

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

Introduction:

In the Orthopedic Foot & Ankle community there is great debate as to why problems develop and subsequently how they should be treated. I have had the privilege of training under some of the leaders in the Orthopedic Foot & Ankle community to learn both approaches as a resident and then in my fellowship specialty training. After extensively studying, applying and seeing results of both methodologies, below is how I believe patients' conditions develop. I hope you find the following pages easy to understand and informative.

In this handout, I will discuss in order the following:

1. OVERVIEW OF A TIGHT CALF
 - a. ANATOMY
 - b. HOW IT IS DIAGNOSED
 - c. HOW IT AFFECTS YOUR FOOT
2. PLANTAR FASCIITIS
3. BUNIONS
4. METATARSALGIA
5. HAMMERTOES
6. ACHILLES TENDONITIS
7. POSTERIOR TIBIAL TENDONITIS
8. MIDFOOT ARTHRITIS
9. ANKLE INSTABILITY
10. TIBIALIS ANTERIOR TENDONITIS

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

Anatomy:

The calf is composed of two muscles that allow the heel to be lifted off the ground placing the weight on the front of the foot (aka standing on “tip toes”). The gastrocnemius muscle starts on the back of the thigh (femur) bone and crosses both the knee and ankle joints. The soleus starts on the back of the leg bone (tibia) and only crosses the ankle joint. They each send a tendon down to the heel bone. The tendons merge a few centimeters above the heel bone to form the Achilles tendon and then insert on the heel bone together.



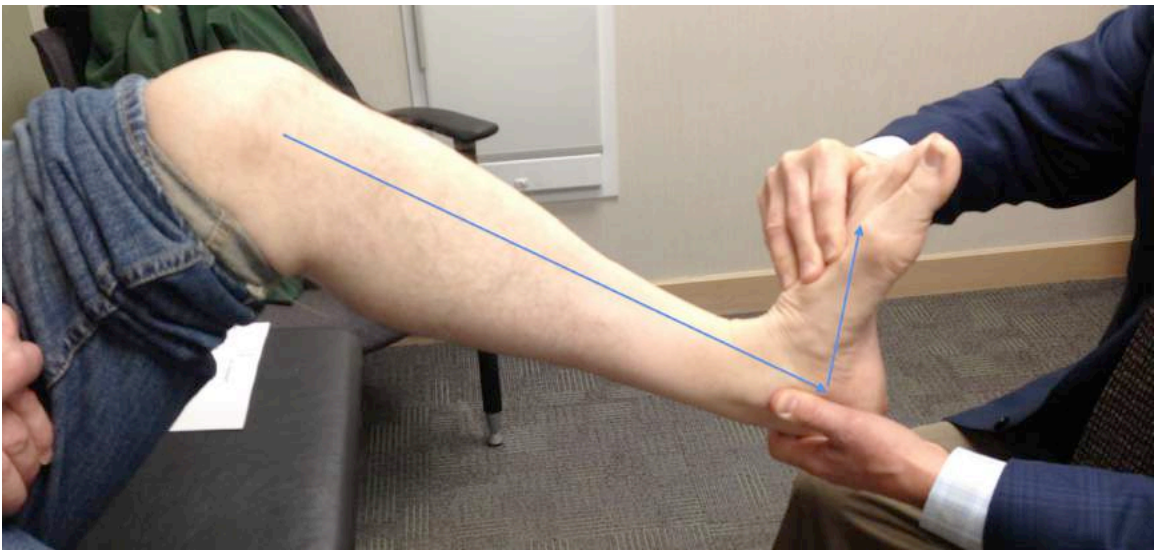
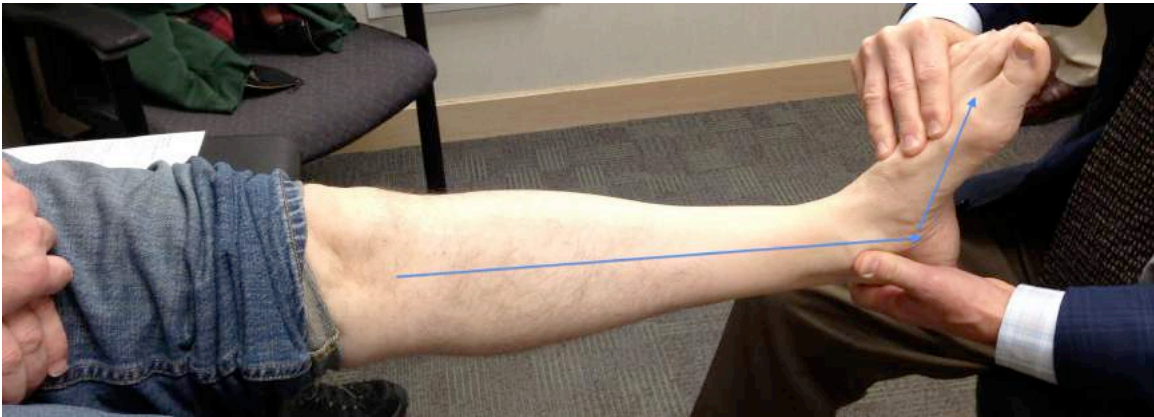
Image borrowed from: <http://faberfitness.weebly.com/bod--body-part-of-the-day/gastrocnemius-upper-calves>

Is my calf tight?

In order to diagnose gastrocnemius equinus (tight calf), Dr. Cheney performs the Silfverskold test. He does this by checking to see how far he can push the foot up with the knee straight (checking the gastrocnemius tightness) and then with the knee bent (checking the soleus tightness). If he cannot get your foot up as high with the knee straight as he can with the knee bent, then you have gastrocnemius equinus (tight calf).

