

Contact:

Balance Pilates & Yoga Centers
7451 Manatee Ave. West
Bradenton, FL 34209

and
703 60th Street Court East, Suite A
Bradenton, FL 34208
Tel. (941) 794-5060

<http://www.BalancePilatesAndYoga.com>

Written By: Carolyn Waygood



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Pilates & Yoga Centers

7463 Manatee Ave. West
Bradenton, FL 34209
Tel. (941) 794-5060

703 60th St. Court E., Suite A
Bradenton, FL 34208
Tel. (941) 773-2967

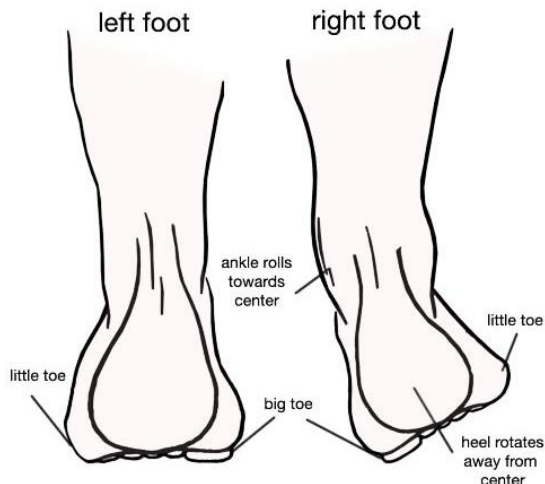
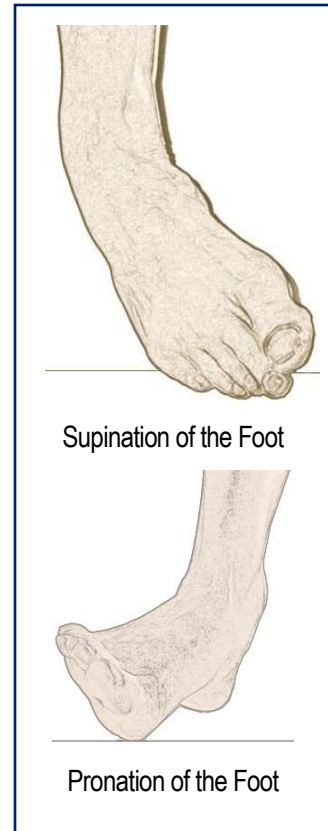
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Getting to Know Your Body

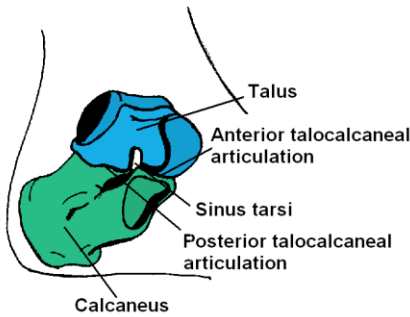
Understanding Pronation of the Feet

The human foot is a versatile body part and is made up of bones, muscles, joints, tendons, and ligaments. The foot consists of the ankle, the toes, and the middle region known as the metatarsus. A whopping 52 bones make up the feet (26 bones in each - one-quarter of the bones in the human body)! The foot has a wide range of motion and can perform many different movements due to the number of joints making up the foot - 33 joints in all! The foot has more than 100 muscles, tendons and ligaments (tendons are fibrous tissues that connect muscles to bones and ligaments are fibrous tissues that connect bones to other bones). To understand the proper alignment of the foot, one needs to understand both the foot anatomy and the proper movements of the foot.

Movements of the Foot: *Dorsiflexion* is the movement of the foot up (lifting the toes toward the ceiling). *Plantarflexion* is the movement of the foot down (like stepping on the gas pedal of your car). *Abduction* is the movement of the foot away from the center line of the body (turning the toes out to the side – often called “duck feet”). *Adduction* is the movement of the foot towards the center line of the body (turning the toes inward – often called “pigeon toes”). *Inversion* is the twisting movement of the foot inward, and *eversion* is the twisting movement of the foot outward. *Supination* and *pronation* are a combination of the above motions. Some people may use supination and inversion interchangeably and pronation and eversion interchangeably. However, **supination** is actually a combination of inversion, plantarflexion and adduction and **pronation** is a combination of eversion, dorsiflexion and abduction.

