# Pilates for Gait Function

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Abstract

Here I have worked with and studied a woman who has been in recovery post ankle surgery. Her ankle surgery was in lieu of a pre-existing injury that originally occurred 10+ years ago. The initial injury was to her accessory navicular--a rare occurrence of an extra ‘floating’ bone in the arch of the left foot--had been pulled away by the attached tendon, resulting in a collapsed arch and instability of the ankle joint. My client had lived with this since she was a young adult and over time and in addition to multiple sprains to that same ankle, her condition had become chronic and was affecting the proper gait function throughout the kinetic chain.

Her surgery was reconstructive in nature and consisted of a few different elements. First, her accessory navicular was removed and the posterior tibial tendon was reattached. She received a calcaneal osteotomy, a cut across the heel bone, shifting it medially and two screws were put in place through the bottom of the heel bone. And finally a gastrocnemius recession, which involved the release of the gastrocnemius tendon and subsequent lengthening of the calf muscle.

I began working with her 12 weeks post surgery. Our focus was to strengthen the entire kinetic chain from the foot, through the ankle, knee, and hip; to retrain gait function and restore full strength to the leg. Specifically, we worked to strengthen the intrinsic muscles through the midfoot and arch, stabilizing the ankle, and restoring full strength to the calf muscles. We focused on hamstrings and glutes to normalize the function of the hip and core stability to bring back balance to the entire body after months of immobility.

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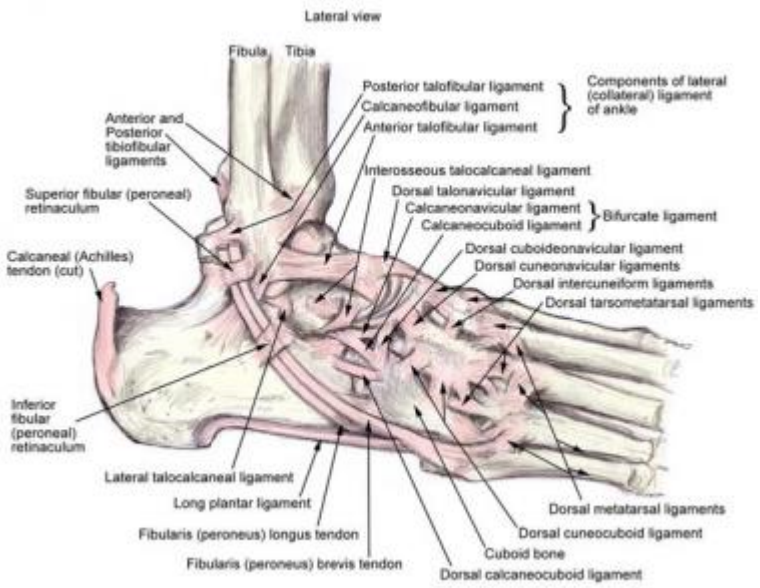
Anatomical Description

The ankle joint acts like a hinge and its unique design offers stability to withstand 1.5 times the body weight when walking and 8 times that when running. Normal ankle function is needed to walk with a smooth gait as the muscles, tendons, and ligaments that support the ankle joint work together to propel the body. Injuries that inhibit normal ankle/gait functioning can make everyday activities, including simply walking or standing riddled with pain and next to impossible; the imbalance not only effects the ankle and foot itself but compromises the health of the knee and hip as well. For the purpose of this paper, the ankle can be divided into a few relevant categories: Bones and joints; Ligaments and tendons; Muscles.




Bones & Joints

The ankle joint is formed by the connection of three bones. The anklebone is called the Talus, and its top fits inside a socket that is formed by the lower end of the tibia and fibula. The bottom of the talus sits on the calcaneus. The talus works like a hinge inside the socket, allowing the foot to move up— dorsiflexion, and down—plantar flexion, while distally, the tibia and fibula clasp the talus—the uppermost tarsal bone—which increases the stability of the ankle joint. The distal tibiofibular joint is a fibrous joint, connecting the two bones with ligaments and fibrous tissue.

