Pilates Training and
Rehabilitation for Professional Ballet
Dancers

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Abstract

Ballet is a rigorous profession in which a steady schedule of practice and performance places high physical demands on the body. As a result, professional ballet dancers often have considerable injuries that are commonly focused in the hip, knee, and ankle/foot. Many of these injuries are due to stress, incorrect body mechanics, repetition, and muscular imbalances. Because Pilates technique aims to correct muscular imbalances, establish proper mechanics, and strengthen the body, it is used as a method of rehabilitation and cross-training for professional ballet dancer Megan Mosely. The subject underwent a 7 month progressive Pilates program using the BASI Pilates Block System. A specific program was designed to focus on the hip, knee and ankle, with an emphasis on proper mechanics, and joint stability. Upon completion of the 7 month regimen, the subject reported a decrease in pain, with an increase in strength, joint stability, and confidence.
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In accordance with the injuries and areas of focus pertaining to this case study, below are descriptions of anatomical landmarks and articulations found at the hip, knee, and ankle.

**The Hip**

The hip joint is a diarthrotic, ball and socket joint that is formed by the head of the femur and its articulation with the acetabulum of the os coxa (Martini et al., 2012). A pad of fibrous cartilage covers the outer borders of the articular surface of the acetabulum and a fat pad covers the center; both help with shock absorption and work to facilitate joint function (Martini et al., 2012). The hip joint is a very mobile joint with the ability to perform abduction/adduction, flexion/extension, and internal/external rotation (in all, circumduction). The articular capsule itself is extremely dense and strong in order to offer stability to the joint. The capsule encloses the femoral head and neck and extends deep into the acetabulum. A fibrous labrum adds to the depth of the capsule, which also helps to stabilize the joint. There are four broad, dense ligaments that reinforce the joint capsule; the iliofemoral, pubofemoral, and ischiofemoral ligaments are thickenings of the capsule itself, while the transverse acetabular ligament crosses transversely and inferiorly, completing the border of the capsule (Martini et al., 2012). A fifth ligament actually attaches from the fovea capitis in the head of the femur and joins the transverse acetabular ligament, keeping the head of the femur from wandering too far out of placement within the acetabulum (Martini, et al., 2012).

In addition to these ligaments, multiple muscles also act on the hip joint to offer more stability and control. The hip flexors, namely the iliopsoas, rectus femoris, and sartorius, as well as the hip extensors - hamstrings and gluteus maximus - aid in hip flexion/extension in the sagittal plane (Isacowitz, 2000). Hip abductors such as the gluteus medius, tensor fascia latae, and piriformis all work toward abduction in the coronal plane. Hip adductors such as adductor longus, adductor magnus, gracilis and pectineus all help to perform hip adduction and stabilize the joint (Isacowitz, 2000). Internal and external rotators of the hip, such as the gluteus medius, gluteus minimus, tensor fascia latae, semitendinosus, semimebranosus (internal rotators) gluteus maximus, piriformis, and biceps femoris (external rotators) also aid in stability of the hip and allow for movement in the transverse plane (Isacowitz, 2000).
The Knee

