, which can then be **spontaneously triggered** in other situations. A small tip is often all that is then required, to trigger complex physical reactions.
- Images are well suited to **instruction for groups**, as the characteristics of an exercise can be described quickly and effectively.

Summary
Table 11.1 summarizes the four instructional strategies.

11.2 Specialized Instruction

Specialized Instruction for Men
Modifying exercise instruction according to gender is recommended.

Men generally experience more difficulty sensing and interpreting detailed physical phenomena. It is therefore best to avoid instructions that are particularly internally directed and subtle. Male clients respond well to:
- Tactile, positioning instructions
- Instructions with resistance
- Demonstration

Instructions utilizing imagery should focus on **direct images** that:
- Reflect the physical image of men (e.g., broad shoulders, flat stomach, upright posture)
- Yet also reflect the qualities of relaxation and peace

Specialized Instruction for Women
The following are generally useful for **teaching women:**
- Verbal instructions, accompanied by
- Tactile, guiding instruction

The desired body image for women often affects exercise performance dramatically. It can therefore be helpful to allow female students space to express and develop their images of both general and personal physical ideals.

Women tend to carry tension in the head, neck, and shoulder area, and particular attention should be paid to these regions.

Specialized Instruction for Patients
The options for processing external stimuli alter fundamentally, if there are physical issues present. The paths for stimulus are dominated by **pain signals, and limitations of function and mobility**. The underlying sensory and proprioceptive systems may be severely impaired. This knowledge has consequences for the instruction of Pilates

exercises in therapy and rehabilitation, as the optimal flow of information must be ensured.

The systems of local stabilization and control are also affected, via the mechanisms of central and peripheral inhibition. This makes it difficult for patients to perceive and control muscle tension consciously. During the instruction of Pilates exercises, techniques can be employed to help normalize these physical processes.

> The goal of a Pilates exercise in therapy and rehabilitation must be to initiate a pain-free, successful movement that serves the goal and exceeds the expectations of the patient. (Anderson 2005)

Facilitation

Facilitation techniques employ knowledge of connections in the musculoskeletal system, in order to have the greatest possible influence on the healing process. For example, sensory stimulation of skin areas through contact also affects the local muscles and associated circulation: in this way, gentle slapping or brushing of the inner side of the thigh may stimulate activation of the stabilizing muscle chains of the leg.

Overflow

If a stimulus is functionally correct and of sufficient intensity or length to be "recognized", the effects can be felt on the **opposing side of the body** or in **areas of the body distant** from the location of the stimuli:

- Arm movements from flexion to extension in the supine position can also stimulate the ventral trunk muscles.
- Leg movements on one side of the body have a training effect on the opposite side of the body.

Positive Body Image

In recent years, the field of rehabilitation has increasingly focused on the influence of the mind on the physical state. Even as the brain conceives a movement, the physical processes required for the actual performance of that movement are initiated. This **feed-forward phenomenon** can be exploited by first visualizing a movement with the patient, before moving on to complete the task.

Feed-forward thinking can be utilized by asking a patient to visualize positive images, which modify basic inhibitions (e.g., "Imagine you were smiling with your whole body").

References

Anderson B (2005) Randomized clinical trial comparing active versus passive approaches to the treatment of recurrent and chronic low back pain. University of Miami, Miami

Bernard A (1997) An introduction to Ideokinesis. Contact Quarterly (Reprint No. 3). Ideokinesis and Creative Body Alignment. Summer/Fall, pp 24–25

Franklin E (1998) Locker sein macht stark. Kösel, München

Hamilton C (2009) Lokale Stabilität der Gelenke. Handout Hamilton, Regensburg

San Miguel L (2011) Oral communication. Conference, Mönchengladbach

Todd M (2001) Der Körper denkt mit: Anantomie als Ausdruck dynamischer Kräfte. Huber, Bern (Nach der Originalausgabe "The Thinking Body" 1937)

Formal Basis for the Implementation of Pilates Training

Verena Geweniger, Alexander Bohlander

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0_12,

12.1 Preventive Pilates

For several decades, the value **of Pilates training for prevention** has been undisputed internationally. Interest in Pilates continues to grow in Germany and Europe, and has increased significantly over the last 5 years, due to the spread and popularity of the method in fitness studios. In public perception, Pilates training is strongly associated with group mat classes. Only a small proportion of those interested in Pilates experience the full range of equipment and mat exercises, either individually or in small groups.

Even in cases where prevention is the actual goal of training, we often find **participants with existing physical ailments** seeking to improve their condition through Pilates. This situation can be challenging for the instructor:

- Because of the burden of responsibility for course participants
- And also in didactic terms

In this context, the reader is referred to the **high-risk low-risk model** in ▶ Chap. 9. An instructor should provide a service to participants, which is appropriate within the bounds of his professional and technical competence. Furthermore, before training begins the instructor has a responsibility to acquire adequate information about the state of health and motivation of the client.

12

12.1.1 § 20 SGB: Current Position on Subsidizing Pilates Classes

In Germany, the legal basis for the **promotion of preventive health measures** provides for the subsidizing of participation in Pilates classes through health insurance, according to the **following criteria**:

- A vocational qualification as a physiotherapist or state certified sports/ gymnastic teacher
- A minimum of 100 hours of Pilates teacher training, at a training institute which meets the guidelines of the German Pilates Association (DPV)
- Registration with one of the health insurance institutions responsible for granting authorization

! Once the required paperwork has been submitted and accepted, a proportion of course fees will be reimbursed according to the terms of the client's specific health insurance policy. A certificate of regular attendance must be submitted.

The Medical Service of the Statutory Health Insurance Funds Association issued the following statement regarding the **promotion of Pilates classes** (February 2009):

The compatibility of a health promotion with the **"Prevention Guidelines"** of the central health insurance association, and specifically, compliance with all **requirements** regarding **qualifications for instructors** are essential criteria of eligibility for potential reimbursement by a health insurer. This does not necessarily mean that every health insurance company automatically subsidizes the promotion for their customers; this decision is always made by the individual insurance company.

Compliance with the standards of the Medical Service of the Statutory Health Insurance Funds Association is checked in individual cases. Pilates classes can be subsidized if the additional **criteria** of the guidelines are met, in addition to the following:

- The course instructor has a nationally recognized qualification in movement.
- The course instructor has completed a training course with an educational institute that is a member of the German Pilates Association, or another institute with similar standards.
- The training takes place in a group.
- The maximum size of a group is between 10 and 12 participants.

12.1.2 Sports Rehabilitation Associations and Functional Training

The most recent version of the agreement on the implementation and reimbursement of **rehabilitation sport** and **functional training** is from January 2011 (§ 44 SGB), and outlines alternative strategic goals to those aimed for in primary prevention according to § 20 SGB.

The professed **aim** is to make self-help resources available to those with physical ailments or disabilities, thereby facilitating increased participation in normal daily life. The central goals of this endeavor are:

- The improvement of existing living situation
- Avoiding the deterioration of existing symptoms

Apart from the guidelines for recognition and reimbursement in primary prevention, additional preconditions stipulated by the German Sports Federation (DSB) must also be met. **Functional training** is a field that demands specific knowledge of chronic diseases, and can only be provided by physiotherapists and occupational therapists.