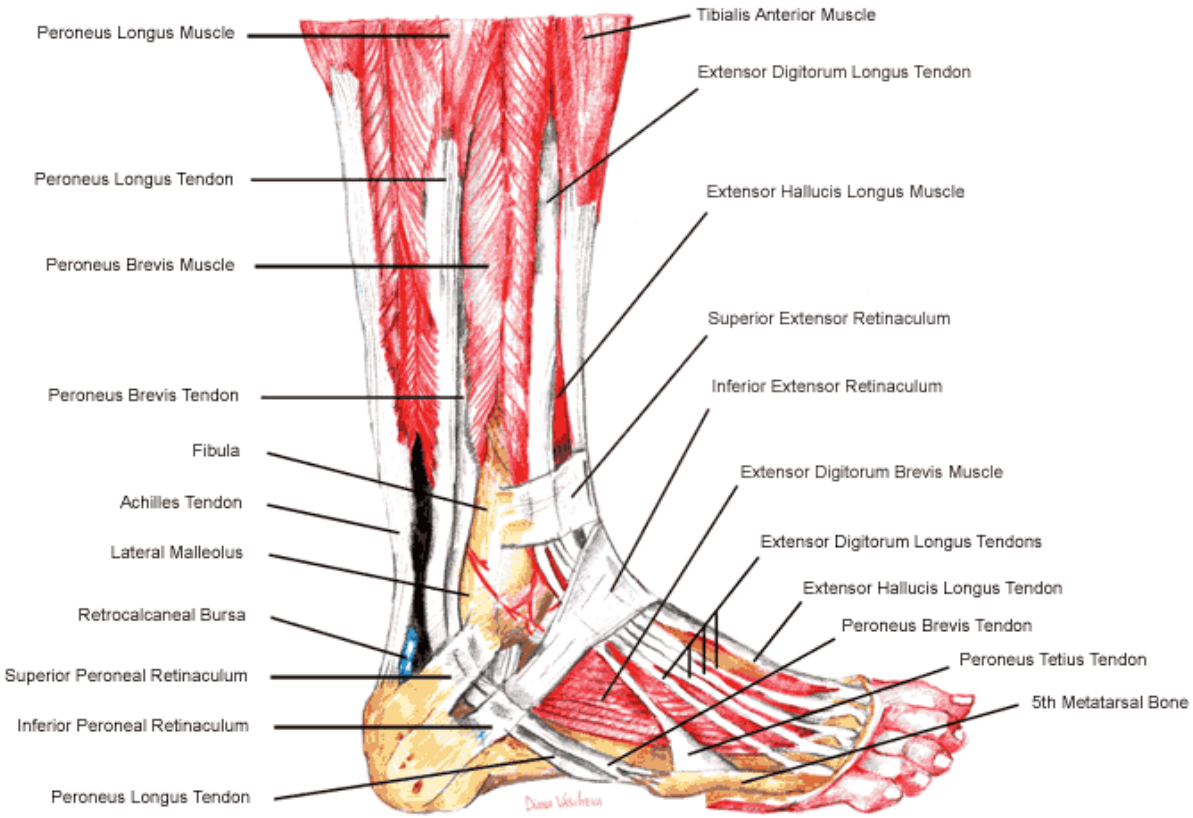

Ligaments & Tendons

Ligaments are the soft tissues attaching bones to bones, and tendons attach muscles to bones. A series of ligaments support the lower end of the leg where it forms a hinge for the ankle where the bottom end of the fibula meets the tibia. The ankle joint is also supported by the tendons--the Achilles tendon, which helps with walking/running, and the posterior tibial tendon that attaches a smaller muscle of the calf to the underside of the foot.

Muscles

Most of the motion of the ankle is by way of the stronger muscles in the lower leg with tendons passing by the ankle and connecting in the foot. Contraction of the muscles in the leg is the main way we walk and run. The peroneals—longus and brevis—are located on the outside of the ankle and foot, bending the ankle down and out (plantar flexion/version). The gastrocnemius and soleus connect to the calcaneus by the Achilles tendon, while the posterior tibialis muscle supports the arch and helps turn the foot inward, and the anterior tibialis pulls the ankle upward (dorsiflexion/inversion).

# Side View of Foot Muscles & Tendons



## Introduction

The importance of healthy feet and ankles is crucial in the health and proper functioning throughout the entire kinetic chain. Walking and running are complex but basic human movements among the most used in everyday activities. The gait cycle holds invaluable information about a person movement patterns, compensations, and imbalances. There are a vast number of joints involved in the proper function of the gait, not only through the foot and ankle, the knee and the hip play a vital role. If there is injury and instability to the ankle it will cause wear and tear on the knee and hip joint. Proper foot function is integral to over all healthy functioning of the entire body.