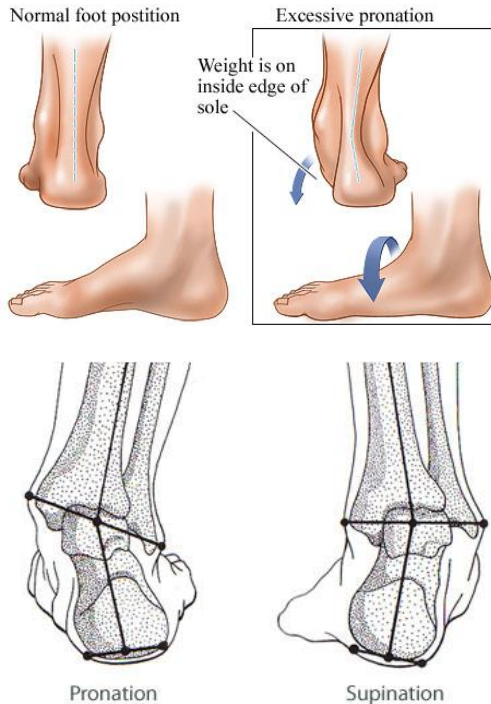


In the diagram to the left, **the right foot is pronated**. The heel rotates away from the center of the body, the little toe moves away from the center of the body, the foot flexes up slightly and the ankle rolls in. When we walk, the feet normally supinate and pronate. However, when the feet pronate too much, people experience problems such as plantar fasciitis, tendonitis and painful arches. Excessive pronation and supination can cause a number of problems that affect the foot, ankle, knees, hips and back. Some of the more common symptoms of excessive pronation and supination include; Arch pain, Heel pain, Flat feet, Corns and Calluses, Ankle sprains, Shin Splints, Achilles tendonitis, Knee pain, Hip pain, and Back pain.



Supination and pronation occur at the Sub-Talar Joint of the foot. It occurs at the meeting point of the talus and the calcaneus. Excessive pronation causes the foot arch to flatten out and stretches the muscles, tendons and ligaments underneath the foot.

The **plantar fascia** is a tight ligament that stretches along the bottom of the foot from the heel bone to the ball of the foot. Plantar fasciitis occurs when this connective tissue inflames and small fibers begin to tear away from the heel bone. Often, the body responds by depositing calcium in an attempt to "glue" the detached ligament fibers back on to the heel. Heel spurs, or calcaneal spurs, can develop if the fascia is continuously under tension. These heel spurs can be re-absorbed by the body when the tension is released. When pronation results in the flattening of the arch, pain (which can sometimes be severe) occurs and the student should seek immediate attention. This is not something that will just "go away" – but rather get worse over time. A Pilates Instructor is trained to identify misalignments of the feet, and can help correct poor biomechanics and relieve pain associated with excessive pronation. When treating pain associated to pronation, your plan should include orthotics or arch supports and the correct choice of shoes, and stretching exercises such as those performed in Pilates Footwork. Pilates exercises such as Footwork - Arches, Tendon Stretch and Running stretch your calf muscles. Crazy as it sounds, this works! The calf muscles/Achilles tendon complex runs from the bottom of the heel to the back of your knee. A tight heel cord pulls the heel bone up and back, stressing the fascia. A relaxed tendon and calf muscles puts less strain on the injury. The student should also focus on resting the feet (avoid continued stress placed on the muscles and tendons through running and walking), take Anti-inflammatory medicine (such as a cortisone injection or oral anti-inflammatory medication such as Ibuprofen), and consider Physical Therapy that includes Massage, Ultra sound, Electrical Stimulation, Paraffin/Deep Heat, and/or a Whirlpool soak.



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There's a reason why Pilates Instructors care so much about proper foot alignment. The feet must be both flexible (to absorb shock from below and above) and strong (in order to maintain the equilibrium of the leg and body above). If feet are continuously misaligned, resulting in poor movement of foot joints, and joints above (e.g., the ankle, knee and hip), problems up the kinetic chain will almost certainly come to fruition. Pronation of the foot most likely will cause rotation of the leg that occurs with each and every step, which can produce torsional, or twisting, forces on the soft tissues that attach to various parts of the leg. If excessive, one may develop *patellar tendinitis* (tendinitis in the knee region), or shin splints. Furthermore, rotation of the lower leg also affects the alignment and motion of the patella (knee cap), which can produce pain in and around the



patella, called "*patellofemoral syndrome*". To reverse pronation, one must strengthen the muscles and tendons of the feet in order to support the arch of the foot, in addition to treating the symptoms and problems above the foot.



As mentioned above, excessive pronation of the foot may not only affect the health of the feet, but may also effect the health of the entire leg, especially the knee. Pronation occurs from the joint between the tibia bone (lower leg) and the talus (ankle bone), and the joint between the talus and the calcaneous (heel bone). As the foot flattens, the ankle will cause the tibia to rotate inward. As the tibia rotates inward, this will affect the angle of the knee joint. When the knee joint turns in more the normal, this is called an increase in the *valgus angle* of the knee. Miscellaneous knee pain is often referred to as "*patellofemoral pain syndrome*", which is pain resulting from physical and biochemical changes in the *patellofemoral joint* (the knee joint). Patients with patellofemoral pain syndrome have anterior (front) knee pain that typically occurs with activity and often worsens when they are descending steps or hills. Foot pronation causes a compensatory internal rotation of the tibia or femur that upsets the proper patellofemoral alignment and causes wear and tear and pain.