! Pilates training is fundamentally unsuited to the fields of rehabilitative sport and functional training; since it is primarily a generalized form of exercise or sporting activity, and its goal is nonspecific.

12.1.3 Outpatient Rehabilitation

As part of a complex, outpatient rehabilitation program (formerly referred to as Advanced Outpatient Physiotherapy), Pilates training can supplement or replace conventional training therapy.

During all phases of rehabilitation, patients can be effectively and efficiently supported through appropriate use of the Pilates equipment and modification of exercises, allowing health centers that fulfill the approval guidelines to integrate Pilates training without difficulty.

12.1.4 Physiotherapy Equipment

The current billing **conditions** for the use of "Physiotherapy equipment" in German physical therapy facilities are as follows:
- Completion of appropriate professional training
- Five specified training apparatus (leg press, angled table, vertical cable pulley apparatus, two universal pulley apparatus)

Circuit style training takes place in small groups of up to 5, planned, documented and under the supervision of a physiotherapist, and is implemented outside of the complex, therapeutic team approach.

The Pilates equipment and mat exercises can meet the requirements for training equipment in principle. If the instructor holds sufficient professional qualifications, Pilates training can meet the requirements for "Physiotherapy equipment", in terms of both structure and content.

12.2 Documentation and Evidence of Efficacy

Documentation and adequate record-keeping are important during Pilates training, particularly in a therapeutic context (but also in prevention), in order to monitor progress, achievements and specific modifications. In addition, the documentation of assessments and the training process can be used to increase the patient's motivation.

Evidence of efficacy can be:
- Provided by documentation of daily practice
- May also be demonstrated in the context of small studies or larger, scientific projects

A number of scientific studies are presented in ► Sect. 14.2, which should be reaffirmed by future projects.

12.2.1 In Rehabilitation

The purpose of the rehabilitation process is to recover the condition which preceded injury or illness. In addition to function in purely mechanical terms, other significant aspects of functionality must be considered. These can be dependent on the work and home environment, as well as the activities of the patient, therefore it is vital to obtain a more precise knowledge of **the patient's goals**.

Detailed recording and planning of the training process is especially necessary during rehabilitation, and **documentation** should meet the following parameters:
- Initial diagnosis, including quantitative and qualitative description of symptoms and functional limitations
- Planning of appropriate measures
- A prognosis for development

This process should be repeated at regular intervals utilizing the same criteria, with a renewed diagnosis after 4–6 weeks (depending on the type of pathology). In this way, the synergy of the rehabilitation team and/or the detection of any disruption to the normal rehabilitation process can be assured.

12.2.2 In Physiotherapy Practice

Work in a **physiotherapy practice** is often constrained by time limitations, spatial confinement, and strictly regulated exercise duration. Precisely for these reasons, the documentation of **therapeutic steps** in Pilates training can be helpful. In general, personal responsibility and commitment to a joint approach to resolution need to be maintained over an extended period of time. Clear documentation in the practice environment is therefore constructive and useful.

12.2.3 In the Pilates Studio

Due to the sheer variety of exercises and possible modifications, staff should endeavor to document the program carried out, as fully as possible. **The goals of the client** are paramount. On the basis of the information on health, physical fitness and prior exercise experience gathered at the beginning of training, parameters for training can be defined, documented and monitored.

Appendix

V. Geweniger, A. Bohlander, *Pilates – A Teachers' Manual,*
DOI 10.1007/978-3-642-38114-0, © Springer Berlin Heidelberg 2014

Glossary

Active structures Body tissue that is able to contract, such as muscles

Active starting position Muscle engagement prior to movement, achieved by means of attention, breathing and basic tension created through axial elongation, or dynamic tension

Alignment Orientation of the movement axis in the plane of motion

Articulation of the spine Evenly distributed segmental motion

Axial elongation Active reinforcement of the alignment of the spine

C-Curve of the spine Image describing an evenly curved spine in flexion

Closed chain The distal joint part of a movement is connected to a stable surface

Compliance Internal agreement

Crosslinks Disorganized healed tissue, with adhesions

Diaphragmatic breathing Three-dimensional activation of the diaphragm to utilize the respiratory space

Dynamic tension Functional co-activation of agonist and antagonist

End position Actively maintained body position at the end of an exercise

Feed-forward mechanism Pre-contraction/pre-programming mechanism, controlled by the central nervous system. The contraction of local stabilizers prior to activation of global movement muscles. Recurrent pain, lack of exercise, poor posture or surgery, can lead to inhibition of this pre-contraction and therefore of intersegmental motor control. Pre-contraction of the local stabilizers can be reactivated and relearned through targeted training, e.g., in the lumbopelvic-hip region, through specific training of the pelvic floor, M. transversus abdominis and Mm. multifidii. It is not power that counts, but timing and coordination (Hodges 1996; Hamilton 2009)

Functional group Functionally linked regions of the body

Homeostasis A state of balance, both in both healthy (physiological) and unhealthy states (pathophysiological)

Imprint Traditional term for an active posterior pelvic tilt, with strongly flattened lumbar spine pressed into the mat

Movement category Didactic classification of Pilates exercises

Mid-position The target body position in the movement path of an exercise

Neutral Zone Active stabilized movement range in a joint or spine segment. The control of the neutral zone is an interaction between muscles and structures. "The feed-forward mechanism of the local muscles restricts the neutral zone, without a loss of efficiency of movement. Cocontractions of the global muscles protect against this by rigidity but at the cost of efficiency of movement" (Hamilton 2009)

Open chain The distal joint part of a movement is not connected to a stable surface

Passive structures Noncontractile body tissue, such as tendons, ligaments, fascia, joint capsules and bones

Pelvic floor tension Physiological, reactive activation of the pelvic floor

Pelvis-ribs connection Active dynamically stabilized trunk organization (neutral, flexion, extension, lateral flexion)

Power cylinder Structures that contribute to the stabilization of the center of the body. Active: cylinder muscles (muscles that work together functionally, i. e., the diaphragm, transversus abdominis, the deepest parts of the multifidus, pelvic floor). Passive: spine, disc, vertebrae, ligaments

Powerhouse Group of synergistic trunk muscles (active)

Progression Increase in challenge (c.f. regression)

Proprioception Internal perception of joint positions and body position

Push and Pull Traditional term for active tension

Regression Simplification, decrease in challenge (c.f. progression)

Stabilization, global 1. Trunk stabilization, 2. eccentric deceleration, 3. phasic activity

Stabilization, local 1. Segmental stabilization, 2. little movement, 3. tonic activity

Starting position Position at the beginning of an exercise

Stenosis Narrowing of the intervertebral space

Table Top Position Supine body position, hips and knees flexed at 90°

Tensegrity "Tensional integrity means tensioned unit." The term was coined by designer R. Buckminster Fuller from "tension" and "integrity." "The stability of a tensegrity structure, compared to a continuous compression structure, has less stiffness and more elasticity", and is of "maximum efficiency" (Myers 2010)

Transition Conscious passage or link from one exercise into the next

Transverse system Local stabilizers that run almost transversely. Cervical spine: Obliquus Capitis. Shoulder: Serratus (according to Vleeming), Infraspinatus, Teres Minor, Subscapularis. Lumbar spine: TA, sections of the Multifidus. Hips: Piriformis, Gemelli, Obtoratorii. Knee: Vastus Medialis et Lateralis at 90° flexion

Description of Anatomical Positions and Directions

(From Wottke D (2004) Die große orthopädische Rückenschule. Theorie, Praxis, Didaktik. Springer Berlin Heidelberg)

Axes and Planes

The following descriptions apply to the body in a standing position.

