
REHABILITATION AFTER A BOOT
ON THE LOWER EXTREMITY OF
A BALLET DANCER

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Abstract

Ashley, age twenty-four, is a hobbyist ballet dancer who suffered a fourth-metatarsal stress fracture on her right foot. After wearing a boot for twelve weeks and rehabilitating with Pilates over a six-month period, Ashley showed signs of externally rotating her right femur and tibia when walking and during Pilates exercises. Ashley also complained of being weaker through her right side during ballet classes. When starting her private Pilates sessions, I chose a program that focused on “single-side” series to treat the imbalance of her left and right sides of the body while also working in parallel for hip work. As she had a background in Pilates and dance, I focused on intermediate and advanced work so that she could continue to lay down foundations for strengthening her entire body. In just six months, the external rotation of her right femur and tibia improved.

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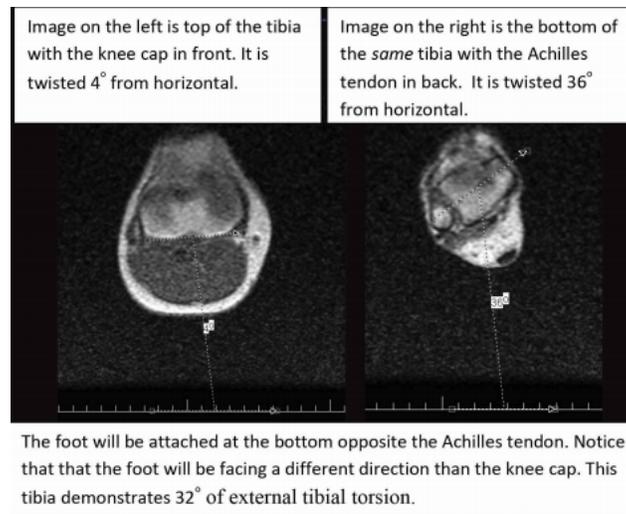
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Anatomy

Having a “duck foot” is a colloquial term for when one hip is externally rotated, causing one foot to point outwards. The anatomical source of “duck foot” can be from the femur in relation to the pelvis or from external tibial torsion. In external tibial torsion, the external rotation of one or both feet is happening at the knee. In this case, the knee will be pointing forward while the foot will be pointing outward. If the rotation is happening at the hip joint, the knee will track toward the externally rotated foot.



As shown in the diagram from “Turnout in Dancers: A Comprehensive Overview of Active and Passive Turnout” by Gayanne Grossman, hip external rotation is often accompanied by some level of external tibial torsion. In the hip, the “spherical femoral head rotates in the socket” of the pelvis; thus, when the femoral head rotates externally, this causes external rotation (4). Grossman found that even in trained ballet dancers, external rotation from the hips varied from 34° to 58° (4). All dancers in Grossman’s study achieved the rest of their turnout from external tibial torsion: when the top and the bottom of the tibia (the shin bone) face in different directions (5). In the case of a dancer who has to wear a boot for an extended period of time, this can exacerbate external rotation in both joints, therefore impacting gait patterns even more.

Case Study

In this case, Ashley, age twenty-four, suffered a fourth metatarsal stress fracture in her right foot. After wearing a boot for twelve weeks, her doctor cleared her to resume her normal activities with no stipulations. Over the coming months, Ashley regained her general strength by taking BASI Pilates mat and equipment classes, with her only modification being using lighter springs for footwork exercises. However, after a six-month period, Ashley's right leg was still significantly weaker. From wearing the boot for so long, her right leg was externally rotated in relation to her pelvis, her adductors and right hamstring failed to fire during certain exercises, and her right foot was supinating. She also had external femur and tibial torsion from her two decades of ballet training, and found after six months of general classes that the boot had exacerbated these external rotations on her right lower extremity.

At this point, Ashley began taking one-on-one sessions to target her asymmetry. When approaching programming for this client, I (the practitioner) chose a program that focused on "single-side" series to treat the imbalance of her left and right sides of the body while also focusing in parallel for hip work. As she had a background in Pilates and dance, I focused on intermediate and advanced work so that she could continue to lay down foundations for strengthening her entire body. When approaching her one-on-one sessions, I chose a three-week cycle of programs so that she could feel a balance of being challenged and having fun, while including but limiting exercises that made Ashley get to a "frustration" point with what her right lower extremity could achieve. To gauge Ashley's work and load tolerance, I also followed the advice of Shelly Power, Pilates Anytime instructor, who stated in her "Pilates After Injuries" video to guide with asking the client if something hurts or if it is just a different sensation (2017).