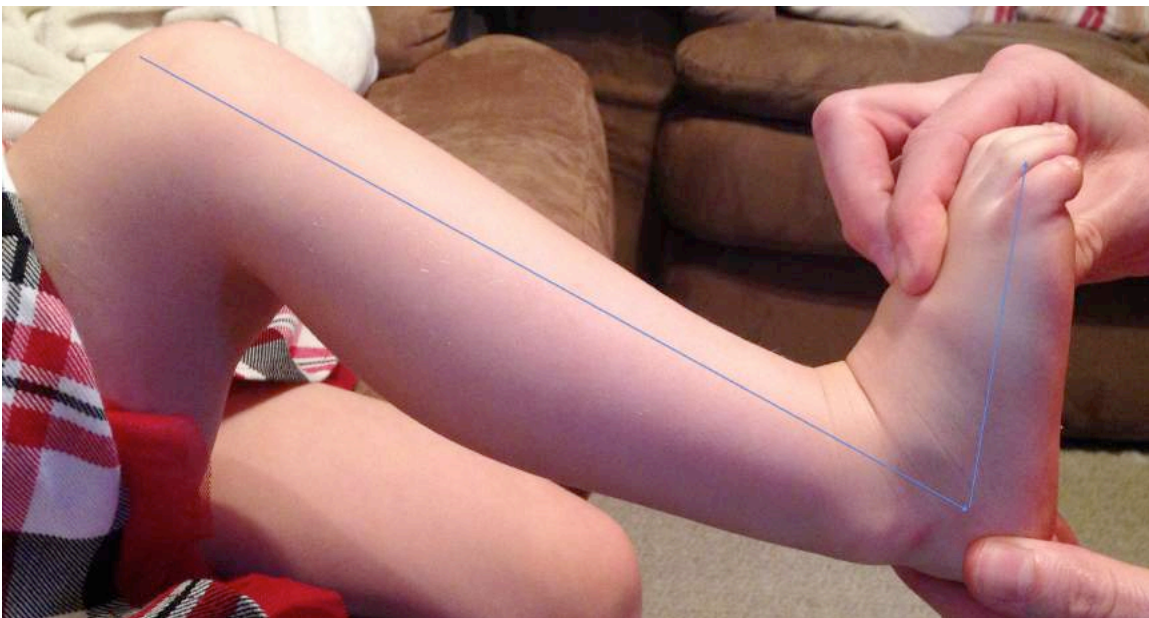
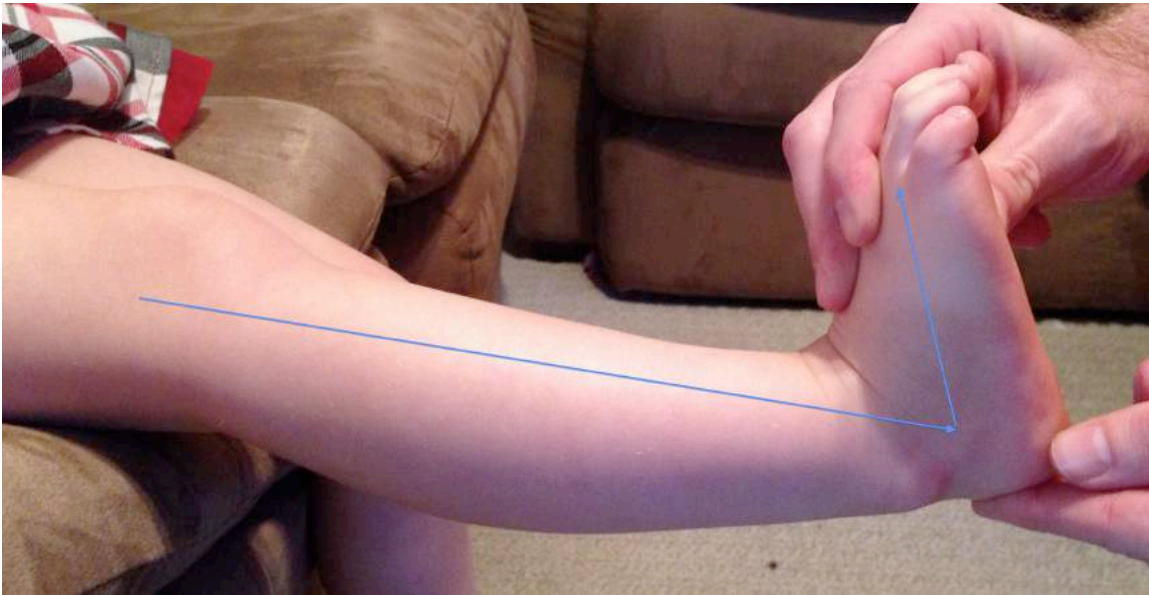
Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

Below is an abnormal examination. Notice the difference in the angle between the blue lines with the knee straight and the knee bent.



Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

Now see a normal examination below. Note the angle of the blue line remains unchanged with the knee straight and with the knee bent.



Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

So, why is a tight calf (gastrocnemius equinus contracture) important?

When we stand, we stand with straight legs. We do not stand with our knees bent. Remember how we check for gastrocnemius equinus? We check for it with the knee straight because the gastrocnemius crosses both the ankle *and the knee*. If the gastrocnemius is tight, it tries to lift the heel up off the ground, which then transfers more weight to the front of the foot (just like going up on our toes).



The foot was intended to be a tripod with the heel being one point and the inside and outside of the front of the foot being the other 2 points. If the gastrocnemius pulls the heel up, then the weight is not evenly distributed and the front of the foot takes more weight than it was intended to take. This imbalance over time can lead to many foot and ankle problems.