Sagittal Axis Axis that passes through the body from front to back, perpendicular to the horizon.

Transverse Axis Axis that passes from right to left, parallel to the horizon (Frontal axis)

Longitudinal Axis Axis that passes from the head to the feet

Sagittal Plane The plane that is vertical to the transverse axis and divides the body into left side and right side. It is formed by the longitudinal axis and the sagittal axis (mid sagittal plane = medial plane = plane of symmetry).

Frontal Plane This plane is vertical to the sagittal axis, parallel to the forehead and divides the body into front and back parts. It is formed by the longitudinal axis and transverse axis.

Transverse Plane This plane is vertical to the longitudinal axis and divides the body into upper and lower parts (horizontal plane). It is formed by the sagittal axis and transverse axis.

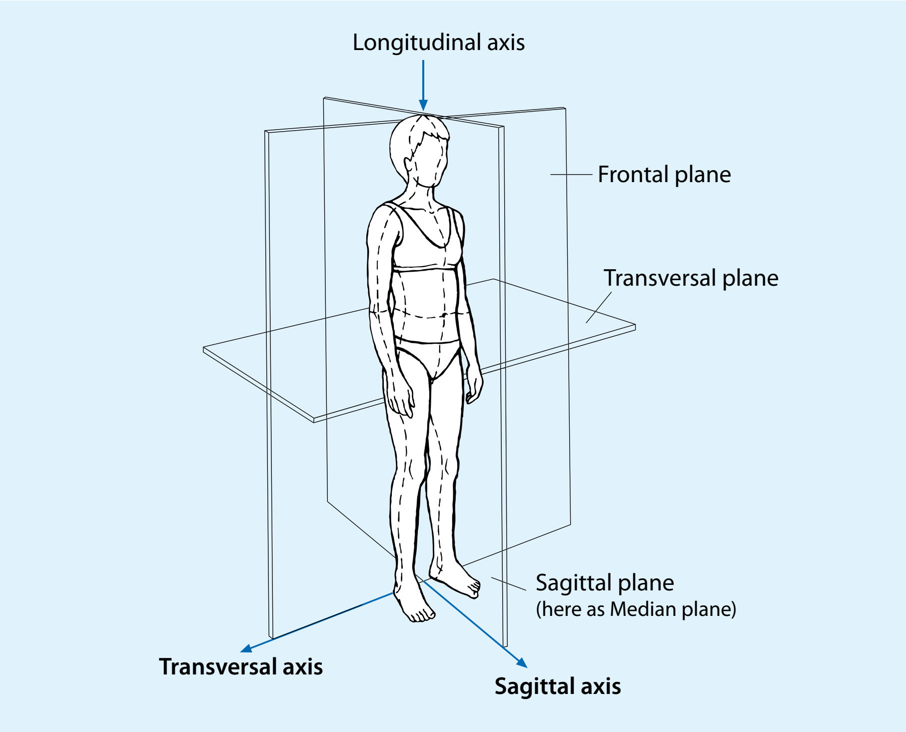


Fig. A.1 Position of the anatomical axes and planes of the human body. Each plane runs along 2 axes, and is perpendicular to the third axis. Thus each axis is at a right angle to the remaining two axes

Description of Positions and Directions

Description of body positions and directions from the frontal and lateral viewpoint.

Anterior	front, to the front
Caudal	toward the feet
Central	toward the center of the body
Cranial	toward the head
Dexter	on the right side (of the patient)
Distal	distant from the center of the body
Dorsal	at the back
Externus	outside, outer, external
Inferior	below, lower
Internus	inside, inner, internal
Lateral	toward the side
Medial	toward the middle
Palmar	toward the direction of the palm
Peripheral	at the edge of the body
Plantar	toward the sole of the foot
Posterior	back, to the back
Profundus	deep
Proximal	part of the extremity that is closer to the center of the body
Radial	toward the thumb side
Sinister	on the left side (of the patient)
Superficial	shallow
Superior	above
Ulnar	toward the little finger side
Ventral	toward the front of the body
Volar	toward the direction of the palm