Program A

Begin	<ul style="list-style-type: none"> • Roll Down
Warm Up (Intermediate)	<ul style="list-style-type: none"> • Roll Up • Spine Twist Supine • Double Leg Stretch • Single Leg Stretch • Criss-Cross
Foot Work (Reformer)	<ul style="list-style-type: none"> • Parallel Heels (3 Reds, 1 Blue) • Parallel Toes (3 Reds, 1 Blue) • V-Position Toes (3 Reds, 1 Blue) • Open V-Heels (3 Reds, 1 Blue) • Open V-Toes (3 Reds, 1 Blue) • Calf Raises (3 Reds, 1 Blue) • Prances (3 Reds, 1 Blue) • Prehensile (3 Reds, 1 Blue) • Single Leg-Heel (3 Reds) • Single Leg-Toe (3 Reds)
Abdominal Work (Reformer)	<ul style="list-style-type: none"> • 100 (1 Red, 1 Blue) • Coordination (1 Red, 1 Blue)
Hip Work (Cadillac: Single Leg Supine Series, 1 Purple Spring)	<ul style="list-style-type: none"> • Frog • Circles Down, Up • Hip Extension • Bicycle, Bicycle Reverse
Spinal Articulation (Reformer)	<ul style="list-style-type: none"> • Bottom Lift (2 Reds, 1 Blue) • Bottom Lift with Extensions (2 Reds, 1 Blue)
Stretches (Ladder Barrel)	<ul style="list-style-type: none"> • Hip Flexors
Arm Work (Reformer: Arms Siting Series)	<ul style="list-style-type: none"> • Chest Expansion (1 Red) • Biceps (1 Red) • Rhomboids (1 Blue) • Hug-A-Tree (1 Blue) • Salute (1 Blue)
Full Body Integration (Reformer)	<ul style="list-style-type: none"> • Tendon Stretch (1 Red, 1 Yellow) • Up Stretch 3 (1 Red)
Leg Work (Reformer)	<ul style="list-style-type: none"> • Single Leg Skating (1 Red)
Lateral Flexion/Rotation (Reformer)	<ul style="list-style-type: none"> • Mermaid (1 Red)
Back Extension (Reformer)	<ul style="list-style-type: none"> • Pulling Straps 1 (1 Blue) • Pulling Straps 2 (1 Blue)
End	<ul style="list-style-type: none"> • Roll Down

Program B

Begin	<ul style="list-style-type: none"> • Roll Down
Warm Up (Cadillac)	<ul style="list-style-type: none"> • Roll-Up with Roll-Up Bar (2 Yellow Springs with Roll-Up Bar) • Mini Roll-Up (1 Red) • Mini Roll-Up Oblique (1 Red) • Roll-Up Top Loaded (1 Red)
Foot Work (Cadillac)	<ul style="list-style-type: none"> • Parallel Heels (2 Reds) • Parallel Toes (2 Reds) • V-Position Toes (2 Reds) • Open V-Heels (2 Reds) • Open V-Toes (2 Reds) • Calf Raises (2 Reds) • Prances (2 Reds) • Single Leg-Heel (1 Red) • Single Leg-Toe (1 Red) • Hip Opener (1 Red)
Abdominal Work (Cadillac)	<ul style="list-style-type: none"> • Roll Up Bottom Loaded (1 Red) • Teaser (1 Red)
Hip Work (Cadillac: Single Leg Supine Series, 1 Purple Spring)	<ul style="list-style-type: none"> • Frog • Circles Down, Up • Hip Extension • Bicycle, Bicycle Reverse
Spinal Articulation (Cadillac)	<ul style="list-style-type: none"> • Monkey Original (1 Red) • Tower (1 Red)
Stretches (Reformer)	<ul style="list-style-type: none"> • Kneeling Lunge
Arm Work (Side Arm Kneeling Series)	<ul style="list-style-type: none"> • Deltoid Reach • Cross Arm Pull • Triceps • Arms Overhead
Full Body Integration	<ul style="list-style-type: none"> • Balance Control Front (Reformer, 1 Red) • Saw (Cadillac, 1 Red)
Leg Work (Chair)	<ul style="list-style-type: none"> • Backward Step Down (3,3)
Lateral Flexion/Rotation (Chair)	<ul style="list-style-type: none"> • Side Pike (3,3)
Back Extension (Chair)	<ul style="list-style-type: none"> • Swan Basic (0, 1) • Back Extension Single Arm (0,1)
End	<ul style="list-style-type: none"> • Roll Down