The knee joint is a diarthrotic joint that includes the condyles of the femur, condyles of the tibia, and the patella. It is actually comprised of two articulations, the articulation of the tibia with the femur, and the patella with the femur (Isacowitz, 2000). These articulations function as a hinge joint, which performs flexion and extension, with very little range of motion in the transverse plane (internal/external rotation) (Isacowitz, 2000). The knee joint has the largest range of motion in the lower limb, but does not have the same sort of ligamentous support that the ankle does or the muscular support that the hip does (Martini et al., 2012). There is not a single, unified capsule in the knee. Paired fibrous cartilage pads called menisci lie between the articular surfaces of the femur and tibia on each condyle and act as cushions, while also conforming to the shape of the articular surfaces of each condyle (Martini et al., 2012). The medial and lateral menisci also provide some lateral stability for the joint. Fat pads surrounding the margins of the joint also provide padding and help the bursae to reduce friction between the articulating surfaces (Martini et al., 2012). There are seven major ligaments that aid in the
support and stability of the knee. The patellar ligament is embedded within the quadriceps tendon and passes over the anterior surface of the joint, connecting from the patella to the anterior surface of the tibia. Its job is to provide stability to the anterior surface of the joint (Martini et al., 2012). The medial and lateral collateral ligaments reinforce the medial and lateral surfaces of the joint, tightening and supporting only when the knee is fully extended (Martini et al., 2012). The anterior and posterior cruciate ligaments work front to back, they “attach the intercondylar area of the tibia to the condyles of the femur” and form a cross or “x” of support on the inner portion of the joint. These ligaments are important in maintaining alignment of the femoral and tibial condyles, as well as limiting range of motion in the sagittal plane (Martini et al., 2012). Popliteal ligaments reinforce the posterior portion of the knee joint and stabilize the back of the knee. The quadriceps muscles are responsible for extension of the knee, while the hamstrings are responsible for knee flexion. However, there is not a lot of muscular support for the joint. The iliotibial band and tensor fascia latae help to support the lateral portion of the joint, while the Sartorius, gracilis, and muscles of the adductor group aid in medial support (Martini et al., 2012).

Knee Joint

* Image retrieved from: https://www.google.com/search?q=the+knee+joint&source=lnms&tbnid=Q_AuAQ&biw=1366&bih=609#imgrc=5S16AmIzLwZrMM%3A%3Bl8vulBoahjM%3BHhttp%253A%252F%252Fwww.humankinetics.com%252FAcuCustom%252FSitename%252FDAM%252FO86%252F251art_Main.png%3BHhttp%253A%252F%252Fwww.humankinetics.com%252Fexcerpts%252Fexcerpts%252Fmany-ligaments-make-up-knees-structure%3B563%3B580
The Ankle

For the purposes of this paper, the area of focus within the ankle is specifically the talocrural joint, which is a hinge joint formed by articulations that occur between the tibia, fibula, and talus bones (Martini et al., 2012). The talocrural joint is a hinge joint that is designed to provide stability for the bipedal human (Isacowitz, 2000). It can perform dorsiflexion and plantar flexion in limited ranges of motion. Inversion/eversion, and supination/pronation can also be performed, however this motion occurs at the midtarsal and subtalar joint (Isacowitz, 2000). The area of primary concern with regard to anterior impingement syndrome is the articulation between the anterior lip of the tibia and the dorsal portion of the talus (the areas that interact in dorsiflexion) (O’Kane and Kadel, 2008). The main portion of the talocrural joint responsible for weight bearing and support is the tibiotalar joint, and the functioning and stability at this joint is typically dependent upon three supporting joints: the proximal and distal tibiofibular joint, and the fibulotalar joint (Martini et al., 2012).

A series of ligaments act upon this joint complex in order to provide stability to the joint. The anterior and posterior tibiofibular ligaments run obliquely to secure the tibia and fibula, while the anterior and posterior talofibular ligaments run laterally stabilizing the lateral surface of the ankle (Martini et al., 2012). The calcaneofibular ligament also helps to stabilize the lateral surface of the ankle and prevent excessive range of motion. On the medial surface, the deltoid ligament acts as the main supportive structure for stability (Martini et al., 2012). There are muscles that act on the ankle joint and help to perform joint functions, such as the anterior tibialis and extensor digitorum (dorsiflexion), and the gastrocnemius and soleus (plantar flexion) (Isacowitz, 2000). The tibialis posterior is responsible for inversion, and the peroneals perform eversion. Though these muscles help to control movements of the foot and aid in stability of the ankle joint, they are not primarily responsible for maintaining the functioning and sole stability of the ankle-foot complex (Isacowitz, 2000).
The Ankle:

* Images retrieved from: https://www.google.com/search?q=the+ankle+joint&tbm=isch&tbo=u&source=univ&sa=X&ei=at-oUt-ff4zloATCnlCQAg&sqi=2&ved=0CEwQsAQ&biw=1366&bih=609#facrc=_&imgdii=MlKQI7R4_G7rZM%3A%3BN1or7Zof25lxM%3BMlKQI7R4_G7rZM%3A&imggclid=MlKQI7R4_G7rZM%3A%3BzpIFHJyc4CW2NM%3Bhttp%3A%252F%252Fwww.kidport.com%252Freflib%252Fscience%252Fhumanbody%252FskeletalSystem%252Fimages%252FAnkle.jpg%3Bhttp%3A%252F%252Fwww.kidport.com%252Freflib%252Fscience%252Fhumanbody%252FskeletalSystem%252Fimages%252FAnkle.htm%3B400%3B429

**Introduction**

Due to the nature of ballet dance and the rigorous training schedules that classical ballet dancers face, research has shown that injuries dominate many of these professional dancers’ lives. In a study performed by Valenti, Vanderlei, Tassi, Fujuki and Moreno, the yearly injuries for professional ballet companies observed was 67-95%, and 60-76% of these were due to overuse (Valenti et al., 2011). There is such a physical demand for rehearsal, practice and performance that these dancers experience more injury than not. Furthermore, the nature of their repetitive movements also contributes to the incidence of injury and overuse; Valenti notes that working in the forced turned out position without acknowledging correct mechanics can lead to multiple joint and musculoskeletal injuries (Valenti et al., 2011). The position requirements and load on the lower body also reflected the types of injuries that were most prevalent: “It was observed high prevalence and incidence of lower extremity and back injuries, with soft tissue and overuse injuries predominating.” (Valenti et al., 2011). Another study performed by Khan, Brown, and Way for Sports Medicine Magazine discusses the frequency of overuse related
injuries in professional ballet dancers. Khan also recognizes the predominance of work within the “forced turnout” position and notes that this factor often plays a direct role in the frequency of overuse injuries (Khan et al., 1995). Not only injuries at the foot and ankle, but also anterior knee pain, clicking hips, and lower back pain were all common injuries attributed to overuse in professional ballet dancers (Khan et al., 1995). In turn, Valenti too discussed the presence of hip dysfunction and lower back complaints in the dancers observed. For their project, the issue of forced turnout as well as the issue of range of motion and flexibility were analyzed in suspected contribution to these overuse injuries (Valenti et al., 1995). Research showed a direct correlation between hamstring flexibility and hip range of motion (Valenti et al., 2011). This finding suggests that flexibility of the hamstring directly speaks to the amount of range of motion that can be achieved at the hip joint, and as a result, stability of the joint is severely compromised. Without proper conditioning, the unstable hip joint may be more prone to injury and dysfunction (Valenti et al., 2011).

Khan’s research suggests that with regard to the knee joint, the anterior knee pain often felt by dancers may be due to the presence of patellofemoral syndrome, which is the presence of retropatellar pain or pain under the kneecap due to biomechanical or biochemical changes in knee joint articulation (Khan et al., 1995 and Juhn, 1999). According to Khan and Juhn, it can be caused by repetitive activity or excessive load to the patellofemoral joint (as observed in ballet dancers) as well as incorrect patellar tracking, which can be directly linked to forcing the turned out position incorrectly (Khan et al., 1995 and Juhn, 1999). Research suggests that with proper tracking, biomechanical technique, and quadriceps strengthening the pain may be lessened so long as appropriate movement modifications are addressed (Juhn, 1999). Khan also noted the presence of problems at the ankle joint, predominantly injuries and pain associated with anterior impingement syndrome (Khan et al., 1995). A study by O’Kane and Kadel specifically researches the correlation between ballet dancers and anterior impingement syndrome; which according to the authors is “a common problem in dancers occurring primarily secondary to the repetitive forced ankle dorsiflexion inherent in ballet.” (O’Kane and Kadel, 2008). The authors recognize that the consistent dorsiflexion movement pattern present in classical ballet training is the main factor contributing to this syndrome and found that the injury may respond to
conservative movement, stabilization of the joint, and correction of biomechanics contributing to the joint articulation (O'Kane and Kadel, 2008).