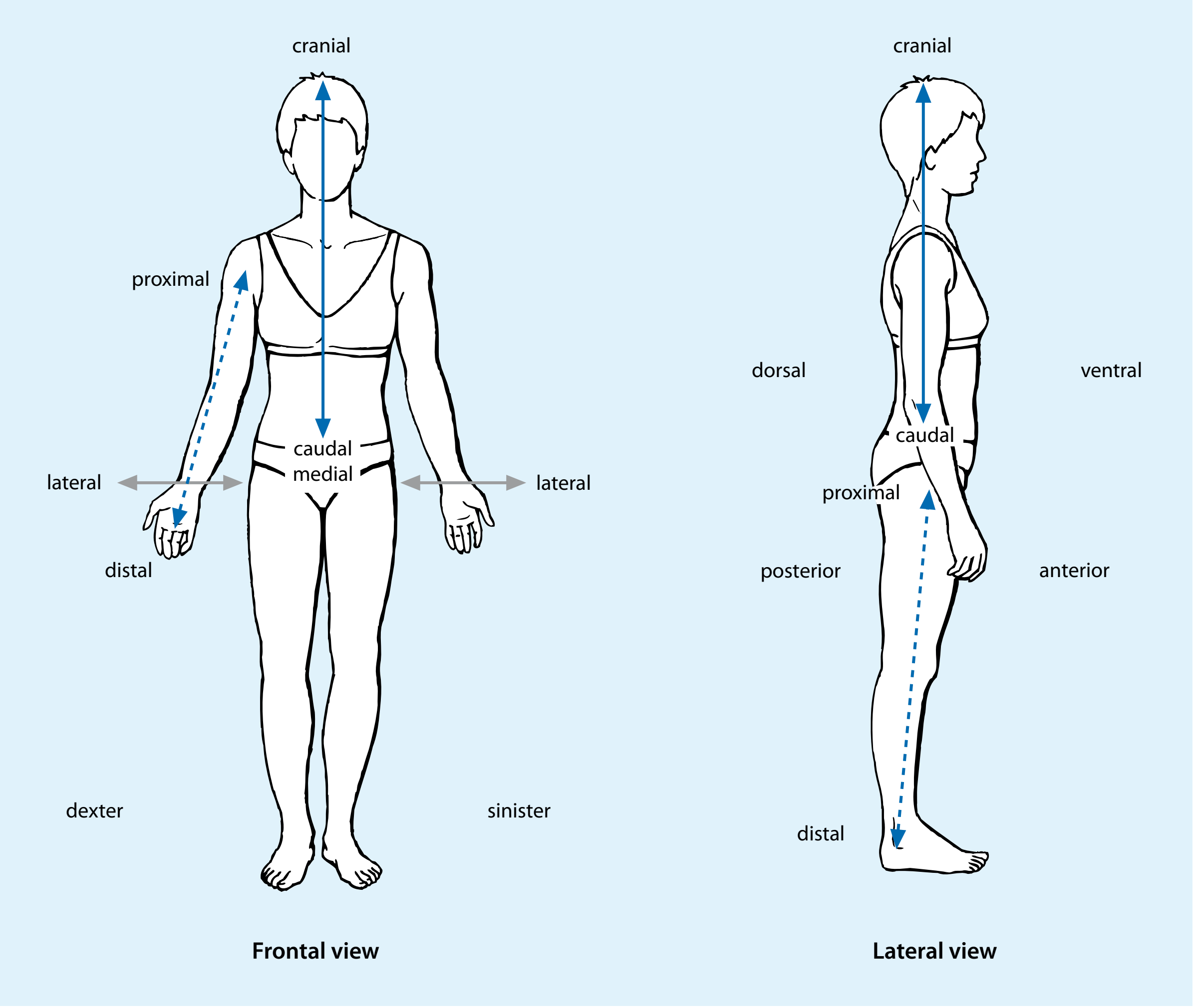
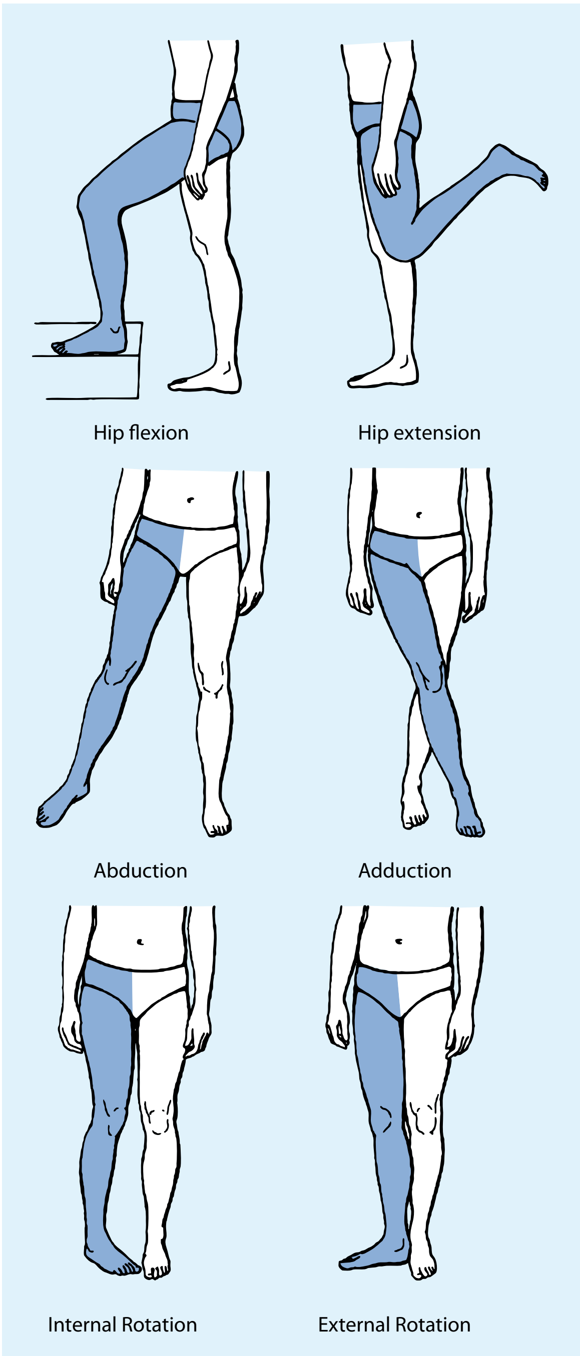


Fig. A.2 Designation of body positions and directions from the frontal and lateral viewpoint

Directions of Movement

Abduction	arm or leg moving outward
Abduct	moving away from the midline of the body
Adduction	moving arm or leg toward the center of the body
Adduct	bring back toward the midline of the body
Anteversion	Moving arm/leg forward
Dorsiflexion	lifting foot/hand
Elevation	lifting horizontally
Extend	straighten
Extension	straightening of a joint
Flex	bend
Flexion	bending at a joint
Lateral flexion	side bending
Palmar flexion	lowering of the hand (= volar flexion)
Plantar flexion	lowering the toes
Pronation	inward rotation of hand/foot with the outer side lifting and inner side lowering
Pronate	rotate hand/foot inward
Retroversion	arm/leg moving toward the back
Supination	outward rotation of hand/foot
Supinate	rotate hand/foot outward
Volar flexion	bending hand toward volar surface of forearm



