PILATES:
A Corrective System of Exercise

by Mariana Shedden, M.S. and Len Kravitz, Ph.D.

LEARNING OBJECTIVE

- To understand the guiding exercise science principles and supportive research of Pilates program design.

Key words:
Stabilization, Injury Rehabilitation, Flexibility, Low-Back Health, Muscular Strength and Endurance

The popularity of the Pilates method created by Joseph H. Pilates in the early 1920s has increased worldwide in the last decade, confirming the fact that Pilates is much more than a fitness fad. According to a survey conducted by American Sports Data Inc, more than 10.5 million Americans participated in a Pilates class in 2004 (1). But the key question is, ''What does Pilates add to the fitness industry?''

BRIEF HISTORY

Pilates created his own philosophy about physical fitness, which, amazingly, is in close agreement with several modern principles of fitness. The foundation of the Pilates method is to attain harmony between mind and body, which comes from an ancient Greek philosophy and attitude toward physical activity. Pilates originally called his method ''Contrology'' which refers to the complete coordination of body, mind, and spirit. In his book (2), he states, ''Contrology develops the body uniformly, corrects wrong postures, restores physical vitality, invigorates the mind, and elevates the spirit.'' Pilates believed that the connection between physical training and mental happiness was an essential and integral part of everyone's life.

Pilates started his work rehabilitating hospitalized patients confined to bed rest. Then, he became a successful physical trainer helping well-known dancers to rehabilitate from injuries and improve their performance. He published two books but did not conduct any systematic research on the benefits touted by his method. However, he did keep records of the changes in form and posture with his students after the practice of what he called ''a corrective system of exercising'' (3).

The major difference between classic and contemporary schools of Pilates is how the exercises are performed. Many of the original Pilates exercises were performed with a posterior pelvis tilt (flat back). At that time, Pilates thought that the spine should be kept flat as a ''plumb line.'' The classic Pilates schools have kept this method intact, whereas contemporary schools have incorporated the concept of neutral spine as the safest and correct position of the spine (Figure 1).

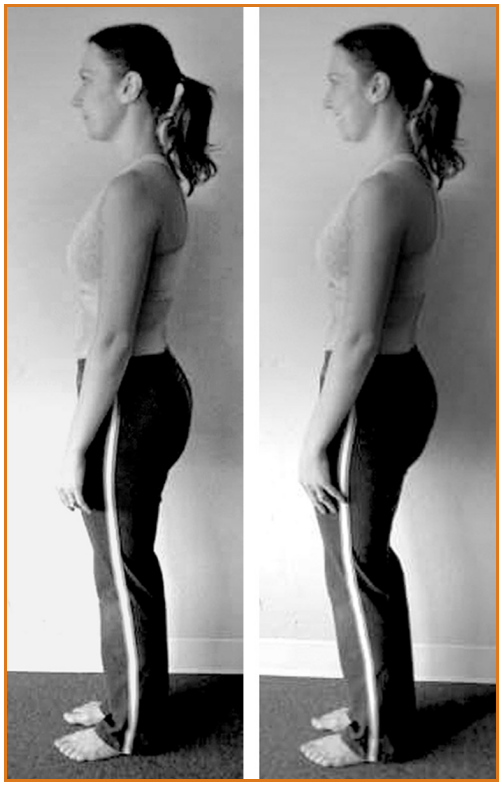

Figure 1. Neutral Spine vs. Flat Back.

UNDERSTANDING THE PILATES APPARATUS

Designing a Pilates program that includes mat and apparatus exercises requires a highly trained and educated Pilates professional. The Pilates exercise repertoire includes floor and apparatus work. The floor work uses gravity as the primary tool to increase difficulty. Also, small apparatuses such as the fitness circle, resistance bands, physioballs, foams, and small weighted balls are some of the common small props used to increase difficulty or to modify any given exercise. However, of these devices, only the fitness circle was created by Pilates as part of his original work. He also used the ladder barrel and the small barrel, both of which have a semicircle shape that serve to accommodate the shape of the spine and provide postural assistance using gravity to increase the difficulty of the exercises. Other apparatuses used in Pilates training are the reformer, cadillac, wunda chair, and pedipull, which all provide resistance by springs of differing tension (Figure 2). These tension springs are designed to become longer under load. One of the physical properties of springs is that they store elastic mechanical energy because of stretching or compression. This elastic mechanical energy storage results from change in the spring position from its equilibrium or unstretched position. The springs can provide assistance and increase the resistance depending on the exercise.