Each of these authors recognize the predominance of injuries associated with professional ballet dancers and attempt to correlate movement and usage with common pathologies or syndromes; particularly correlating the practice of forcing turn out, flexibility/range of motion, and overuse, with injuries to the ankle, knee, and hip joints, as well as foot and back pain. Many of the treatments discussed place a focus on strengthening as well as correction of biomechanics. Due to the particular focus that the Pilates technique places on correction of biomechanics, movement technique, posture, and strengthening, a Pilates regimen may be an appropriate treatment for successfully rehabilitating classical ballet dancers and preventing the common injuries associated with ballet dance practice (Isacowitz, 2000). In addition to the postural and biomechanical fundamentals of Pilates technique, its exercises often mimic the movements and positions of classical ballet dance, making it an excellent method to retrain and re-establish correct technique and biomechanics in specific ballet dance positions. Not only may the correction of biomechanics through Pilates contribute to injury prevention, it may also work to strengthen the surrounding stabilizers involved in joint articulation and as a result foster more control and stability in the joints that have lost stability due to forced flexibility and range of motion (Isacowitz, 2000). As a result of Pilates training, ballet dancers may build a greater degree of strength and control in proper kinetic posture, preventing the common injuries associated with incorrect mechanics and fatigue due to overuse. In the case study below, classical ballet dancer Megan Mosely undergoes a BASI Pilates treatment regimen specifically tailored to address injuries associated with classical ballet training and prevent future injury.

**Case Study**

Megan Mosely is a semi-professional classically trained ballet dancer in Oceanside, California. She is 28 years old, and has been training in classical ballet for 20 years. Of those 20 years of training and performing, she spent 12 of them on and off of pointe shoes, engaging in pointe work. Dancing “en pointe” is the act of dancing in an extreme plantar flexed position with all weight bearing on the ankle and foot placed in this extreme plantar flexed position. Upon meeting Megan, she complains of pain, popping, and vulnerability in both hips, though she notes
that her right hip is primarily affected. She feels that her hip may at any given time “pop out” and fears that it is too loose. When it does come out of alignment, she attempts to re-align the joint, but it immediately becomes inflamed and painful. She notices that the hip feels most insecure and uncomfortable when performing circumduction and flexion/abduction with external rotation, as in a développé or extending/lifting motion of the leg. Megan also reports a pain present in the anterior medial surface of her right knee. She feels that particularly when she stands in a turned out position (external rotation of the hip) her pain is most pronounced and is primarily on the inside (medial) surface of the knee and under her knee cap. In addition, Megan complains of a similar pain and soreness in her right ankle, toward the anterior, located on the dorsal surface of her foot where the ankle dorsiflexes. She notices the pain increases when she performs demi-plié (a motion that includes a slight bending of the knees and extreme dorsiflexion) and is ever so slightly toward the medial surface of the ankle. She notes that she also often experiences low back pain, particularly after long days of training. Megan explains that the pain associated with her hip, ankle, and knee has not only begun to affect her ability to train, but also her performance quality and general quality of everyday life. She feels she is unable to complete tasks that are required of her and is concerned for her future as an athlete and performer. Currently Megan has modified her training schedule and is taking 5 hours of ballet per week, without doing any type of cross-training. She rests and ices the areas during her off time, but notices no real improvement. She has been given no restrictions, and can continue to train according to her modified schedule. Her goal is to reduce her pain so as to regain a better quality of life and feel more confident training and performing.