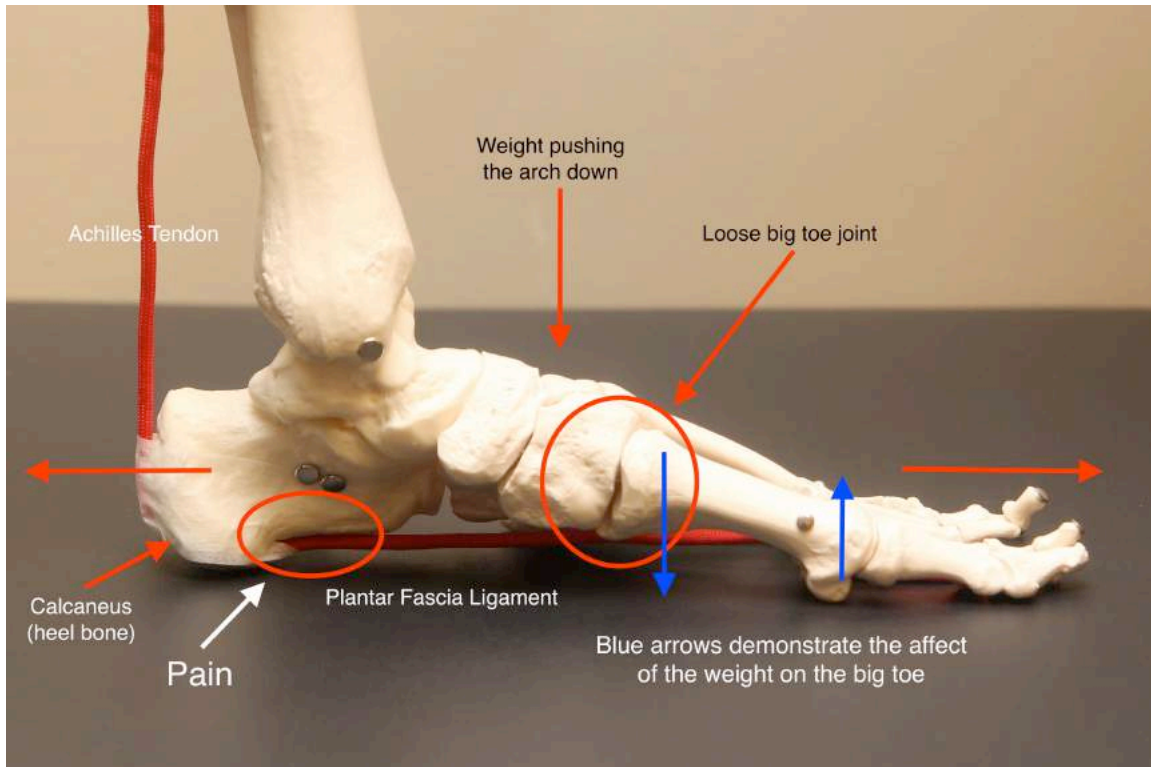
What problems can a tight calf cause?

The simple answer is that it can cause arch collapse. The arch collapse can cause painful conditions, which can all be explained by a tight calf and the following arch collapse.

Plantar fasciitis:

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

Plantar fasciitis causes heel pain. Heel pain that is worse in the mornings or after sitting for a period of time when the patient takes their first steps. This can be explained by having a tight calf and the beginning of an arch collapse progression.



If you look at the foot from the side, notice the plantar fascia, it is attempting to hold the arch up by preventing it from falling, which causes it to fall and stretch the plantar fascia. As the arch starts to fall, the plantar fascia is stretched (horizontal arrows) and causes pain at the insertion point onto the calcaneus (circled). The arch begins to fall as the big toe joint begins to become loose from the excess weight shifted to the front of the foot. Bone spurs can develop on the heel due to the chronic inflammation at the insertion of the plantar fascia but *they do not cause pain*, they are a reaction to the problem.

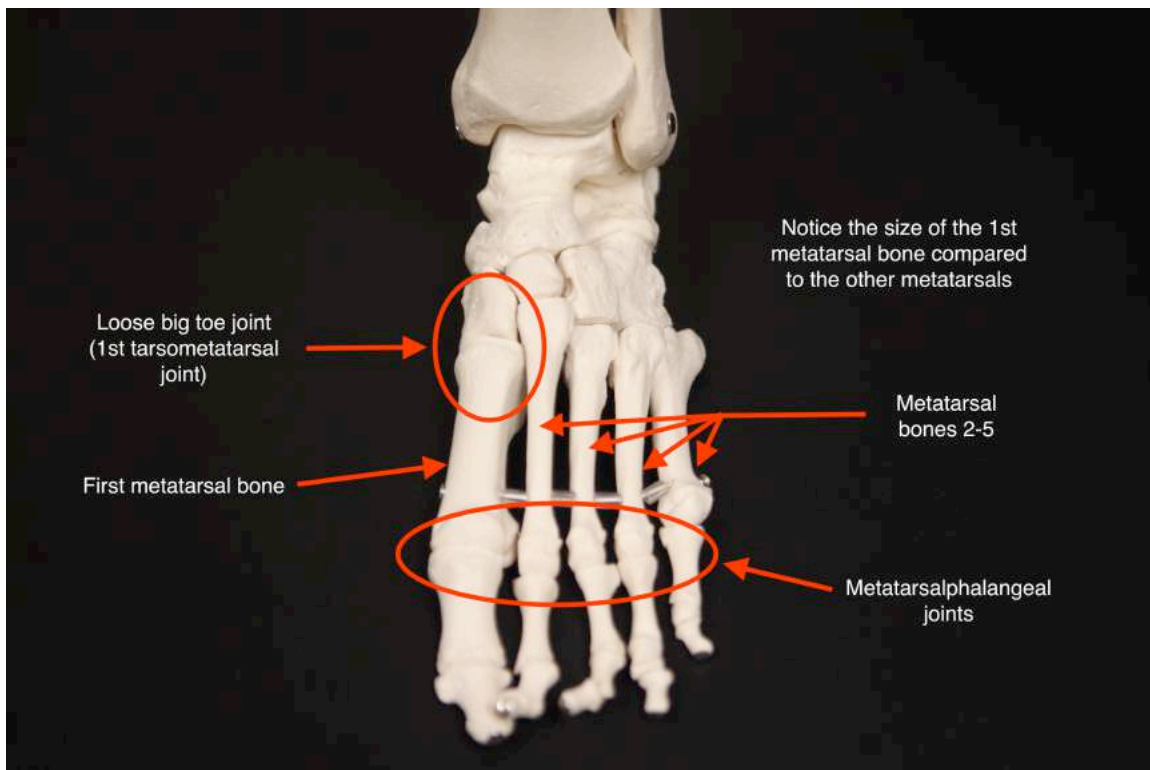
Bunions and forefoot pain (metatarsalgia):

If you look at the view of the foot from the top, notice the size of the 1st metatarsal. It is roughly twice the size of the other metatarsals. The reason for this is that the 1st

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

metatarsal supports roughly 50% of the weight on the front of the foot. If a patient has a tight calf, then the weight placed on the 1st metatarsal is well beyond 50% and it causes the first tarsometatarsal (TMT) joint to eventually wear out from the increased stress. This means that the ligaments at that joint get loose and cannot support the weight. If this joint gets loose, then it can cause bunions to form as the joint can rotate and shift. When this joint changes, it can cause the bunion to develop at the 1st metatarsophalangeal joint.