DOES RESEARCH SUPPORT THE EFFECTIVENESS OF THE PILATES METHOD?

Research on the effectiveness of Pilates exercise is limited. However, research on spine stability indirectly supports the foundation of this method. The Pilates method is based on stabilization of the spine during the execution of all exercises. The stability of the spine allows the back to support loading while maintaining a given posture or while performing a specific movement. The achievement of spine stability has been associated with a decreased risk of lower back injury (4,5). Several studies support the concept that spine stability in healthy individuals is achieved by coactivation of the paraspinal and abdominal muscles (6–8). The Pilates method promotes conscious involvement of the deep abdominal muscles with the purpose of stabilizing the spine. Pilates practitioners commonly cue clients to ''pull navel to spine.'' This ''drawing in maneuver'' of the abdomen is referred to as abdominal hollowing by P. Hodges et al (9). These researchers suggest that a delayed contraction of the transversus abdominis in individuals with lower back pain can result in an improper stabilization of the spine. On the other hand, S. McGill (10) proposes that proper stability of the spine is achieved by coactivation of the transversus abdominis with the internal and external obliques, which he calls bracing (Figure 3).

The Pilates method also teaches how to recruit the pelvic floor muscles during the execution of many exercises. R. R. Sapsford and P. W. Hodges (11) suggest that voluntary contraction of the abdominal muscles increases the contraction

Photos courtesy of Mariana Shedden, M.S.

Figure 2. Equipment pictured from left to right include: small barrell, wunda chair, reformer, cadillac, ladder barrell, and Ped—Pull.

of the pelvic floor muscles, which also may be useful in preventing urinary incontinence.

PILATES BENEFITS SUPPORTED BY THE LITERATURE

The following section will highlight some known benefits of Pilates training. Specific implications and practical applications will be included for fitness professionals.

Motor control

A. McMillan et al (12) reported that Pilates training, which included mat and apparatus work, allowed dancers to achieve better motor control because of the emphasis placed on spine stability. This improved motor control translated into a significant decrease in body sway and an improvement in body alignment during the performance of a grand plie (similar to a squatting action) used in dance.

Practical application and implications

Pilates mat and reformer exercises can be used to increase body awareness. The emphasis of Pilates on neutral spine and proper stabilization of the lumbar spine can help clients achieve the motor control necessary to create the correct integration of muscles, bones, and neural function.

Range of motion

S. Fitt et al (13) reported positive results in flexibility after a 7-week Pilates mat and reformer training program. Participants showed significant increases in shoulder, hip, and knee flexion strength and significant increases in range of motion of the shoulder, hip, and knee joints. An important improvement on pelvic alignment during static posture also was observed.

Photos courtesy of Mariana Shedden, M.S.

Figure 3. Left photo shows abdominal hollowing while the right photo shows abdominal bracing.

Similarly, N. A. Segal et al (14) reported a significant increase in spine flexibility in participants who practiced mat Pilates 1 hour per week for 6 months.

Practical application and implications

It is widely accepted that increasing flexibility of a muscle-tendon unit promotes better performance and decreases the number of injuries in some activities (15). However, the benefits of joint mobility must always be balanced with a complimentary goal of joint stability. S. McGill (10) states that too much flexibility in the lower spine may predispose one to injury. He further suggests that endurance of the lower back muscles is a better predictor of lower spine health. Therefore, Pilates mat and apparatus classes should emphasize range of motion of the hip and knee joints and muscular endurance of the back extensor muscles while maintaining spine stability. Some Pilates exercises such as leg circles, leg abduction, and jumping frog are excellent examples of how to increase hip range of motion while maintaining spine stability (Figure 4).