Upon first reviewing Megan’s case, it is clear that she has multiple muscular imbalances related to the nature of her specific training in ballet. She favors her dominant right side and thus experiences the majority of her symptoms on the right side. Similarly, she has general imbalances in strength and stabilization. Ballet primarily trains in positions of external rotation of the hip, and places a large focus on flexibility, thus, Megan lacks strength and stability in both the turned out and parallel positions. She also lacks muscular strength needed to balance the excessive range of motion she has achieved in her hip, ankle, and knee joints, and as a result the joints are less stable and more vulnerable to injury. The anterior knee and ankle pain that increases with knee flexion and dorsiflexion that may be due to a problem with proper joint
alignment and tracking. Due to the excessive training in a forced turn-out position, Megan may misalign her knee and ankle joints when performing knee flexion and dorsiflexion (as in plié) and as a result most of her weight bearing falls to the medial surfaces of the knee and ankle. This misaligned tracking combined with the lack of stability in the hip joint most likely explains the anterior and medial pain she is experiencing in her right ankle and knee.

In designing a program to meet Megan’s needs, a combination of strengthening and stabilization training with emphasis on proper tracking and technique is a priority. With appropriate cross-training for her muscular imbalance, as well as a focus on hip, knee and ankle strength and stability, Megan should experience a decrease in her symptoms. Working in positions of both parallel and external rotation may help to increase stability in Megan’s hips, and help to alleviate her hip pain. In addition, proper tracking technique will greatly improve her joint and alignment and potentially reduce her knee and ankle pain. Finally, working to condition Megan’s core, along with appropriate conditioning of the back extensors may help to alleviate Megan’s low back pain related to forced hyperextension of the lumbar spine (as in arabesque). Our primary objectives will include pelvic stabilization, core stabilization and strengthening, and strengthening of the muscles that act on the hip joint. A focus will also be placed on exercises that emphasize proper tracking and joint alignment, particularly in knee flexion/extension and dorsiflexion. Strengthening of the muscles that act on the knee, ankle and foot, will also be addressed.

At the start of Megan’s first session, she was instructed to perform a Roll-down and was observed for any asymmetry, imbalances, or deviations. She noted some lower back discomfort, but displayed extreme flexibility in her hamstrings. We then began on the mat with the Fundamental Warm Up; the Pelvic Curl, Spine Twist Supine, Chest Lift, and Chest Lift with Rotation. The goal of the Pelvic Curl was to encourage pelvic stabilization and strengthen the hamstrings. In addition, an emphasis was placed on abdominal activation during the articulation of the spine to foster correct abdominal neuromuscular pathways. The goal of the Chest Lift was to achieve abdominal strength and introduce proper technique and muscle recruitment in abdominal work. The rotation was added to encourage oblique muscle strength and control. Next Leg Circles were introduced, in order to focus on pelvic stabilization and proper hip function.
The circles were kept small so as to not aggravate the hip joint and foster functional motion with proper muscle recruitment rather than forced and unsupported motion.

As Megan progressed through her first 10 sessions, the exercise content was increased, utilizing more of the blocks in the BASI block system. She completed the Footwork on the reformer (Footwork Block) with an emphasis on tracking in the knee and the ankle, so as to encourage proper joint alignment and correct any deviation. We worked on traction specifically in the turned out position, which is such a large part of her specificity training. The goal was to correct misalignment in the ankle and knee joint so as to improve articulation and alleviate the anterior/medial knee and ankle pain. In addition, we began progressing abdominal work from the mat to the reformer. Megan began performing 100 prep, 100’s, and Roll-up on the mat (Abdominal Work Block). Once she had achieved sufficient abdominal strength and proper muscle recruitment she began performing 100 prep and 100’s on the reformer. These exercises would encourage abdominal strength and pelvic stabilization to reduce her low back pain and increase the stability of her hip joint.