The pain under the ball of the foot (metatarsalgia) can feel like a bunched up sock, a pebble or a marble and can be very painful. Patients also frequently have a callus on the ball of the foot. It is due to the fact that the big toe cannot support the weight it needs to and the weight then shifts to the second, third or sometimes even the fourth toes at the metatarsophalangeal joints.

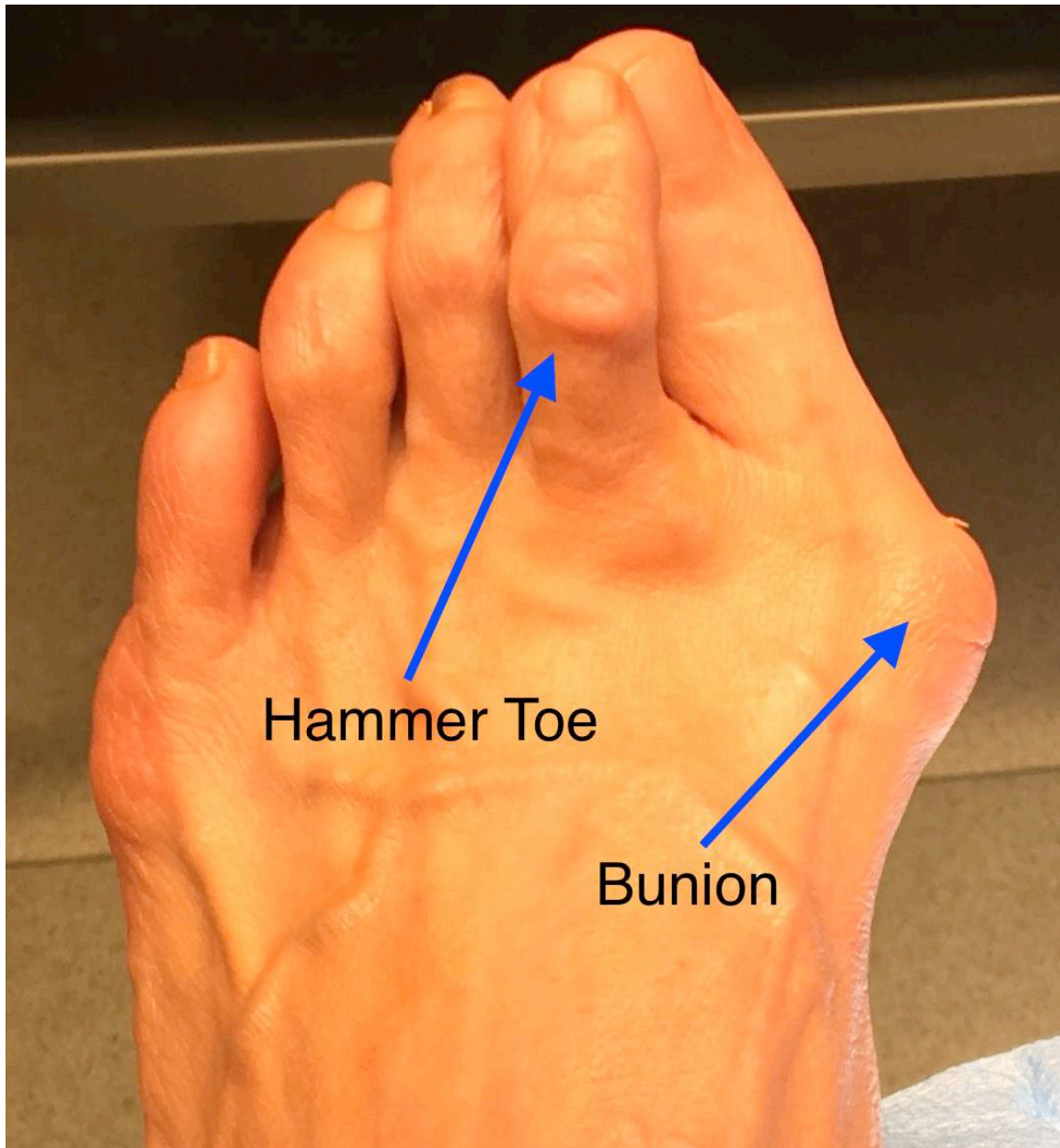


Hammer toes:

As the 2nd, 3rd and sometimes the 4th metatarsophalangeal joints are taking more weight than they were intended to take (because of the tight calf and loose big toe joint), the joints can become irritated. The irritation from the excess weight and the pull of the

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

tendons on the top of the toes (trying to pull against the tight calf) can cause the toes to take on a hammered appearance.

