The Pilates Method:
A Conditioning Program for Clients with
Acetabular Dysplasia and Charcot-Marie-Tooth Disease

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Abstract

This study applies Pilates as a conditioning program for a client with acetabular dysplasia and Charcot-Marie-Tooth disease. It provides an overview of acetabular dysplasia and Charcot-Marie-Tooth disease, as well as the client’s experience with these conditions. The Body Arts and Science International Block System was the backbone of the conditioning program for the client, with special attention to the hip and ankle joints. The client achieved short-term goals of increased body awareness, stability, control, and strength. Long-term goals include increased flexibility, strength, muscle balance, decreased pain, and improved function. Overall, Pilates is an effective conditioning program for individuals with acetabular dysplasia and Charcot-Marie-Tooth to reduce joint pain and stiffness, strengthen the muscles around the joint, and increase flexibility, endurance, and stability.
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Anatomical Overview of Acetabular Dysplasia and Charcot-Marie-Tooth Disease

Acetabular Dysplasia

Acetabular dysplasia is the result of abnormal development of the acetabulum, the socket in the pelvis that, with the head of the femur, forms the hip joint. Acetabular dysplasia is characterized by a “dish shaped” vice a “cup shaped” acetabulum. As a result, the acetabulum usually does not completely cover the femoral head. Individuals with acetabular dysplasia typically do not experience pain in their hip until adulthood. The condition is associated with arthritis, due to the high stress on the rim of the acetabulum.¹


![Figure 1: Normal, cup-shaped acetabulum.²](image1)

![Figure 2: Hip dysplasia, characterized by a dish-shaped acetabulum.³](image2)

Charcot-Marie-Tooth Disease (Also known as Hereditary Motor and Sensory Neuropathy or Peroneal Muscular Atrophy)

Charcot-Marie-Tooth disease (CMT) is a hereditary neurological disorder affecting approximately 1 in 2,500 people in the United States.⁴ CMT causes damage to the peripheral nerves, which control movement and balance. As a result, CMT instigates muscle weakness and wasting in the extremities of the body, typically beginning in the feet and ankles. A common
consequence is foot drop, a condition characterized by difficulty in lifting the foot at the ankle, which causes a downward point of the toes during walking. Hence, individuals with CMT may experience frequent tripping and develop an abnormal gait, due to increased weakness and compensating movement patterns. Over time, people with CMT may develop contractures (stiffened joints) in the feet and hands as some muscles around a joint weaken, while other muscles remain unaffected. There is no cure of CMT; however, regular stretching and low-impact exercise may delay or reduce muscular atrophy, prevent or reduce joint deformity, and provide relief. This study focuses on the affects of CMT on the muscles of the ankle joint.

Figure 3: Muscles that act on the ankle joint. Anterior, lateral, and posterior views.

Case Study – Adrienne C., Washington, DC

Adrienne C. is a 30 year-old woman with acetabular dysplasia and CMT. CMT is a hereditary disease in Adrienne’s family. Adrienne has experienced several symptoms of CMT, including weakness in the muscles of the ankle, flat feet, difficulty with balance, and loss of sensation in her extremities. The weakening affects of CMT are most apparent in Adrienne’s dorsiflexors. Stiffness in the calves and Achilles tendons also appear to inhibit Adrienne’s range of motion in dorsiflexion.
Adrienne began experiencing hip pain in her late teens and developed an abnormal gait. After several misdiagnoses, Adrienne requested an x-ray of her hip, which revealed she had acetabular dysplasia in both hip joints. In May 2004, she underwent Periacetabular Osteotomy (PAO) on her right hip joint. PAO is a surgical treatment that detaches the acetabulum from the pelvis and rotates it to cover the femoral head. Adrienne has not undergone surgery on her left hip joint. Since the surgery, Adrienne developed cysts, areas of lesser bone density, in her acetabulum. Her body compensated the imbalanced pressure in her hip joint through additional bone formation on the head of the femur. Since 2006, Adrienne has experienced muscular imbalances and increased pain in her right hip joint. Although the surgery improved her gait, it remains abnormal. To walk, Adrienne rotates her pelvis to the right rather than further extending her hip. A physical therapist at the University of Boston hospital assessed that her abnormal gait may be due to tight hip flexors and weak hip extensors. Another contributing factor may be Adrienne’s unequal leg lengths - her right leg is one half inch longer than her left. Adrienne consulted the physical therapist in November 2007, who recommended exercises for balance, flexibility in the iliopsoas, hamstrings, and calves, and strengthening her iliopsoas and gluteus maximus. The physical therapist approved Pilates as part of Adrienne’s program.