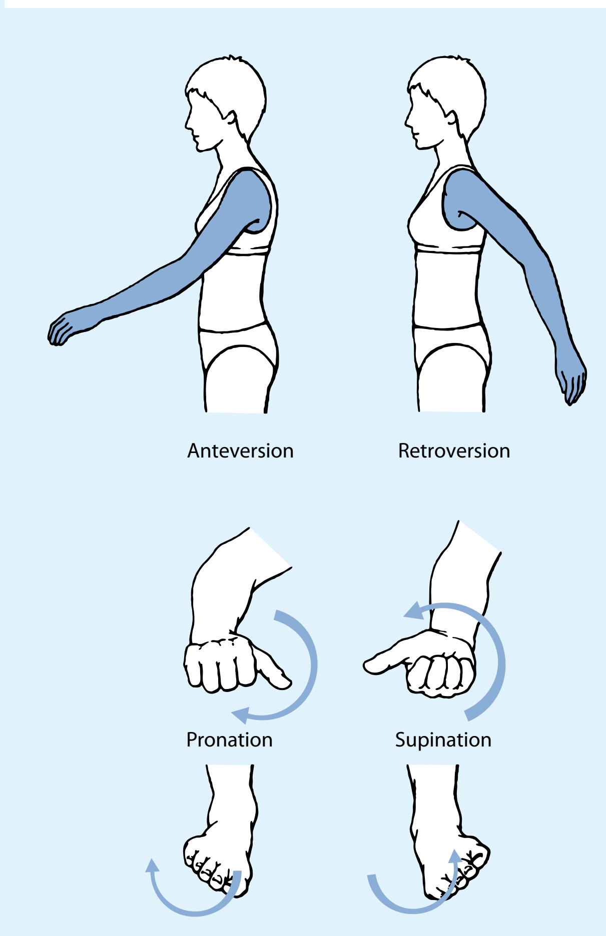


Fig. A.3 Movement terms for the joints of the extremities

Research Literature

Research activity	Summary	Author
Is the Polestar Pilates™ concept an effective continuation therapy for pelvic floor dysfunction after initial physiotherapy to maintain the success of therapy?	The case study investigated whether women with pelvic floor dysfunction could maintain or even increase the success of previous physical therapy with 8-weeks of Polestar Pilates training. Comparative electromyography measurements before and after Pilates training showed improved neuromuscular control of the pelvic muscles in the majority of the subjects following Pilates training. The **results** show that Pilates was effective as a follow-up to initial physiotherapy, for the subjects of this study.	S.F. Stein, H. Wagner (2011)
Can isolated activation of M. transversus abdominis be more effectively triggered by Pilates training than by training with other equipment, and does this represent a link to the relief of nonspecific low back pain?	This study compared the effect of Pilates training with that of un-specified equipment training, for the relief of nonspecific low back pain. Using before and after measurements, the isolated activation of local abdominal muscles, pain levels and functional ability were examined for both groups. **Result:** The machine-training group achieved a significant improvement in everyday functioning. A correlation with the isolated activation of the transversus abdominis could not be established, however.	K. Auer, E. Reineck (2010)
Effects of the Polestar method of Pilates training on the activity of the transversus abdominis, external oblique, internal oblique and pelvic floor muscles	Comparison of neuromuscular triggering of the pelvic floor muscles and the deep abdominal muscles during the execution of Pilates exercises. One group of subjects had previously taken part in Pilates training, the other group had no experience. Electromyographic activity of the pelvic floor muscles, lower abdominal muscles and accessory muscles were measured, firstly during Multi-activity tests and secondly during selected Pilates mat exercises. **Results**: The multiactivity tests showed that Pilates trained subjects' pelvic floor muscles had a higher level of endurance. They were able to activate the muscles more strongly during mat exercises, and could perform the exercises with more control than the untrained subjects. This suggests that long-term Pilates training can lead to increased muscular endurance of the pelvic floor muscles, improved activation of the deep abdominal muscles, and strengthening of core control.	C. Kunkelmann (2010)

Research activity	Summary	Author
Pilates exercise as a therapeutic movement technique for depression – an intervention comparison with endurance training	Two movement therapy methods – Pilates and aerobic exercise (walking/jogging) – were analyzed for their impact on hospitalized, depressed patients. Research followed a controlled, two-group design with 60 subjects recruited, and randomly assigned to one of two intervention groups. Each subject took part in a 5-week therapeutic exercise program (3x/week 60 minutes of Pilates or walking), the design of which reflected a specific methodological approach, with a focus on the manifestation of depressive disorders. To define training parameters, subjects completed initial, continuing and concluding diagnoses as well as catamnesis. Parallel to the movement program, all subjects received identical multimodal depression therapy in a clinic. The antidepressant effect of endurance training has already been established in numerous studies. **The aim of this study** therefore was to investigate the suitability of Pilates in this field, and clarify to what extent if any, the methods differed in their effects on patients. The following parameters thus provided the focus of study during the intervention period: changes in depression, body image, competence and control conviction, coordination and submaximal endurance over the 5-week period. Changes in mood and body image were tested during the course of each therapy session. The catamnesis after 16 weeks encompassed the current level of physical activity and motivation, in addition to the level of depression. Although the evaluation of data demonstrated some significant differences in the investigated patient samples, these differences were not specific enough to be extrapolated to the reference population **Result:** In summary, the Pilates method may be considered a suitable movement therapy for the treatment of depressive patients. However this study was not able to demonstrate significant differences in comparison to the endurance method.	S.M. Opitz (2011)
Analysis of the effects of 8-week Pilates training on movement quality, using running as an example	The study analyzed whether Pilates can help runners improve their quality of movement. Female volunteers aged 20–40 years, were selected, with prior experience in running. The changing running motion of the subjects was illustrated and discussed, using a comprehensive analysis of movement before and after 8-weeks of Pilates training. The **results** of the study will be available in 1–2 months.	H. Felder (2011)

Useful Contacts and Addresses

4.1 Manufacturers

Pilates Equipment and Supplies

- Balanced Body equipment: www.sissel.de
- Gratz Pilates – Gratz Industries: www.pilates-gratz.com
- PEAK Pilates – equipment: www.peakpilates.com
- STOTT Pilates – equipment: www.stottpilates.com

Pilates Small Apparatus and Mats

- OPTP: www.optp.com
- Sissel: www.sissel.de
- Core Band: www.kathycoreypilates.com
- TOGU: www.togu.de
- YOGISTAR: www.yogistar.com
- AIREX: www.airex.de

4.2 Recognized Teacher Training Programs

- **APPI Health group**

APPI Ltd Lower Ground Floor 50 – 52 Kilburn High Road London, NW6 4HJ, UK
info@appihealthgroup.com
www.appihealthgroup.com

- **BASI® Pilates**

Natascha Eyber
Maisacher Straße 100a, 82256 Fürstenfeldbruck
natascha@basipilates.net
www.basipilates.de

- **Peak® Pilates**

Core Pilates by Simone Hörster
Planufer 92d, 10967 Berlin
training@corepilates.de
www.corepilates.de

- **Essence-Pilates**

Kerstin Reif
Kohlhökerstr. 53, 28203 Bremen
studio@essence-pilates.de
www.essence-pilates.de

- **STOTT PILATES (www.merrithew.com)**

Pilatesbody by Michaela Bimbi-Dresp
Wittelsbacherstraße 16, 80469 München
Michaela.Bimbi-Dresp@t-online.de
www.pilatesbody.de

- **PILATES Bodymotion GbR**

Britta Brechtefeld und Ute Weiler
Klutstein 22, 51467 Bergisch Gladbach
info@pilates-bodymotion.de
www.pilates-bodymotion.de

- **Pilates New York**

Davorka Kulenovic-Bischoff
Ostendstraße 72, 70188 Stuttgart
info@pilates-newyork.de
www.pilates-newyork.de

- **Pilates Polestar**

Krefelder Straße 18, 50670 Köln
info@pilatespolestar.de
www.pilatespolestar.de

- **Peak Pilates®**

Studio Pilates Erlangen by Susan Colijn
Lazarettstr.4, 91054 Erlangen
studio@pilates-erlangen.de
www.pilates-erlangen.de

- **The Pilates Standard**

Juliana Afram
Kanalstraße 38, 22085 Hamburg
juliana@powerpilatesonline.de
www.powerpilatesonline.de

- **THE BODY IN BALANCE STUDIO U.G.**

Joanna Mounitfield
Mehringdamm 69, 10961 Berlin
info@pilatesberlin.de
www.pilatesberlin.de

- **art of motion training in movement® – Switzerland & Australia**

Karin Gurtner Zentweg 17a, 3006 Bern, Switzerland
info@art-of-motion.com
www.art-of-motion.com

4.3 Professional Organizations

Deutscher Pilates Verband e. V. – Association of Certified Pilates Instructors

The DPV e. V. (founded 2006) is a nonprofit, professional association of German Pilates trainers who have completed a sound training and have a commitment to regularly attend continuing training courses.

Since its foundation, the DPV has been a working partner of the German statutory health insurers. It has been instrumental in achieving the recognition of Pilates mat training for prevention courses according to § 20 SGB V, and ensuring that participation can be subsidized.

Lobbying on behalf of dedicated Pilates trainers, the Association aims to provide the German public with information and increase awareness of the value of quality education. The DPV e. V. also represents the problems and interests of its members, helping to protect them from unfair competition and providing resources and advice. Those who have completed their professional education outside the European Union may gain access by completing an independent examination set by the DPV.

Membership of the organization is a mark of quality for Pilates trainers. The health-conscious and other interested parties can find a list of certified trainers on the Associations website on the Internet.

Contact:

Alte Darmstädter Str. 12 A , 64367 Mühltal/Trautheim
Tel. +49-01-51-1200-3653
www.pilates-verband.de
www.pilates-forum.de
www.pilates-trainer.de

Pilates Method Alliance

The Pilates Method Alliance (PMA) is an international, nonprofit, professional association and certifying body, committed to the teachings of Joseph H. and Clara Pilates. Its mission is to support the interests of the community in all its diversity and integrity, to establish certification, to continue education standards and to spread the Pilates method.