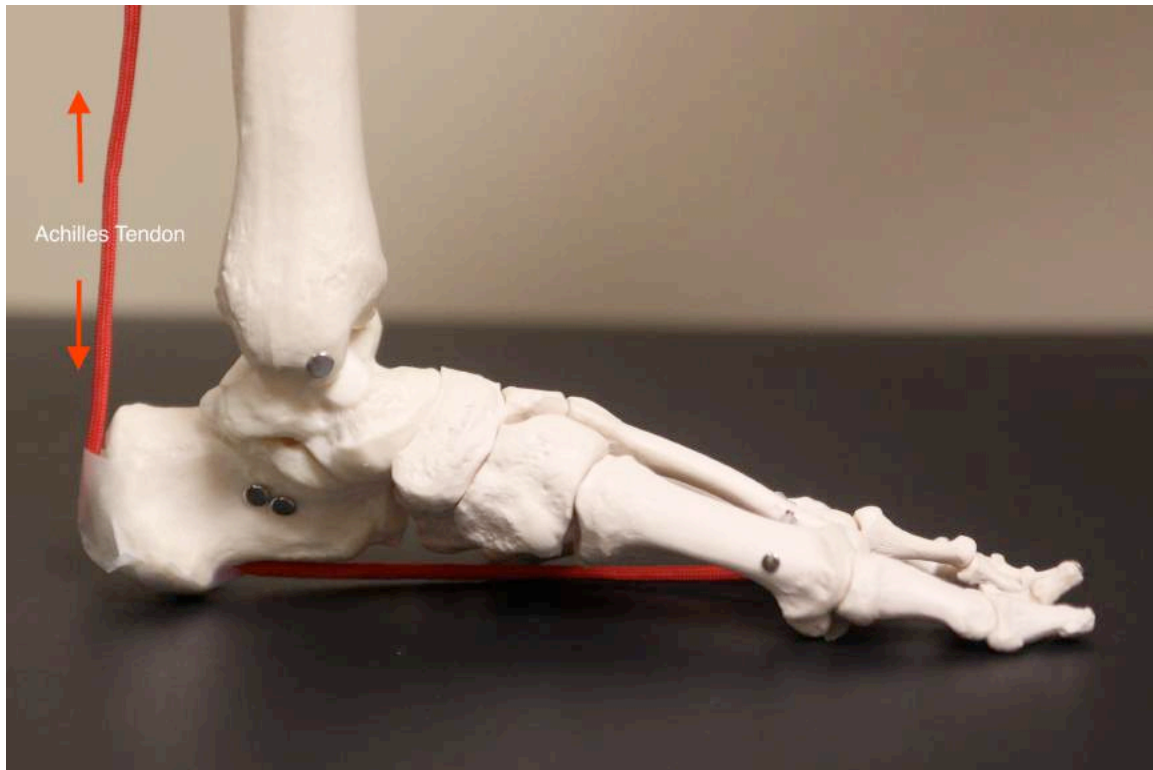


Achilles tendonitis:

If the calf is tight, it wants to pull the heel up. If the gastrocnemius is pulling the heel up, but the heel is being forced to the ground by your body weight, then the achilles is being stretched more than it was intended and it can cause pain. Patients can also get spurs

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

(pump bump or Haglund deformity) from the chronic inflammation. The achilles pain can be either over the tendon above the heel bone or over the insertion site (attachment to the heel bone).

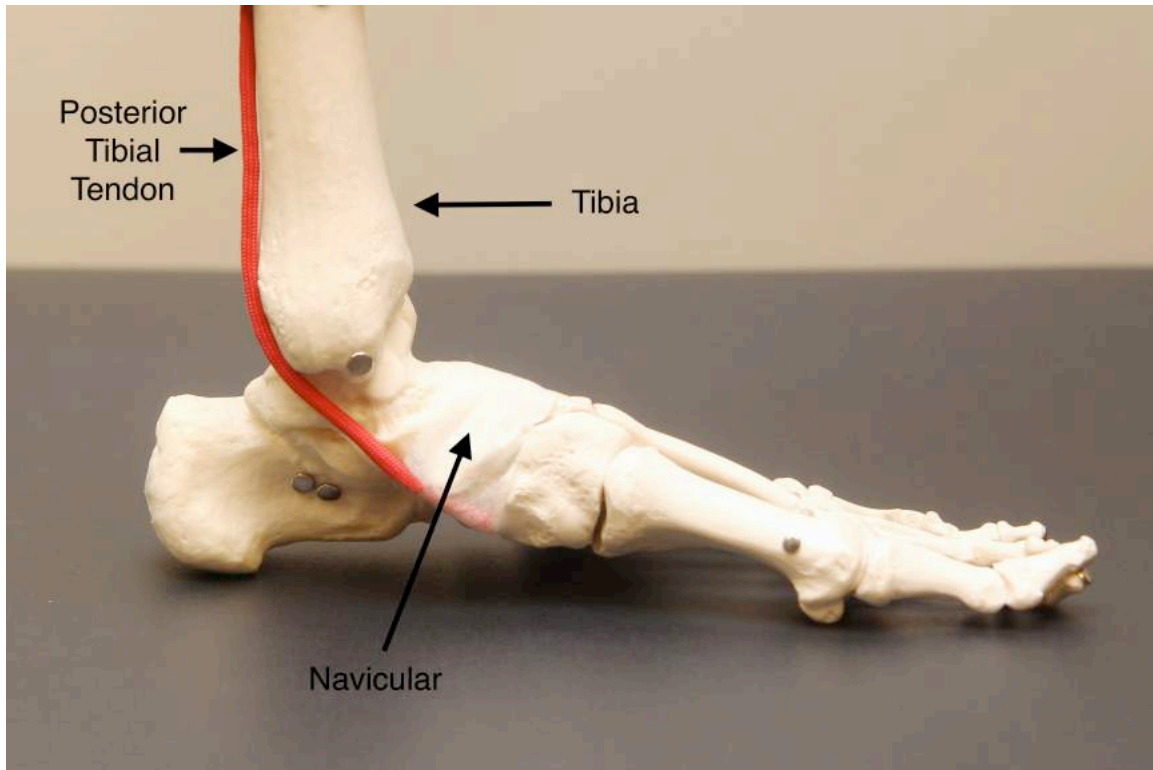


Posterior tibial tendonitis:

This tendon is also called the “arch tendon.” Its’ job is to help keep the arch up. If the patient has a tight calf and the arches are falling then the posterior tibial tendon has to

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

work extra hard to try and pull the arch back up or keep it up. Eventually, it gets tired and inflamed and can cause significant pain and swelling.