Application of the Pilates Method

Adrienne started participation in a group beginner mat class once a week in November 2007. The beginner mat sessions focused primarily on fundamental exercises and the 10 Pilates principles. In January 2008, she began a weekly private session on the apparatus. The program incorporated the Body Arts and Science International Block System (BASI) for total body conditioning, while addressing muscular imbalances and weaknesses. Short-term goals included
body awareness, pelvic lumbar stabilization, and increased strength, flexibility, and balance. Adrienne’s program incorporated the BASI approach for holistic body conditioning, while incorporating special attention to strengthening the muscles that act on the hip and ankle joint to promote joint stability and mitigate muscular atrophy, particularly atrophy of the dorsiflexors (tibialis anterior and extensor digitorum longus). Long-term goals of Adrienne's program are to counter imbalanced movement patterns and to improve joint stability, gait, function, and quality of life.

\textbf{Apparatus Program:}

\textbf{1. Warm Up:} Adrienne began her apparatus sessions with the roll down to warm up her spine and focus on her alignment. Adrienne displayed good spinal mobility and a healthy posture. She has a tendency towards right rotation of her pelvis, as she displays in her gait cycle. However, she is more able to control this imbalance in a standing position. Her hamstrings appeared tight and, at times, she had difficulty with balance. Warm-ups also incorporated pelvic curls and modified hip circles with an exercise band as an assist. Adrienne displayed a mechanical limitation with her right hip, likely due to the reorientation of her acetabulum from the surgery. Warming up her hip joint facilitated greater comfort throughout the rest of the session.

\textbf{2. Foot Work:} Sessions primarily alternated between the reformer and the cadillac for the foot work. The cadillac was very appropriate for Adrienne’s program due to emphasis on hip flexion and hamstring flexibility. Additionally, the upright position of the legs allowed for a more intense stretch of her calves. Adrienne initially had difficulty stabilizing her pelvis on the reformer. She displayed a tendency towards lateral flexion on the right side of her pelvis, which
may be due in part to unequal leg length. However, Adrienne showed quick improvement in body awareness and control. Her pelvic lumbar stability and alignment corrected significantly within a few sessions. The foot work exercises were particularly beneficial for Adrienne’s hip and CMT conditions due to the focus on the hamstrings, dorsi and plantarflexors, ankle mobility, and stabilization. Sessions incorporated single leg positions for additional strengthening and stabilization challenges. After approximately six sessions, Adrienne had shown significant control and stabilization progress. I started incorporating the wunda chair as an alternative apparatus for foot work, using medium resistance and positioning Adrienne with her hands holding onto rear of the chair to aid trunk stability.

3. **Abdominal Work** – Adrienne worked on several pieces of equipment for the abdominal block. Initial sessions focused on the cadillac spring-assisted exercises, the warm up series. This allowed focus on correct form and recruitment of the internal support system. Adrienne advanced toward a light spring setting for top-loaded exercises with the push through bar. Initial sessions also incorporated fundamental abdominal exercises on the reformer. After several sessions, more complex movements were added to Adrienne’s practice. Adrienne displayed a very good grasp of coordination. She also advanced towards intermediate moves in the short box series.

4. **Hip work:** Hip work has been a primary focus and goal of Adrienne’s program. I first introduced Adrienne to hip work on the cadillac to address muscles imbalances and place greater load on the hip extensors. The hip work was the most challenging element for Adrienne. She displayed weakness and difficulty controlling her adductors, especially on her right side. At times she would lose control of her leg and use her hand to bring it back into form. To counteract this tendency, sessions emphasized a smaller range of motion and lighter resistance to
maintain control and stability. Adrienne made significant gains in control and stabilization. After approximately eight sessions, I introduced the single leg supine series on the cadillac to further challenge her stability. The program also utilized hip work on the reformer. Adrienne advanced to intermediate hip work and showed overall gains in strength, control, precision, and stabilization.