Program C

Begin	<ul style="list-style-type: none"> • Roll Down
Warm Up (Intermediate)	<ul style="list-style-type: none"> • Roll Up • Spine Twist Supine • Double Leg Stretch • Single Leg Stretch • Criss-Cross
Foot Work (Chair)	<ul style="list-style-type: none"> • Parallel Heels (3,3) • Parallel Toes (3,3) • V-Position Toes (3,3) • Open V-Heels (3,3) • Open V-Toes (3,3) • Calf Raises (3,3) • Single Leg-Heel (2,3) • Single Leg-Toe (2,3)
Abdominal Work (Chair)	<ul style="list-style-type: none"> • Pike Sitting (0,2) • Full Pike (2,3)
Hip Work (Cadillac: Single Leg Supine Series, 1 Purple Spring)	<ul style="list-style-type: none"> • Frog • Circles Down, Up • Hip Extension • Bicycle, Bicycle Reverse
Spinal Articulation (Reformer)	<ul style="list-style-type: none"> • Semi-Circle (1 Red, 1 Blue)
Stretches (Reformer)	<ul style="list-style-type: none"> • Standing Lunge (1 Red)
Full Body Integration (Reformer)	<ul style="list-style-type: none"> • Round Back (1 Red) • Flat Back (1 Red)
Arm Work (Cadillac: Arms Standing Series)	<ul style="list-style-type: none"> • Chest Expansion • Hug-A-Tree • Circles Up • Circles Down • Punches • Biceps
Leg Work (Cadillac)	<ul style="list-style-type: none"> • Squats (2 Yellow Springs)
Lateral Flexion/Rotation (Cadillac)	<ul style="list-style-type: none"> • Butterfly (2 Yellow Springs)
Back Extension (Cadillac)	<ul style="list-style-type: none"> • Prone 1 (1 Red) • Prone 2 (1 Red)
End	<ul style="list-style-type: none"> • Roll Down

Programming Rationale

For this three-week rotating program, I intentionally chose exercises that would encourage a parallel rotation of the femur and the tibia while also encouraging the body to work together. From an Anatomy Trains perspective, “every pattern in the body is a total body pattern,” so when approaching this client, I wanted to take a neuro-myofascial-skeletal-psycho-social-emotional perspective (Rogers 3). Or, in shorter terms, I wanted to support this dancer by making her feel both successful and challenged. By having a three-week rotation, the exercises were repeated often enough to feel success with them, but not repeated too often for her to feel bored of them.

For the warm-up, we cycled between the Cadillac warm-up and the intermediate mat warm-up. The Cadillac warm-up provides both assistance and challenge with the springs. Ashley’s main focus during the Cadillac warm-up was to keep activating her inner thighs and hamstrings during the roll-up with the roll-up bar and roll-up top loaded so that she did not go into external rotation. During the mat warm-up, we focused on the same concepts during the roll-up. For the spine twist supine, besides activating her obliques, Ashley’s focus was to keep her inner thighs squeezing together. Over the course of a couple months, Ashley went from always having her knees separated during this movement, to needing a gentle reminder, to keeping her inner thighs activated on her own. This same movement pattern was seen during the double leg stretch/single leg stretch/criss-cross series: over time, her hips, knees, and ankles began to track in a parallel pattern.

For the foot work, we cycled through the Reformer, Cadillac, and Wunda Chair foot work series. For Ashley, a relatively strong client despite her rotational asymmetry, the different load point of the springs provided a different challenge for her, all the while keeping in mind the

glute-hamstring connection. I believe that being able to cycle through doing prehensile during the Reformer footwork, the hip opener during the Cadillac footwork, and the soleus-focused calf raises of the Chair footwork allowed Ashley to gain her lower extremity strength faster than if we had just focused on one footwork for a few months. The hip opener, which could be counter intuitive for a client with exaggerated external rotation, helped guide her external rotators by encouraging and guiding them to fire instead of using her hip flexors.

For the abdominal work, I chose exercises that would require loading the abdominals by trunk flexion while also requiring inner thigh connectivity and hamstring activation. In coordination on the Reformer and the teaser on the Cadillac, Ashley's propensity was to find a small "V" with her feet. We used a black knee pad as a prop to help engage her inner thighs. She had to squeeze the pad above her knees and in between her thighs. By the fifth week, she was able to stay in parallel without the pad. We occasionally need to use the pad again, but in general, she is able to fix it with a reminder.