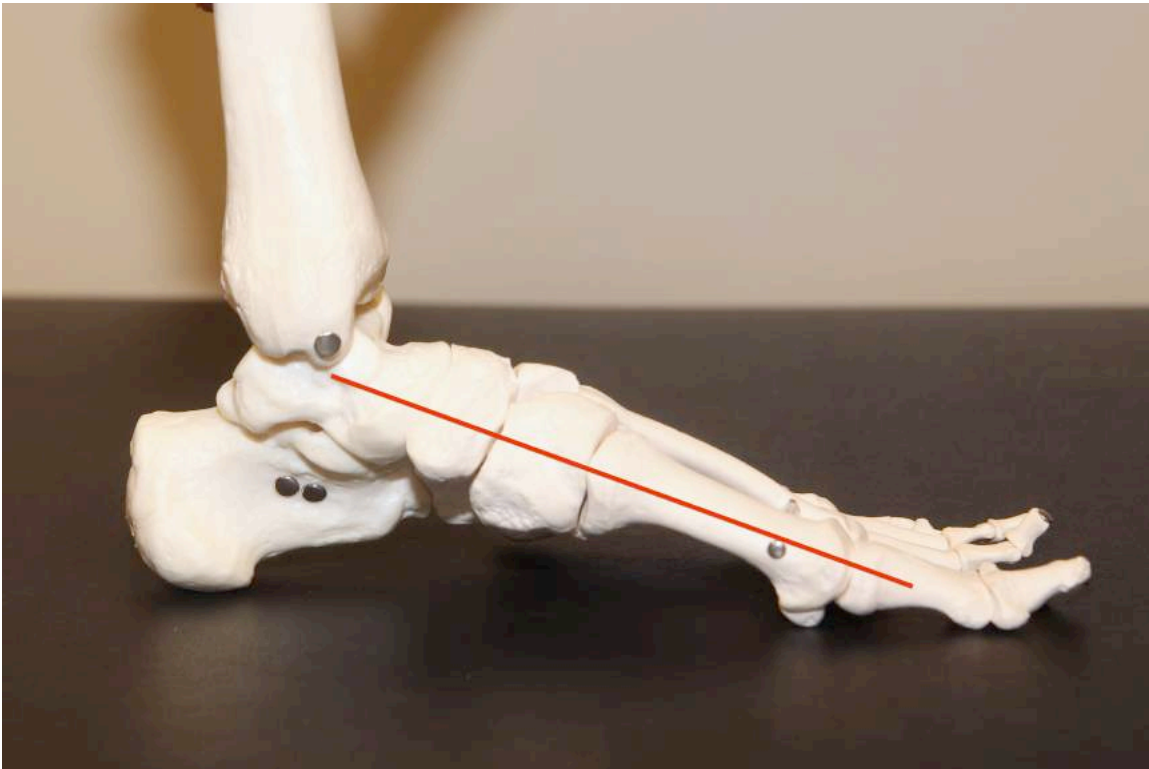
Midfoot arthritis:

As I've stated above, tight calves cause the arch to fall. Midfoot arthritis occurs when the arch has fallen enough to create abnormal forces across the joints in the middle of the

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

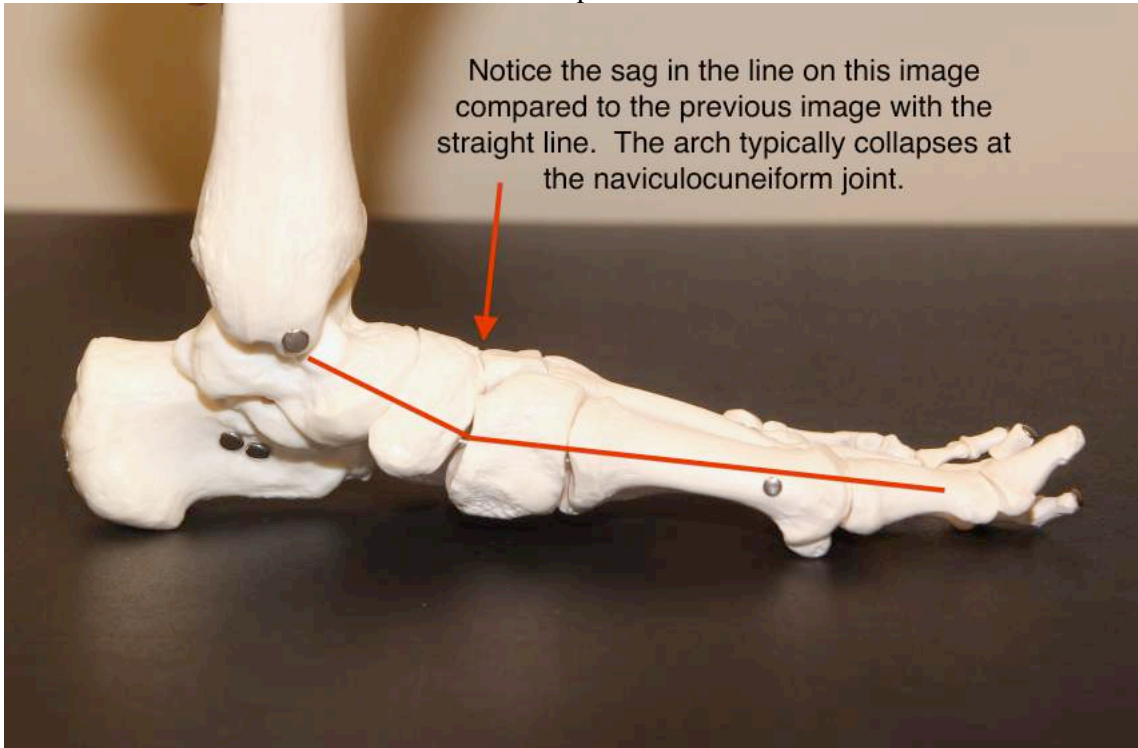
foot and can cause arthritis to develop. Arthritis is just the loss of cartilage in the joints. Without the cartilage, bones rub against one another and this can cause significant pain.

As the arch falls, more force is placed on the top of the bones as they are squeezed together and less force through the bottom of the bones as they are pulled apart.



Notice the straight line drawn down the foot. This is normal before arch collapse.