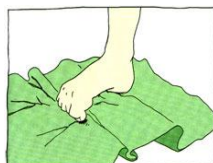
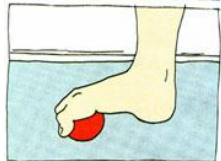
Exercises for patellofemoral pain should include quadriceps strengthening (if the quads are detected as being weak) or quadriceps stretching (if the quads are recognized as being too contracted) because the quadricep muscles play a significant role in patellar movement. Hip, hamstring, calf and iliotibial band stretching is also important. Many Pilates exercises address these goals including, but not limited to, Footwork (strengthens and stretches muscles of the feet, and strengthens the quadriceps), Frog and Leg Circles (stretches and opens the hip muscles, and IT bands), Thigh Stretch (stretches the quads and hip flexors), and Running (stretches the calf muscles).

What may be thought of as a simple misalignment of the feet, may actually turn out to be a more comprehensive problem of related issues further up the kinetic chain. A Pilates Instructor is trained to not only consider the biomechanics of the feet and ankle, but to also look at the entire kinetic chain running from the feet to the hip and spine. Consult with your Pilates Instructor to make sure your hip or knee pain isn't related to your feet, and work with them to correct the problem and alleviate the symptoms that may occur higher up. Remember to follow their home exercise plan, and typical problems with the feet can be cured in 6 weeks or more depending on the severity of your condition and how long the condition has been going on.

Recommended Home Exercises;



Toe Grip Exercise; This exercise massages the bottom of the foot and also strengthens the transverses arch. Stand or sit on the edge of a chair with good posture, and place a small rubber ball under your heel. Roll the ball around under your foot with gentle pressure to massage and stimulate the sole.



Towel Exercise; This exercise works best on a smooth surface. Lay a towel on the floor and stand or sit on the edge of a chair with good posture and the heel pressed into the towel. Spread the toes like a fan, then grip the towel and pull it toward you. Focus on the outer edge of your foot, working the little toes, and keeping the ankle from rolling inward.



Pool Running; Stand in the shallow end of a pool. Start at one end and sprint to the other end, pushing off with your feet as hard as you can with each step. The water adds resistance, so your push-off stresses the muscles of the lower leg and foot more than ground running. For best results in strengthening the structures that support the arch, the water should be between waist- and chest-deep.

Sand Running; Walking or running in the sand targets the foot and leg muscles. The foot sinks into the soft surface, so you have to push off harder than when on solid ground, thus forcing the muscles that compose the arch of the foot to work harder.

This exercise will do you no good if you allow your ankle to roll inward as you walk – thus further enabling your pronation. So remember to focus on proper alignment and keep the ankle centered and knee over the ankle.



Yoga Band Stretch: Plantar Flexion; Plantar flexion of the foot or pointing the toes. This can be done with an exercise band to get the maximum amount of stretch and resistance. Sitting with your legs straight and the band wrapped wide around the ball of the foot and toes. Tension the band with your feet flexed or pointed up to get a stretch and then point the foot or press the ball of the foot into the band to really strengthen the foot, ankle, and calf muscles. Repeat on each foot 10-20 times.



Yoga Band Stretch: Dorsiflexion; Sitting with your legs straight and the band wrapped around the top of your foot and secured to an object for resistance. Pull your toes up against resistance pointing them up to the ceiling, then release back to a pointed foot. Repeat for 10-20 repetitions on each foot.

About Balance Pilates and Yoga Centers

Balance Pilates and Yoga Centers was founded in 2004 by Connie Borho, Peak Pilates Master Teacher Trainer and resident of Bradenton. Connie now offers two locations to serve the Northwest Bradenton area, as well as the East Bradenton/North Sarasota communities. The studios offer Pilates Mat and equipment classes, yoga classes, and private personalized training. Balance is also the host to Peak Pilates Teacher Training certification courses for the Southeast United States. For more information about Balance, visit www.BalancePilatesAndYoga.com.

ARCH TYPE — FOOT ALIGNMENT



NORMAL ARCH



NEUTRAL ALIGNMENT



HIGH ARCHED PRINT



SUPINATOR-ROLLS

TO OUTSIDE/LATERAL



FLATFOOT PRINT



PRONATOR-ROLLS TO

INSIDE/MEDIAL