Contact:

Pilates Method Alliance
PMA PO Box 370906 , Miami, FL 33137-0906, USA
US Toll Free: +1-866-573-4945
Tel: +1-305-573-4946
Fax: +1-305-573-4461
info@pilatesmethodalliance.org
www.pilatesmethodalliance.org

References and Further Reading

Research Literature

References and Further Reading

Adamany K (2005) Post pregnancy Pilates. Penguin, New York

Adouni M, Shirazi-Adl A (2009) Knee joint biomechanics in closed kinetic-chain exercises. Comput Meth Biomech Biomed Eng 12(6):661–670

Anderson B (2005) Randomized clinical trial comparing active versus passive approaches to the treatment of recurrent and chronic low back pain. University of Miami, Miami

Anderson B, Spector A (2000) Introduction to Pilates based rehabilitation. Orthop Phys Ther Clin N Am 9:395–410

Anderson B (2004) Polestar Ausbildungshandbuch. Polestar GmbH, Köln

Bernard A (1997) An introduction to Ideokinesis. Contact Quarterly (Reprint No. 3). Ideokinesis and Creative Body Alignment. Summer/Fall, pp 24–25

Betz S (2009) Thera-Pilates® for Low Back Pain, Arbeitsbogen. POT-Tagung, Wiesbaden

Bimbi-Dresp M (2006) Das große Pilates-Buch. GU, München

Blech J (2007) Bewegung, die Kraft, die Krankheiten besiegt und das Leben verlängert. Fischer, Frankfurt/Main

Bohlander A (1997) Das Pilates-Polestar Konzept in der Physiotherapie. Ztschr für Physiotherapeuten 7:1147–1153

Brügger (1986) Die Erkrankungen des Bewegungsapparates und seines Nervensystems. Urban & Fischer, Frankfurt/Main

Bunton E, Pitney W, Kane A, Cappaert T (1993) The role of limb torque, muscle action and proprioception during closed chain rehabilitation of lower extremity. J Athl Training 28(1):10–20

Calais-Germain B (2006) Anatomy of breathing. Eastland Press, Seattle

Calais-Germain B (1999) Anatomie der Bewegung. Fourier, Wiesbaden

Chaitow L (2004) Maintaining body balance, flexibility and stability. Livingstone, London

Da Fonseca J, Magini M, de Freitas T (2009) Laboratory gait analysis in patients with low back pain before and after a Pilates intervention. J Sport Rehabil 18(2):269–282

Deutsche Rentenversicherung (2003) Grundsatzpapier der Rentenversicherung zur Internationalen Klassifikation der Funktionsfähigkeit, Behinderung und Gesundheit (ICF) der Weltgesundheitsorganisation (WHO)

Disse O (2007) Köperwahrnehmung bei chronischem Rückenschmerz im Rahmen kognitiver Verhaltenstherapie [Sensory motor learning as part of cognitive-behavioural therapy with chronic low back pain. Psychotherapie 12:101–114

Dowd I (2005) Taking root to fly – Articles on functional anatomy, 6th edn. Eigenverlag Irene Dowd, New York

Egoscue P, Gittines R (1999) Schmerzfrei Leben. Beust Verlag, München

Ehlenz H, Grosser M, Zimmermann E (2003) Krafttraining. Grundlagen, Methoden, Übungen, Trainingsprogramme. BLV Buchverlag, München

Ehrlenspiel F, Maurer H (2007) Aufmerksamkeitslenkung beim motorischen Lernen. Ztschr für Sportpsychologie 14(3):114–122

Emery K, de Serres S, McMillan A, Coté J (2010) The effects of a Pilates training program on arm-trunk-posture and movement. Clin Biomech (Bristol Avon) 25(2):124–130

Endleman I, Critchley D (2008) Transversus abdominis and obliquus internus activity during Pilates exercises with ultrasound scanning. Arch Phys Med Rehabil 89:2205–2212

Esamilla R, Fleisig S, Zheng N, Barrentine S, Wilk K, Andrews J (1998) Biomechanics of the knee during closed kinetic chain and open kinetic chain activities. Med Sci Sports Exerc 30:556–569

Feldenkrais M (1981) Die Entdeckung des Selbstverständlichen. Suhrkamp, Frankfurt/Main

Feldenkrais M (1985) Das starke Selbst. Suhrkamp, Frankfurt/Main

Fenske M (2007) Die segmentale Stabilisierung der Lendenwirbelsäule – Biomechanik, Wirkungsweise und Training der stabilisierenden Muskulatur. Physiotherapie 1:17–23

Fiasca P (2009) Discovering pure classical Pilates. Eigenverlag, Milton Keynes

Fischer P (2006) Wirbelsäulen-Fitness. Trias, Stuttgart

Franklin E (1998) Locker sein macht stark. Kösel, München

Friedman P, Eisen G (2005) The Pilates method of physical and mental conditioning. Penguin Books, London

Gallagher S, Kryzanowska R (1999) The Pilates method of body conditioning. Bainbridge Books, Philadelphia (PA)

Gallagher S, Kryzanowska R (2000) The complete writings of Joseph H. Pilates: Your Health 1934 – Return to Life Through Contrology1945, The authorized editions. Bainbridge Books, Philadelphia (PA)

Gladwell V, Head S, Haggar M, Beneke R (2006) Does a program of Pilates improve chronic non-specific low back pain? J Sport Rehabi 15:338–350

Gottlob A (2001) Differenziertes Krafttraining mit Schwerpunkt Wirbelsäule. Urban & Fischer, München

Grant K, Fletcher R (2001) Oral communication. Founding meeting of the PMA, Miami 2001

Grant K (2001) Oral communication. Founding meeting of the PMA, Miami 2001

Green Y, King M (2002) Pilates workbook for pregnancy. Ulysses Press, Berkeley (CA)

Halprin A (1997) Bewegungsritual – Tänzerische Meditationsübungen. Hugendubel, München

Hamilton C (2009) Lokale Stabilität der Gelenke. Handout Hamilton, Regensburg

Hanna T (2000) Beweglichg sein – ein Leben lang. Kösel, München

Hanna T (1986) Physical education as somatic education: A scenario of the future. In: Kleinman S (ed) Mind and body: East meets West. Human Kinetics Publishers, Champaign, pp 175–181

Herdman A, Selby A (1999) Pilates – creating the body you want. Gaia Books, London

Herdman A, Selby A (2000) Das große Buch Pilates. Econ. Ullstein, Berlin München

Herrington L, Davies R (2005) The influence of Pilates training on the ability to contract the transversus abdominis muscle in asymptomatic individuals. J Bodywork Mov Ther 9:52–57

Hides J, Jull G, Richardson C (2001) Long-term effects of specific stabilizing exercises for first-episode low back pain. Abstract Exercise physiology and physical exam. Lippincott Williams & Wilkins, Philadelphia

Hodges P (1999) Is there a role for transversus abdominis in lumbopelvic stability? Man Ther 4(2):74–86