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

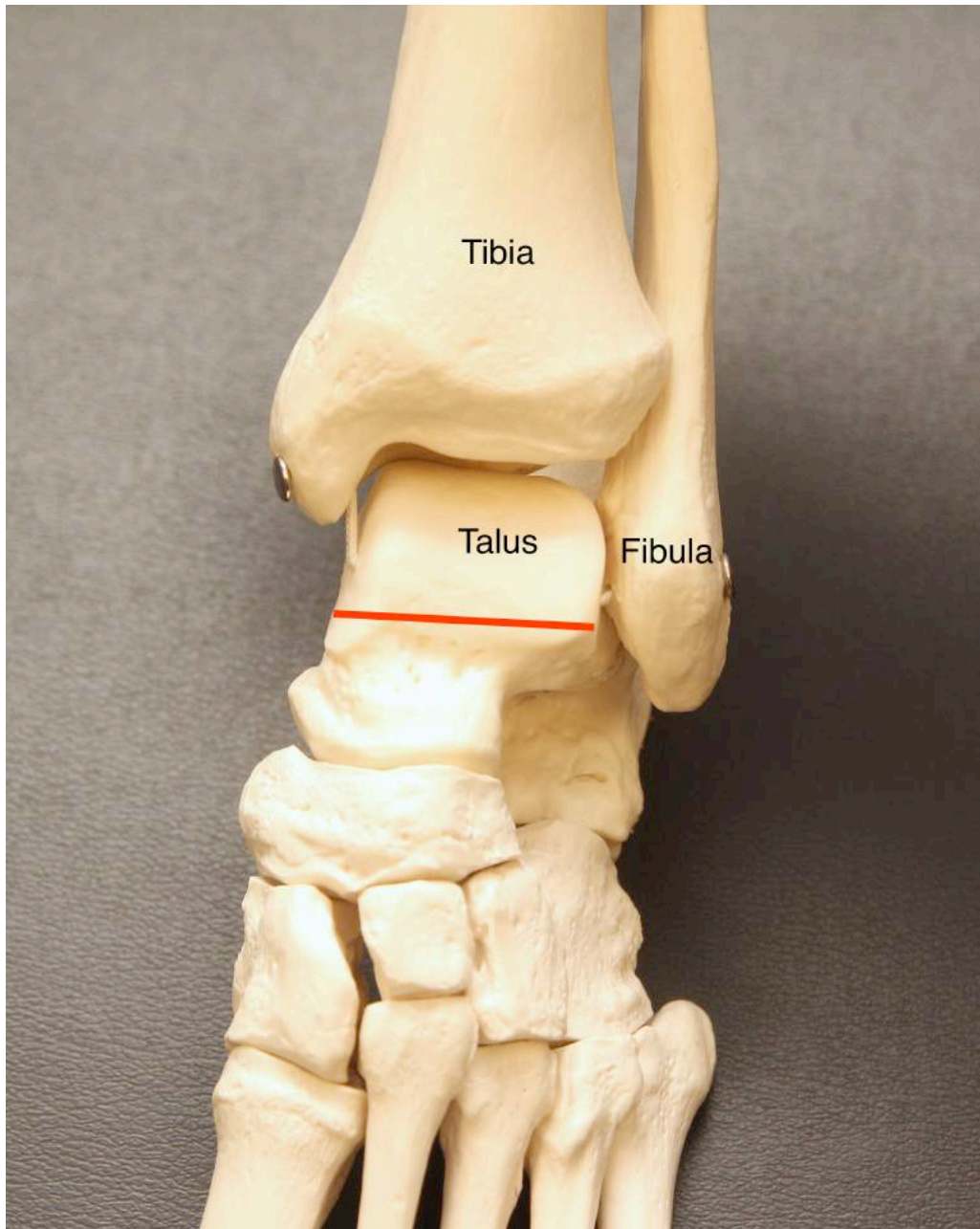


The collapse in the foot causes compression of the bones on the top of the foot while the bottom parts of the bones are separated.

Ankle instability:

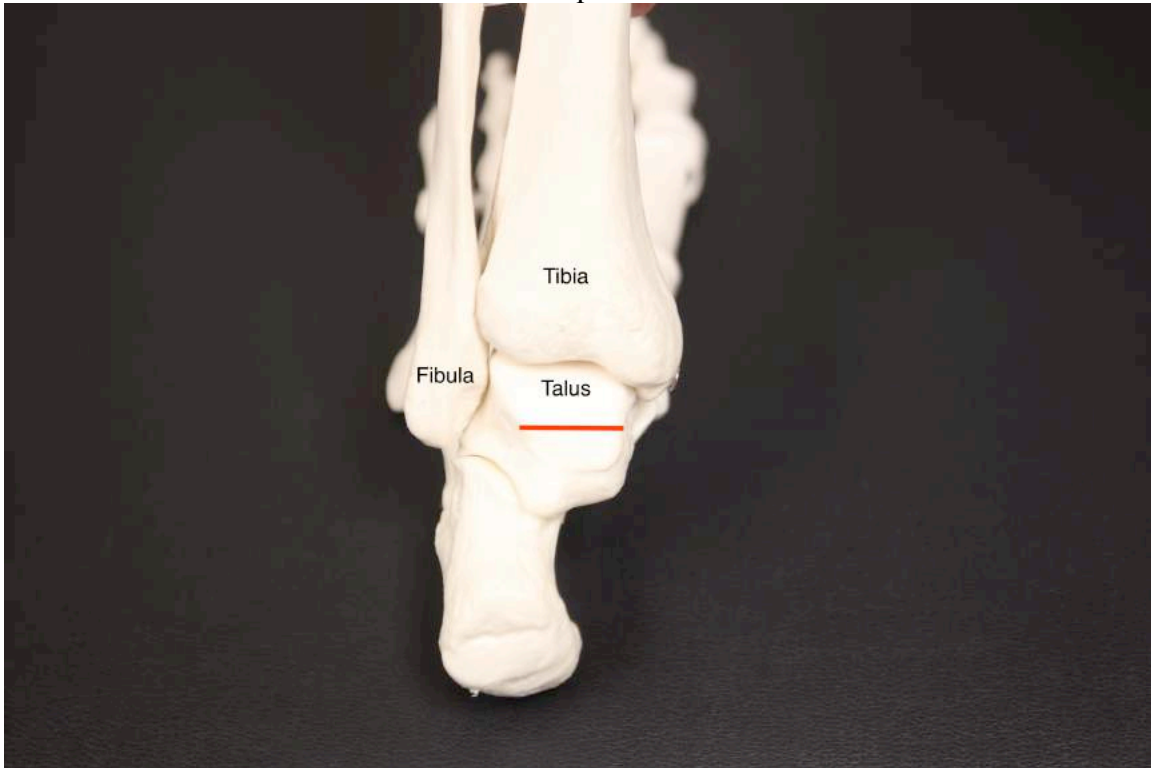
Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

If you look at the ankle joint, it is composed of three bones, the tibia, the talus and the fibula. The tibia sits on top of the talus.