Body composition

Whether Pilates promotes a noteworthy caloric expenditure to promote improvements in body composition remains under study. R. Jago et al (16) found a lower body mass index in young girls after a 4-week, 1-hour, 5 days per week mat Pilates program compared with a control group. However, the exact activities performed by the control group were not specified, and there was a lack of dietary control. Also, the mean heart rate was reported to be 104 beats per minute, so it remains unclear how this low training stimulus led to meaningful changes in body composition. Other abstract data (17) reports that advanced and intermediate Pilates exercise provides a sufficient stimulus to increase energy expenditure and possibly promote health and fitness benefits.

Practical application and implications

As with any other physical activity, energy expenditure seems to be related to the intensity and duration of the activity. Any Pilates instructor would concur that following the core principles of Pilates should be the emphasis of every Pilates session. These principles are the following: centering, which means that all exercises are performed while maintaining core control; breathing, which refers to the performance of deep inspiration and exhalation for facilitation of the exercise; concentration, which refers to the mental engagement in the specific exercise; control, which refers to the proper control of the body parts; precision, which refers to the awareness that should be incorporated in every motion; and fluidity, which refers to the performance of the exercises with flow and grace. A beginning student would need a longer time to assure the adherence to these principles. Intermediate and advanced students have learned to incorporate these principles into their