Hodges P, Richardson C (1996) Inefficient muscular stabilization of the lumbar spine associated with low back pain: A motor control evaluation of transversus abdominis. Spine 21(22):2640–2650

Hüter-Becker A (ed) (2002) Bewegungssystem Lehrbuch zum Neuen Denkmodell der Physiotherapie vol. 1. Thieme, Stuttgart

Isacowitz R (2006) Pilates. Human Kinetics, Champaign (IL)

Janda V (1994) Manuelle Muskelfunktionsdiagnostik. Ullstein, Berlin

Johnson EG, Larsen A, Ozawa H, Wilson CA, Kennedy K (2007) The effects of Pilates based exercise on dynamic balance in healthy adults. J Bodywork Mov Ther 11:238–242

Journal Lennox Hill Hospital (1960) Scope Weekly Special (5 October 1960)

Junginger B (2009a) Presentation, Physiotherapist Congress 2009, Fellbach

Junginger B (2009b) Dysfunktion und Training des Beckenbodens. Uro-News. http://www.physiotherapiejunginger.de. Cited December 2009

Keller Y, Krucker J, Seleger M (2007) BeBo® Gesundheitstraining. BeBo Verlag, Zürich

Kempf HD (2010) Die neue Rückschule. Springer, Heidelberg Berlin New York

Kibler B, Livingston B (2001) Closed chain rehabilitation for upper and lower extremities. J Am Acad Orthop Surg 9(6):412–421

Klinkenberg N (2007) Achtsamkeit in der Körperverhaltenstherapie. Klett Cotta, Stuttgart

Knebel KP (2005) Muskelcoaching: Top in Form mit Stretching. Rororo, Hamburg

Korsten-Reck U, Marquardt K, Wurster KG (2009) Schwangerschaft und Sport. Dt Zeitsch für Sportmedizin 60(5):117–121

Kuhnt O (2005) Die kognitive Leistungsfähigkeit bei chronischem Lumbalsyndrom. Universität Gießen (Dissertation)

Lange C, Unnithan V, Larkam E, Latta P (2000) Maximizing the benefits of Pilates-inspired exercise for learning functional motor skills. J Bodyw Move Ther 4:99–108

Larence AS (1997) The Pilates Trademark Cancellation. Newsletter Vol. 1, No. 1, New York

Larsen C (1997) Die S-Form der Wirbelsäule. Physiotherapie ÖPV Wien 2:1–8

La Touche R, Escalante K, Linares MT (2008) Treating non-specific chronic low back pain trough the Pilates method. J Bodyw Mov Ther: doi:10.1016/j.jbmt.2007.11.004

Lesson D (2011) Written communication

Lyon D (2005) Pilates for men. Harper Collins, New York

Martins P (1997) New York City Ballet Workout: Fifty stretches and exercises anyone can do for a strong, graceful and sculpted body. William Morrow and Company Inc., New York

Massey P (2010) Pilates Anatomie. Riva, München

Maxwell J, Masters R, Eves F (2000) From novice to no know-how: A longitudinal study of implicit motor learning. J Sports Sci 18:111–120

McMullen J, Uhl T (2000) A kinetic chain approach for shoulder rehabilitation. J Athl Train 35(3):329–337

Melzack R (1999) From the gate to neuromatrix. Pain Suppl 6:121–126

Melzack R (2004/2005) Evolution of the neuromatrix theory of pain. The Prithvi Raj Lecture: Presented at the Third World Congress of World Institute of Pain, Barcelona

Myers TW (2004) Anatomy Trains, 1st edn. Elsevier, München

Myers TW (2010) Anatomy Trains, 2nd edn. Elsevier, München

Panjabi M (1992) The stabilizing system of the spine, Part I: function, dysfunction, adaption and enhancement. J Spinal Disc Techn 5(4):383–389

Paterson J (2009) Teaching Pilates for postural faults, illness & injury. Elsevier, Butterworth Heinemann, Oxford (UK)

Pilates Method Alliance (2005) The PMA Pilates Certification Exam Study Guide. Pilates Method Alliance Inc., Miami (FL)

Pilates Method Alliance (2007) The PMA Pilates Certification Exam Study Guide. Pilates Method Alliance Inc., Miami (FL)

Pilates Method Alliance (2007) Handbuch der PMA-Tagung "Pilates for everybody" 2007. Pilates Method Alliance Inc., Miami (FL)

Porterfield JA, DeRosa C (1991) Mechanical Low Back Pain: Treatment of Lumbopelvic Disorders. WB Saunders, Philadelphia (PA)

Redfield S (2011) Whisper Down Pilates Part I & II. http://www.physicalmethods.com. Cited 20 March 2011

Redfield S (2011) Chasing Joe Pilates. http://www.physicalmethods.com. Cited 20 March 2011

Richardson C, Hodges P, Hides J (2009) Segmentale Stabilisation im LWS- und Beckenbereich. Elsevier, München

Rivera J (1994) Open versus closed kinetic chain rehabilitation of the lower extremity: A functional and biomechanical analysis. J Sport Rehabil 3:154–167

Rodrigues S, de Guedes B, Samaria A, Torres B, Oliver N, Ediléa Monteiro O, Dantas M, Henrique E (2010) Pilates method in personal autonomy, static balance and quality of life of elderly females. J Bodyw Mov Ther 14(2):195–202

Rydeard R, Leger A, Smith D (2006) Pilates based therapeutic exercise: effects on subjects with nonspecific chronic low back pain and functional disability: a randomized controlled trial. J Orthop Sports Phys Ther 36(7):472–484

San Miguel L (2011) Oral communication. Conference, Mönchengladbach

Sapsford R, Hodges P, Richardson C, Cooper D, Markwell G (2001) Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. Neurol Urodynamic 20(1):31–42

Schleip R (2009) Faszien im Zentrum der Aufmerksamkeit. Medical Tribune 13. http://www.somatics.de. Cited 4 June 2011

Schmidt M, Klümper A (1989) Basisgymnastik für Jedermann vol. I. Reba-Verlag, Darmstadt

Schmidt M, Klümper A, Rießland M (1990) Basisgymnastik für Jedermann vol. II. Reba-Verlag, Darmstadt

Schmidt M, Klümper A, Rießland M (1991) Basisgymnastik für Jedermann vol. III. Reba-Verlag, Darmstadt

Schöllhorn W et al (2009) Differenzielles Lehren und Lernen im Sport. Ztschr Sportunterricht 2:36–40

Segal NA, Hein J, Basford JR (2004) The effects of Pilates training on flexibility and body composition: An observational study. Arch Phys Med Rehabil 85:1977–1981

Seidenspinner D (2005) Training in der Physiotherapie. Springer, Heidelberg Berlin New York

Siler B (2000) The Pilates body. Broadway Books, New York

Stepper S, Strack F (1993) Attitudes and social cognition. Proprioceptive determinants of emotional and nonemotional feelings. J Pers Soc Psychol 64:211–220

Stinger R (1986) Sports performance. A five-step mental approach. JOPERD 4:82–84

Streicher H (2005) Virtuose Harmonie zwischen Nerv und Muskel-koordinatives Training in der Medizinischen Trainingstherapie. Die Säule 15(4):167–172

Todd M (2001) Der Körper denkt mit: Anantomie als Ausdruck dynamischer Kräfte. Huber, Bern (Nach der Originalausgabe "The Thinking Body" 1937)