Next, we focused on hip work, introducing Frog, Up Circles, Down Circles, and Openings on the reformer (Hip Work Block). There was a huge emphasis placed on proper hip placement and muscle recruitment for each of these exercises. Her tendency was to relax into an over-pronounced external rotation without activation of any hip adductors or abductors. The goal for this work was to achieve proper muscle recruitment for functional hip motion with the hip joint supported, as well as pelvic stabilization, which would in turn alleviate Megan’s hip pain and vulnerability. We then incorporated Standing Lunge on the reformer (Stretches Block) to emphasize proper tracking when in hip flexion, a position that is very common in her training. She then performed Arm Series Sitting (Arm Work Block) to foster co-contraction of the abdominals and back extensors and potentially alleviate her low back pain. For leg work, we began incorporating the Glute Side-lying Series to emphasize pelvic stabilization, and to strengthen muscles that act on the hip, in the hopes to add stability and support to the joint. By session 10, Megan was performing Side Lifts (Lateral Flexion/Rotation Block) with a focus on core stabilization and control, as well as Basic Back Extension (Back Extension Block). The goal in strengthening the back extensors was to foster correct muscle recruitment and usage when performing movements with hip extension (like an arabesque) and alleviate her low back pain.
As Megan advanced into her next grouping of sessions 11-20, her program was gradually promoted to include more intermediate exercises that specifically aimed to target her areas of focus. She progressed to the Intermediate Mat Warm-up, which included Roll-up, Spine Twist Supine, Double Leg Stretch, Single Leg Stretch, and Criss-cross. Her abdominal strength was rapidly increasing and her muscle recruitment improved to the point where she could correctly execute the warm up exercises without deviation or rapid fatigue. We began practicing footwork on the Wunda chair, playing with resistance and challenging her neuromuscular pathways for tracking to ensure that the correct habits she’d established remained. This work was vital to correcting her foot and ankle mechanics, as well as her tracking, which would in time alleviate her ankle and knee pain. She began performing Coordination and Double Leg Stretch with rotation on the reformer (Abdominal Work Block) to continue progressing in abdominal strength and pelvic stability. Megan advanced to hip work on the Cadillac; she performed Basic Leg Springs Series, which would challenge her ability to maintain pelvic stability and reinforce the stability of the hip joint. Strengthening the muscles that act on the hip, Frog, Circles Up/Down, Walking, and Bicycles would help to add stability to her hip in external rotation - the position in which Megan often worked and felt the most vulnerability in her hip. It would also help to correct the imbalance between strength and flexibility, particularly in the hamstrings.

Next, Monkey Original and Tower Prep were introduced on the Cadillac (Spinal Articulation Block) in order to increase her awareness of abdominal muscle recruitment and potentially alleviate her low back pain. She then moved to the reformer to perform Hamstring Stretch Series, in which the goal was to maintain proper hip, knee, and ankle alignment and keep the joints supported within the stretch, rather than forcing the stretch with incorrect alignment as she had often done in practice (Stretches Block). In this next grouping of sessions we began incorporating some Full Body Integration of Fundamental level work, namely Up Stretch 1 and Elephant. The goal here was to encourage hip dissociation, but with control, and pelvic stabilization so as to increase the stability and control she had within her hip joint. In addition, abdominal strength would continue to build her core strength. She then advanced to the Arms Kneeling Series on the reformer (Arm Work Block) to add the challenge of maintaining correct posture and co-contraction while completing the arm series exercises. We began alternating between Leg Press Standing on the Wunda chair and the Leg Work Supine Series with the Magic
Circle (Leg Work Block) in order to strengthen the muscles that act on the hip, knee, and ankle joints. Leg Press Standing focused heavily on stabilization and balance so as to add stability to each of her 3 focus areas, and the single leg stance mirrored a common movement pattern in her ballet training. The Magic Circle leg work would continue to deepen Megan’s strength in her hip abductors, adductors, extensors and flexors, which would result in added stability to Megan’s hips and knees. She also performed Side Stretch (Lateral Flexion/Rotation Block) to condition the obliques and maintain core strength. Swan Prep was added, first with the Magic Circle, until she was able to progress to Swan Basic on the Wunda chair (Back Extension Block). The emphasis on back extension would continue to encourage proper muscle recruitment and keep Megan out of her low back as much as possible when in ballet class.