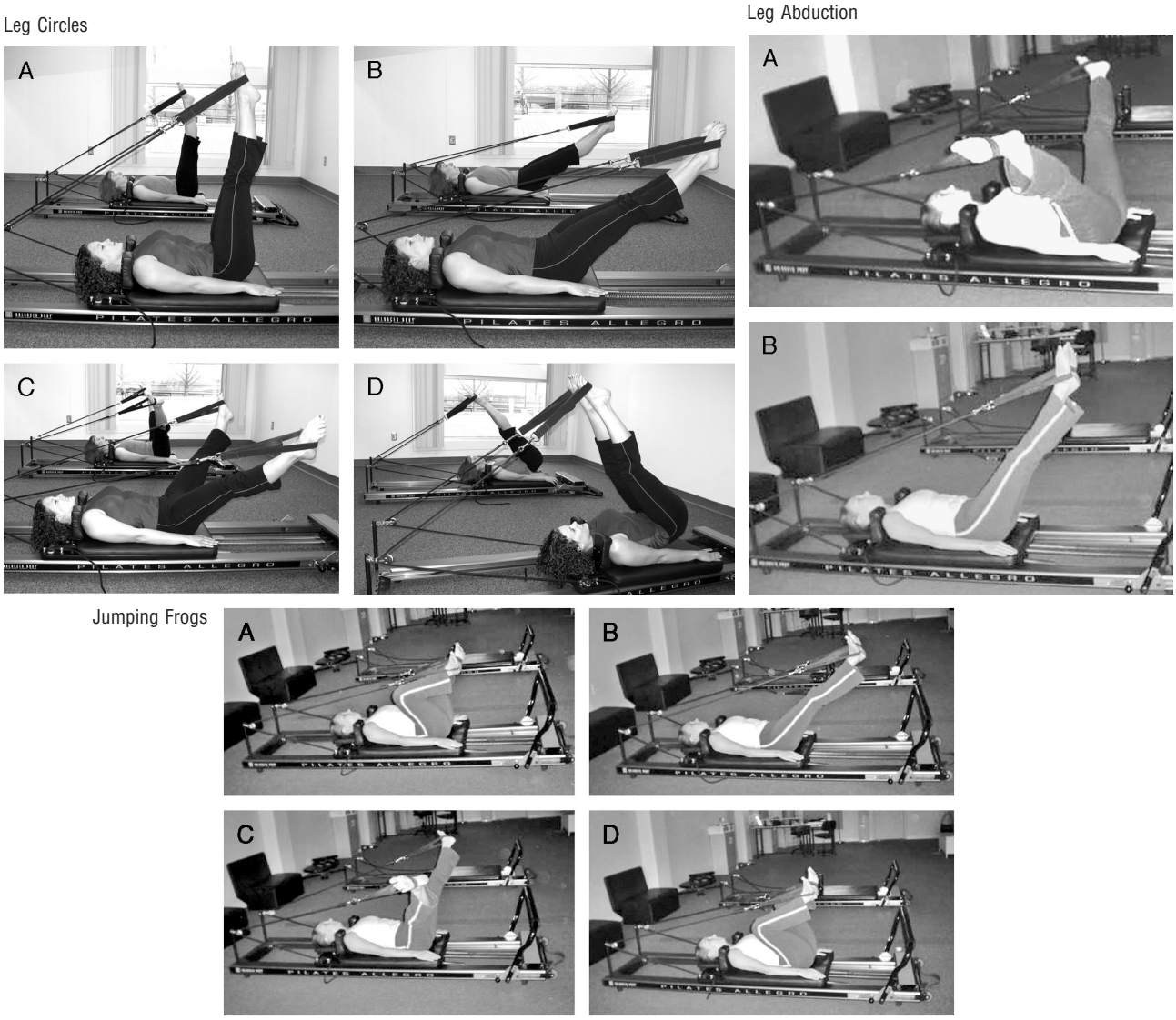

Figure 4. Figure shows exercise progressions for Leg Circles, Leg Abductions, and Jumping Frogs.

routines. Therefore, greater emphasis can be placed on intensity and duration of the exercises (which will lead to an increase in caloric expenditure). Also, as the difficulty of the exercise increases, a greater energy expenditure is expected. Figure 5 shows how three different progressions of the ''Bridge'' could increase the physiological demand of the exercise.

Injury rehabilitation

Pilates training has been shown to be useful as part of a rehabilitation program in dancers. B. P. Self et al (18) showed that Pilates reformer exercises could help dancers achieve a greater degree of knee flexion without the need to maintain balance because most of the exercises are performed in the supine position on the reformer. This could help individuals who have a lower body injury to train with a progressive overload.

Also, performing exercises in the supine position on the reformer decreases the ground reaction force, which in turn decreases the load placed on the joints. Recently, a case study (19) was published on the successful use of Pilates exercises for the correction of hip, spine, and pelvic stabilizer muscle misalignment in a highly trained female runner.

Two recently published articles suggest that a Pilates-based rehabilitation program can be intently used for the treatment of injuries of patients with lower back pain. R. Rydeard et al (20) found that patients who participated in a 4-week Pilates apparatus program (which focused on the stabilization of the pelvis and lumbar spine) significantly decreased functional disability and pain as compared with a control group. Also, S. Donzelli et al (21) reported that Pilates-based exercises, which included postural and breathing education exercises could be used as an alternative treatment for low-back pain. The Pilates

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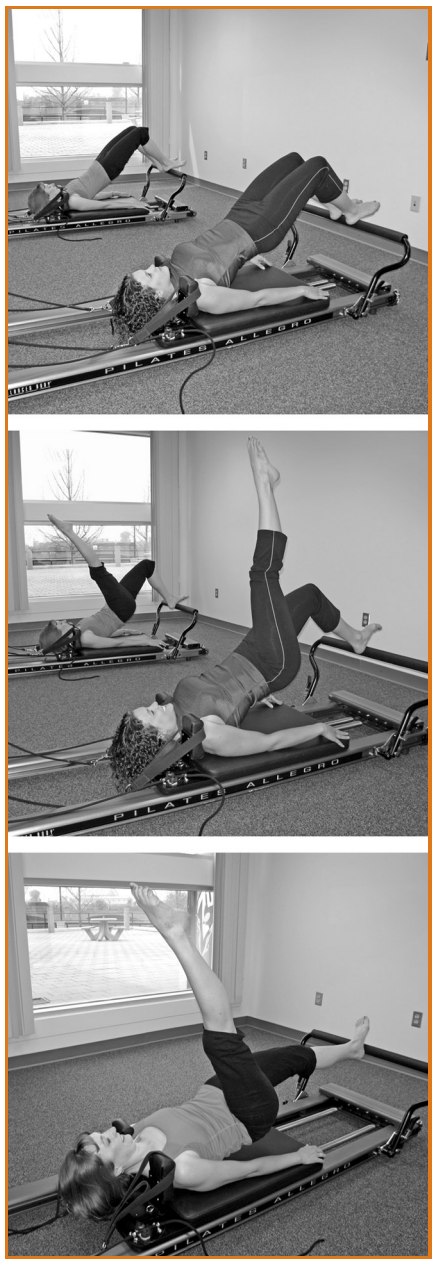