In hip work, I decided to solely do the single leg supine series on the Cadillac. At the beginning of the six-month period, her pelvic lumbar stabilization was weak, causing her to shift on the Cadillac. Over the six months of following this program and this specific hip work series, Ashley was able to use more "load" by moving the bar higher on the Cadillac, and her mobility in parallel has increased. After this six-month period, Ashley was able to stay stabilized without moving around the Cadillac.

For spinal articulation, we cycled between bottom lift with and without extensions, monkey and tower on the Cadillac, and semi-circle on the reformer. I chose the first four exercises because of the focus on working in parallel and working the hip extensors. The semi-circle also works the hip extensors, but it is also done in a small "V" position and requires slight

external rotation of the hip joint. In this exercise, Ashley focused on being equal with her rotation on both sides, therefore not allowing her to “slump” into her right external rotation.

In the stretching block, Ashley worked on the standing and kneeling lunges on the Reformer and the hip flexors stretch on the Ladder Barrel. The reformer stretches required her to keep her hips square while stretching both the hip flexors and the hamstring; and the Ladder Barrel stretch allowed a deeper focus on the hip flexors. Over time, she was able to get deeper into the stretch and needed fewer reminders of keeping her hips square.

For the chosen intermediate and advanced exercises for Full Body Integration, my focus was for Ashley to feel challenged and to have fun in more “dance-like” exercises with balance control front, saw, tendon stretch, and up stretch 3. However, for Program C, I programmed flat back and round back so that Ashley would have to focus on her hip disassociation, which was initially very challenging. By only doing this once every three weeks, she was able to build strength without feeling consistently frustrated with these exercises.

In the arm work series, we cycled between the Arms Sitting Series, the Side Arm Kneeling Series, and the Arms Standing Series. In Arms Sitting, Ashley focused on stretching her sometimes tight hamstrings to sit up tall and lengthen through her spine. In the Side Arm Kneeling Series, Ashley focused on stabilizing through her pelvis while working on this cross-body lateral work. Finally, in the Arms Standing Series, Ashley had to find stability in parallel while leaning into the springs at a slight diagonal. Overall, all three series encouraged stability through her pelvis.

For leg work, we rotated through single leg skating, backward step down, and squats. Doing two single-leg exercises (single leg skating and backward step down) mixed in with the

double-leg, parallel-working squats exercises allowed Ashley to strengthen her right side independently of her left, and then allowed her to work in tandem during squats, which further allowed me to see if her pelvis could work in a stable pattern or not. Ashley also benefitted from doing squats once every three weeks since this is a functional movement pattern. She reported being able to get items off of lower shelves more easily over time.

In lateral flexion and rotation, I programmed Ashley to work on mermaid, side pike, and butterfly. With mermaid, Ashley had to have the leg close to the shoulder rests in internal rotation, which gave her a hip stretch. In side pike, Ashley focused on engaging both sides of her obliques so she did not “dump” into one side of her pelvis. In butterfly, Ashley had to stand in parallel while keeping her hip points facing forward. All three exercises proved challenging in different ways for her right external rotation while still achieving the muscle focuses.

Finally, in back extension, we cycled through pulling straps one and two, swan basic and back extension single arm, and prone one and prone two. For the Reformer and Chair exercises, Ashley’s focus, besides her back extensors, was to keep her legs squeezing into parallel. In prone one, Ashley was able to not worry about her legs as much and to focus more; and in prone two, she was able to focus on the lumbar extension she needs in her dance practice.

Conclusion

Overall, in the six-month period I worked with Ashley on this program cycle, she went from having an extreme femur and tibial rotation on her right side to being closer to parallel. Although we are still working to achieve symmetry in her lower extremities, we are no longer following this program cycle, and we have begun to mix in more repertoire, especially with different hip work series. Since she has regained her strength in her right side and no longer needs the consistent support of straps seen in equipment work, we have also begun to focus on more intermediate and advanced mat work.

In conclusion, I am pleased with how Ashley progressed with this program over a six-month period. Not only is she able to work in parallel more often without being corrected, showing that her hamstring and adductors are now firing when they should, but her pelvic lumbar stability has improved, as well. Ashley also reports feeling stronger and feeling more successful in her ballet classes.

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