5. Spinal Articulation: I introduced fundamental spinal articulation exercises into Adrienne’s program after assessing that Adrienne showed good spinal mobility and sufficient abdominal control. Adrienne displayed strength in this block, which was first introduced with the bottom lift on the reformer. Subsequent sessions introduced monkey on the cadillac. The deep pike position proved to be a challenge due to tightness in her hamstrings. Adrienne advanced to more complex movements, including tower prep on the cadillac and short spine on the reformer.

6. Stretches: Stretches were an important element in Adrienne’s program to increase flexibility in her hamstrings and hip flexors. I utilized the reformer and ladder barrel for this block. The standing lunge was the primary stretch in Adrienne’s program for the initial sessions to emphasize proper alignment and control. She progressed to the kneeling lunge after approximately six sessions. The ladder barrel was excellent for deep stretches in her hip flexors, hamstrings, adductors, gluteals, and shoulders. Adrienne had difficulty with the hip flexor stretches recommended by her physical therapist, which caused a pinching sensation in her hip joint. The ladder barrel allowed her body to stretch the hip flexor in a comfortable position.

7. Full Body Integration: After several sessions, I introduced full body integration work into Adrienne’s program on the reformer with scooter and elephant. These exercises reinforced primary goals in Adrienne’s program - strengthening the hip extensors and focus on
hip disassociation. Elephant was excellent for its added emphasis on hamstring and calf flexibility. As Adrienne progressed, I introduced intermediate full body integration exercises on the cadillac.

**8. Arm Work:** Adrienne displayed good arm strength and core stabilization. The program concentrated on arm work on the reformer and wunda chair. The client performed the supine and sitting arm work series on the reformer. The supine series was particularly beneficial for added hip flexor work. Additionally, the program incorporated shrugs and seated and prone triceps on the wunda chair.

**9. Leg Work:** Leg work was another essential element of this conditioning program, primarily performed on the wunda chair. Standing leg press was a challenging move due to Adrienne’s CMT condition. She initially needed my support to maintain sufficient stability to perform this move. However, Adrienne showed quick improvement in stabilization and control – she was able to execute this movement unassisted by the second session. Hip opener and hamstring curls on the wunda chair were also incorporated into nearly every session. After a couple months, I incorporated the leg series on the step barrel for additional leg work.

**10. Full Body Integration 2:** Adrienne’s conditioning program did not include advanced full body integration exercises.

**11. Lateral Flexion/Rotation:** Throughout the program, I utilized the full range of apparatus available at Balanced Bodies for the lateral flexion/rotation exercises, which included the reformer, cadillac, wunda chair, ladder barrel, and step barrel. The program focused on fundamental movements and progressed to intermediate exercises. Adrienne demonstrated a good grasp of pelvic lumbar stability.
12. **Back Extension:** Exercises for strengthening the back were also accomplished on a variety of equipment - the reformer, cadillac, wunda chair, ladder barrel, and step barrel. Adrienne’s program focused primarily on fundamental exercises. She displayed good control in isolating the mid- and upper back extensors, while maintaining abdominal recruitment and shoulder stabilization. However, Adrienne periodically experienced head rushes following back work. Hence, the transition following this block was an important factor. I focused on easing the client into a rest, stretch, or standing position. Following back extension, sessions would end with a roll down to again emphasize spinal mobility, abdominal support, stabilization of the pelvis, and alignment.

**Conclusion**

Adrienne’s program demonstrates the benefits of Pilates as a conditioning program for individuals with acetabular dysplasia and/or CMT. The ten Pilates principles and BASI block system are efficient guidelines for addressing individual weaknesses, while emphasizing the body as a whole. Clients with acetabular dysplasia are prone to arthritis and joint pain. Exercise is essential to reducing joint pain and stiffness, strengthening the muscles around the joint, as well as increasing flexibility and endurance. Pilates focuses on working the muscles that act on the hip joint through all three planes of motion, while emphasizing pelvic lumbar stability. The results include balanced strengthening, increased range of motion, arthritis prevention, decreased pain, and improved function. Individuals with CMT will experience similar benefits. Pilates focuses on strengthening the muscles that act on the ankle joint, correct alignment of the feet, increasing flexibility, and improving stability and balance. These benefits delay or reduce effects of CMT. Working with Adrienne honed my awareness of the holistic effects of joint and
muscle imbalances and weaknesses. Moreover, it reinforced my appreciation of the Pilates method’s versatility and contribution to well being.

2 Ibid.
3 Ibid.
6 Ibid.
7 National Institute of Neurological Disorders and Stroke, National Institutes of Health.