## Case Study

Erin is a 29-year-old, moderately active female. As a young girl, Erin was often bothered by pronation of her ankles and hypermobile joints throughout her body. Her first injury to the foot and ankle was a "simple" roll of the ankle from stepping backward on an incline. The initial injury was to the navicular bone and posterior tibial tendon--of which she is in 2-14% of the population with an "accessory navicular"--, the tibialis posterior muscle that attaches to the navicular bone was sprained and began to tear the accessory navicular bone away from the arch of the foot. Over time this caused excessive pronation and instability to the ankle.

She kept healthy and as active as she could with yoga and pilates but having a waitressing job on her feet for much of her adult life meant that she, much of the time, was dealing with chronic pain not only in the foot but up through the knee and hip as well. She kept the ankle, knee, and hip as strong and mobile as she could but 10+ years of managing her injury she realized that the instability was something that could not be restored without medical intervention so she went on to have reconstructive surgery to the midfoot and ankle joint, including, gastroc recession (calf lengthening), excision of accessory navicular (bone removed in arch), and calcaneal osteotomy (medial heel shift).

## Conditioning Program

8 weeks post surgery we began Erin's pilates rehabilitation. She had begun a few weeks of basic, non-weight-bearing movements of the foot/ankle/knee/hip on her own. At least 3 times per/week, Erin did the following with light spring tension due to nerve pain, general weakness in the body, and still favoring non-weight-bearing exercises.

Warm up: Pelvic Tilt (non-weight-bearing), Spine Twist Supine, Chest lift and Chest lift w/ rotation

By week 10 she was able to lightly weight bear and began the pelvic curl

Foot work: non weight-bearing plantar flexion, dorsiflexion, inversion, eversion
By week 10 she was on the reformer with 1 blue or 1 red spring starting the foot work series

Abdominal work: Hundred Prep & the Hundred—1 red spring

Hip Work: (mat) gluteal side lying series, gluteal kneeling series
By 12-14 weeks she began hip work series on the reformer with light tension 1 red spring

Spinal Articulation: quadruped, cat/cow (flexion/extension)
By week 10-12 we implemented pelvic curl progressing eventually to bottom lift & bottom lift with extension 1 red spring

Stretches: hip rotator stretches (number 4 stretch), seated forward fold for hamstrings
Progressed to kneeling lunges on mat once she was weight bearing for hip flexors/quads and ensuring proper gluteal activation and soon onto standing lunges 1 red spring

Full Body Integration: did not implement this block until 12-14 weeks when weight bearing was more fully restored. We began with the stomach massage series 1 red spring. Moving soon to elephant/up stretch 1

Arm work: Supine Series—1 red spring, progressed to seated series for deeper core integration

Leg work: Hamstring Curl—1 red spring
12-14 weeks side skating 1 blue spring

Lateral Flexion/Rotation: Mermaid—1 red spring

Back Extension: Breaststroke Prep—1 blue spring

Erin began her rehab practices on her own with fundamental movements of the joints; ankle plantar/dorsiflexion, inversion, eversion, knee flexion/extension, hip flexion/extension and circumduction. She was determined to recover quickly and restore efficient and proper movement throughout the kinetic chain. Erin committed to doing these mat exercises on a daily basis. From about 6-10 weeks much of her practice was non-weight-bearing and open chain, in

both eccentric and concentric contractions. By 10-12 weeks she was playing and experimenting with weight-bearing exercises.

Conclusion

Erin was strong-willed and she was focused on healing. Her number one intention was to not live with the pain she had lived with for so long, so she committed to restoring her body back to health mostly for the sake of her mental health. She understood the importance of uniting both. She worked hard in her exercises and also embraced how healing her rest periods were for her body-mind. She frequently incorporated foot soaks alternating in ice and then hot water, she took as much downtime as she could and kept her foot elevated as often as she could. Because of this tenacious attitude, her recovery progressed quickly and her body took on an entirely new shape. Not only did her ankle become more functional, so did her central core.

Erin reached her desired results within our 12 weeks together. At 6 months post surgery, she felt better then she had ever felt in her adult life. It was a profound shift for her since living with chronic pain and instability for so long. She exceeded her own expectations in her recovery as well as her surgeons. She contributes her full and quick recovery to her dedicated Pilates practice. She said not only did the practice work her body but it kept her mind focused and clear which is essential when healing from such traumas. She learned so much about how her body is meant to move functionally and she is grateful that that knowledge will now be with her for life. She continues to practice 3 x week with me and the girl I once knew pre-surgery has come through a total body-mind transformation. Erin's recovery has been profound and deeply inspiring.

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