Ungaro A (2002) Pilates. Dorling Kindersley Verlag, Starnberg

Vad V (2004) Back RX. A 15-Minute-a-day Yoga- and Pilates-Based Program to End low Back Pain. Gotham Books, New York

Valerius KP et al (2002) Das Muskelbuch: Anatomie, Untersuchung, Bewegung. KVM, Marburg

Van Lysebeth A (1999) Die große Kraft des Atems. Scherz Verlag, Bern München Wien

Van Wingerden B (1998) Bindegewebe in der Rehabilitation. Scipro, Frankfurt

Verstegen M (2010) Core Performance. Riva, München

Vleeming A, Mooney V, Stoeckart R (2007) Movement, Stability und Lumbopelvic Pain. Elsevier, London

Vleeming A (2011) Funktionelle Anatomie. Berlin (Kursunterlagen Juni 2011)

Weineck J (2010) Optimales Training. Spitta Verlag, Balingen
Weitzer K (2010) Sich vom Schmerz befreien – Spannungen abbauen – Ins Gleichgewicht kommen – Beschwerdefrei leben. Kösel, München
WHO (2005) Internationale Klassifikation der Funktionsfähigkeit, Behinderung und Gesundheit
WHO (2011) Global recommendations on physical activity for health. http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/index.html. Cited 21 May 2011
Wilk K, Arrigo C, Andrews J (1993) Closed and open kinetic chain exercise for the upper extremity. J Sport Rehabil 5(1):88–102
Wulf G (2009) Aufmerksamkeit und motorisches Lernen. Elsevier, München
Wottke D (2004) Die große orthopädische Rückenschule. Theorie, Praxis, Didaktik. Springer, Berlin Heidelberg

Websites

http://www.ideokinesis.com. Cited19 June 2011
http://innere1.uk-koeln.de/forschung/ag-sportonkologie. Cited 25 September 2011
http://www.polestarpilates.com/files/Pilates%20References-2013a.pdf. Cited 12 February 2014
http://www.sportundschwangerschaft.de. Cited 19 June 2011
http://www.wido.de. Cited 24 April 2010
http://www.wikipedia.org/training. Cited 24 April 2011

DVDs on History

Bowen M (n.d.) Joseph H. Pilates, demonstrating the principles of his method with Clara, students and friends. Compiled and edited by Mary Bowen from Joe Pilates's private film collection 1932–1945. From http://www.pilates-marybowen.com
Power Pilates Inc. (2005) Archival Footage of Joseph Pilates. From http://www.powerpilates.com

Trainings DVDs/CDs (Recommendations)

Classical Pilates Technique (2002) The complete Mat Workout Series, Classical Pilates Inc. From www.classicalpilates.net
Classical Pilates Technique (2002) The complete Universal Reformer Series. Classical Pilates Inc. From www.classicalpilates.net
Classical Pilates Technique (2002) The Studio Equipment Series. Classical Pilates, Inc. From www.classicalpilates.net
Geweniger V (2001) Pilates Matwork. Sissel, Bad Dürkheim
Geweniger V (2005) Roller und Circle Workout. Sissel, Bad Dürkheim
Geweniger V (2005) Pilates Ball und Ball Workout. Sissel, Bad Dürkheim
Pilates Gesundheit (2010) Schlanke und gesunde Beine. Polyband, München
Pilates Gesundheit (2010) Gesunder Nacken und Schultern. Polyband, München
Pilates Gesundheit (2010) Starker und gesunder Rücken. Polyband, München
Pilates Gesundheit (2010) Die besten Übungen für 50. Polyband, München
Polestar Pilates Podcast Edition 1 (2011). Polestar, Köln
Romana on Pilates (2006) The Legacy Edition, 4 CDs. Basil Blecher
Ungaro A (2000) Portable Pilates Mat Class at the Pilates Center of New York. Tribeca Bodyworks, New York

Scientific Studies on Pilates

Auer K, Reineck E (2010) Vergleichende Studie: Transversusspannung nach Pilates-/Kieser-Training – Auswirkung auf Schmerzlinderung [Comparative study on the effectiveness of Pilates compared with Kieser training]. Physical Therapy BAC, Hochschule 21 Buxtehude
Dudenhöfer M (2007) Veränderung der aktuellen und habituellen Befindlichkeit bei Frauen durch ein achtwöchiges Pilates Training. Deutsche Sporthochschule, Köln (Thesis)
Felder H (2011) Auswirkungen eines 8-wöchigen Pilates-Trainings auf die Lauftechnik. Sports Science BAC, Deutsche Sporthochschule, Köln (Effects of Pilates on runners' performance)
Giesecke N (2003) Kooperation als Unternehmensstrategie auf Auslandsmärkten an einem Marketingkonzept für die Polestar Deutschland GmbH. Deutsche Sporthochschule, Köln (Thesis)
Grenz K (2010) Effekte auf die WS-Form, isometrische Anspannung der Rückenstreckmuskulatur [Effects on spinal alignment and back stability]. Thesis, Universität HH Bewegungswissenschaften
Haider IB (2007) Die Steigerung der Aktivität des M. transversus abdominis durch Pilates-Training. Wien (Master's thesis)
Hamm M (2001) Zur Brauchbarkeit der Pilates-Methode für Balletttänzerinnen. Department of Sport, Mainz (Thesis)
Kunkelmann C (2010) Effizienz der Pilates-Methode/Auswirkung auf den Tonus von M. transversus, Mm. obliquus int./ext., Beckenbodenfunktion. Physical Therapy BAC, FH Fresenius, Idstein (Efficiency of Pilates for pelvic floor function)
Lambriew D (2011) Effekte des Pilates-Trainings innerhalb der Polestar Pilates-Ausbildung unter Verwendung des Polestar Fitness-Screenings [Effects of Pilates in an educational program with Pilates screening]. Master's thesis, Sports and Exercise Sciences, University of Salzburg
Lenz S (2010) Effizienz der Pilates-Methode bei Beckenbodendysfunktion. Physical Therapy BAC, FH Fresenius, Idstein (Efficiency of Pilates for pelvic floor dysfunction)
Opitz SM (2011) Pilates als bewegungstherapeutische Methode bei Depressionen – Ein Interventionsvergleich mit einem Ausdauertraining. Universität Rostock (Dissertation)
Ritter M (2005) Die Pilates-Methode – Trainingsmöglichkeiten für die Anforderungen im alpinen Skisport. Deutsche Sporthochschule, Köln (Thesis)
Stein SF, Wagner H (2011) Effizienz der Pilates-Methode als Folgetherapie nach BB-Dysfunktions-Therapie. Physical Therapy BAC FH Fresenius, Idstein (Efficiency for follow-up after pelvic floor reeducation)
Thielke S (2011) Pilates-Training für Wettkampfsportler einer Sportklasse, Auswirkung auf die Wettkampfleistung (Pilates in a competitive sports class). Physical Therapy BAC, Hochschule 21 Buxtehude
Wellhöfer A (2011) Unterstützende Wirkung von K-Tape auf die Effekte einer Pilates-Anfängergruppe [Supportive use of elastic tape in Pilates training]. Project in Cooperation with K-Tape, Köln

Index