Figure 5. Three different progressions of the bridge.

Photos courtesy of Mariana Shedden, M.S.

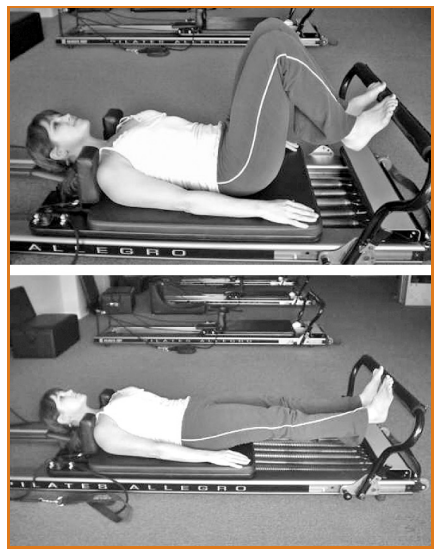

Figure 6. Leg Presses.

method provided similar improvements in decreasing lower spine pain for a 6-month period, as did a traditional low-back rehabilitation program.

Practical application and implications

Pilates mat and reformer exercises can be incorporated into a postrehabilitation program for the lower body. Pilates reformer exercises can help to gradually regain mobility and control of the injured site while also restoring functional range of motion. In addition, research findings suggest that Pilates exercises can be positively used to increase the muscular fitness of the pelvic stabilizer muscles, contributing to improved low-back health. For example, leg presses on the reformer are excellent to help in the postrehabilitation of a knee injury. This gravity-assisted exercise helps to reduce the load placed on the knee joint while strengthening the quadriceps and hamstring muscles (Figure 6).

Progressive overload

As part of his early work, Pilates used springs of beds to increase the load of the exercise to help reverse muscle atrophy of patients confined to bed rest. L. H. Mallery et al (22) used Pilates exercises to help restore muscular fitness in hospitalized acutely ill older patients. Pilates exercises were used to help maintain muscle condition and range of motion while ensuring a safe conditioning program for frail older adults.

Several abstracts have been published that support the use of Pilates to increase flexibility and muscular strength and endurance (23–25). K. Rogers and A. L. Gibson (23) reported a significant increase in flexibility and muscular endurance after 3 days per week for 8 weeks of mat Pilates training. Similarly, Kimberly Sewright, M.S. et al (24) reported an increase in muscular endurance and tennis serve velocity after a 3 days per week for 6 weeks of mat program. Also, R. Otto et al (25) indicated that a 24-session reformer program provides comparable increases in lower body and upper body strength, core muscular endurance, and posture similar to a traditional weight training program. However, the sit and reach test showed a significantly greater improvement by the reformer training program group as compared with the weight training group.

Practical application and implications

Pilates mat and apparatus exercises may be used in special populations to prevent loss of muscle mass. Preliminary data suggest that mat and reformer Pilates training will meaningfully increase flexibility, muscular strength, and endurance.

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CONDENSED VERSION AND BOTTOM LINE

Joseph H. Pilates was a pioneer whose extraordinary exercise method has been adopted by many fitness professionals. Enhancement of muscle control, achievement of postural stabilization, and an increase in overall muscular strength, flexibility, and endurance are the pillars that support the popularity of Pilates. Although some fitness professionals find in Pilates some new training tools, others consider Pilates a unique method that physically trains the body while creating body awareness. Pilates' original work serves as the conceptual framework that may be integrated with sound exercise science research to develop safe and effective exercise programs.