As we moved beyond Megan’s 21st session, slight adjustments were made that would offer Megan a bit more of a challenge in her particular areas of focus; pelvic stabilization, strengthening of the muscles that act on the hip and knee, tracking, and abdominal strength. She advanced to a warm-up on either the reformer or the Cadillac, and performed Footwork both on the reformer (for neuromuscular feedback) and the Cadillac (for more visual feedback and added resistance/hamstring emphasis). She began tackling the Short Box Series on the reformer until she had nailed Round Back, Flat Back, Tilt, Twist, Round About, and Climb-a-Tree with proper muscle recruitment and hip alignment (Abdominal Work Block). We continued hip work on the reformer - still focusing heavily on the hip placement and pelvic stability, which was improving greatly. She started to integrate Short Spine into her reformer work (Spinal Articulation Block), which aimed to place a focus on stabilization and hamstring strength, as well as proprioception and reinforcement of neuromuscular pathways. Performing hamstring work while in hip external rotation was also an integral part of Megan’s rehabilitation because she worked so frequently in this position and had incorrect mechanics in her past training. She advanced to Side Split Series on the reformer (Stretches Block) to shift toward a focus on mechanics in second position with external rotation. The goal was to add an element of challenge in maintaining hip stability and proper mechanics throughout the exercise. She continued her work on the reformer in the Full Body Integration Block with exercises from the Up-Stretch Group, namely Up Stretch 1 and Elephant. The goal here was to continue to reinforce control with hip dissociation as performed in each movement.
Megan advanced to the Rowing Series on the reformer (Arm Work Block) to challenge her to maintain correct mechanics when performing more complex coordinated movements (which mirrored her dance training). We continued to place a large focus on the legs and hip function as well, alternating between Jumping Series on the reformer, and Single Leg Side Series on the Cadillac (Leg Work Block). The Jumping Series would allow her to perform movements that were similar to movements she did in her ballet training (likened to petit allegro; changement and sauté in 1st – 5th position). In this way she could practice using correct ankle, foot, and knee mechanics and take this technique with her to the floor in training. It would also help to strengthen the muscles that support the ankle, knee, and hip. The Single Leg Side Series really emphasized pelvic stability and correct hip alignment and control. This would aim to combat the vulnerability she had felt in her hip and encourage more functional movement in the hip that was stable, rather than forced and unsupported. Megan also advanced to Side-Over on the reformer (Lateral Flexion/Rotation Block) and Pulling Straps 1 and 2 on the Long Box. The Side-Over exercise aimed to challenge her technique and mechanics with the addition of more compound movements. Pulling Straps 1 and 2 worked toward further development of her back extensor strength, which would encourage correct mechanics in back extension and help her to avoid unsupported hyperextension in her lumbar spine while working in ballet class.

**Conclusion**

After 7 months of training with Megan, it was evident that her program had significantly improved her general quality of life, as well as her ballet training. She noticed a decrease in her knee and ankle pain as a result of improving her tracking and biomechanics. When performing pliés, she found that the new movement patterns and proper tracking altered her weight distribution and lightened the load placed on her knees and ankles. She also reported that she felt much stronger in general, “from the inside-out”. Megan recognized that a clicking in her hip was still present, but was less common and not as painful as before. She often reminded herself to work from a place of support within her hip and to stabilize her pelvis rather than relaxing into the extreme turn-out as she had so often done in the past. As a result, she noticed a decrease in hip pain and felt that it was more secure and stable overall. Megan reported that her left hip felt better as well, and that her left side seemed stronger – she could maintain better balance and pirouette more comfortably on the left side as compared to her turns before beginning Pilates.
training. Furthermore, she felt as though she could hold her positions in great ranges of motion with more strength and precision than she had before, and attributed this to the strengthening of the muscles acting on the hip and knee - as well as her core. She found that her back pain had significantly decreased, and when she did begin to notice soreness, she could perform pelvic curls to help alleviate the pain and tension. In all, Megan truly experienced great benefit from her Pilates program and was able to return to a normal ballet training schedule. However, she maintained her Pilates program in order to consistently address her biomechanics, tracking and muscular strength. She had discovered the benefits of Pilates as a method of cross-training for her particular sport of ballet, and wanted to continue to not only utilize the principles she had learned, but to continue to grow and improve in multiple disciplines.
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