If you look at the ankle from the front (above picture), look at the width of the talus (red line) and compare it to the view from behind (below picture)

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

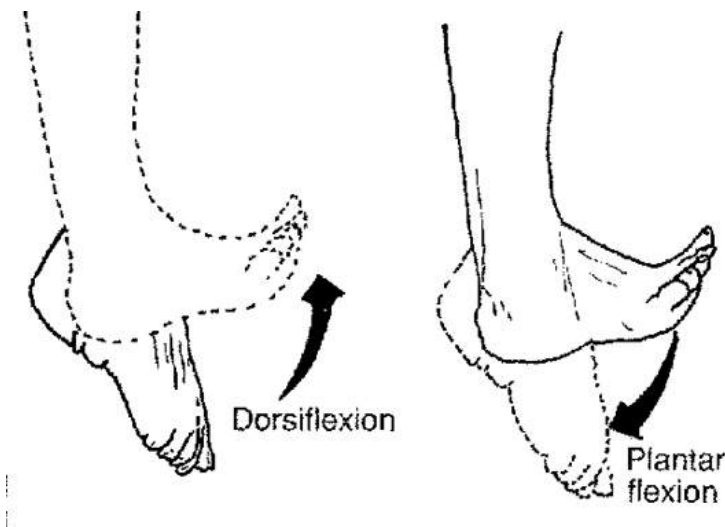
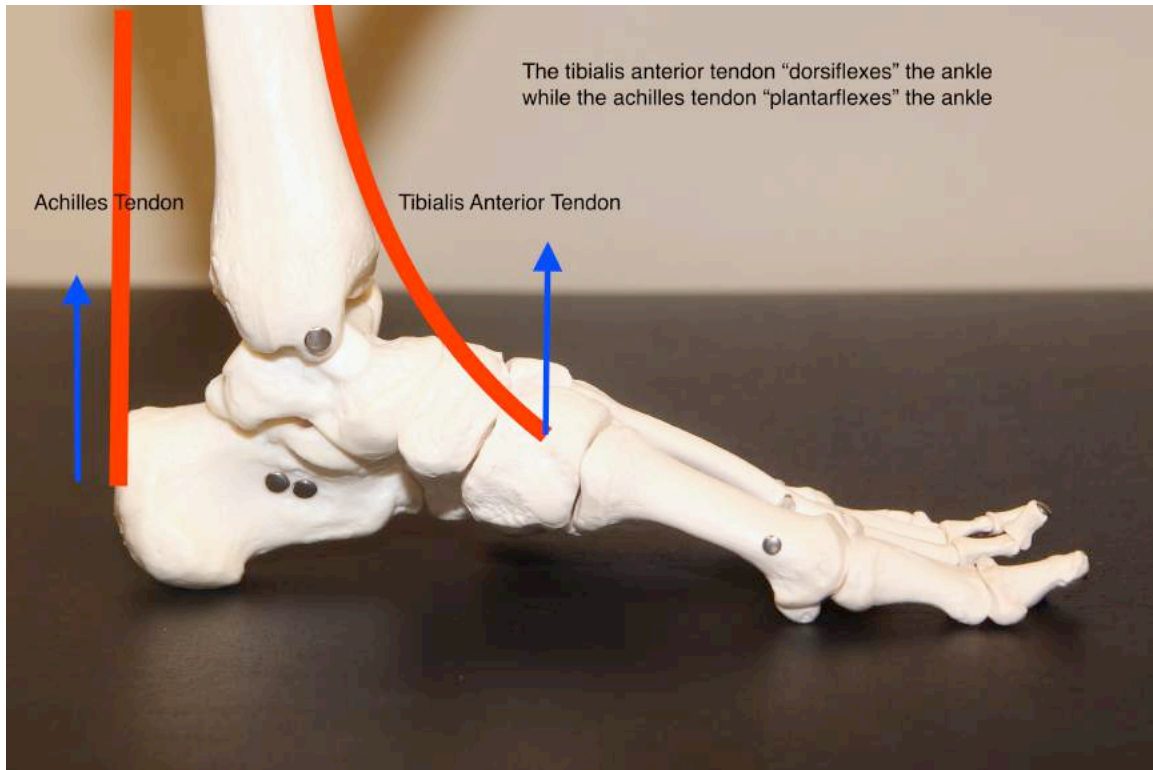


If a patient has a tight calf, the toes are pointed downward more (bringing the heel up) and this puts the narrow part of the talus in the joint. This creates a less stable ankle joint by putting more space between the tibia, talus and fibula bones. This can make the patient more likely to sprain/roll the ankle and stretch the ligaments on the outside of the ankle.

Tibialis Anterior tendonitis:

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

If you are diagnosed with anterior tibial tendonitis it is likely due to a tight calf. The anterior tibial tendon is the primary dorsiflexor of the ankle. This means that it is the tendon that brings your ankle up. The tibialis anterior tendon pulls against the achilles tendon (gastrocnemius and soleus)



Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

If your calf is too tight, it will force the tibialis anterior tendon to work too hard (similar to the posterior tibial tendon) to bring the ankle up. If you rapidly increase your activity level and have a tight calf you are at increased risk of irritating the tibialis anterior tendon. The concern with having tendonitis in this tendon is that with time and prolonged inflammation, the tendon could rupture and require surgery to repair it.

Other problems:

A tight calf has also been known to lead to the development of shin splints, calf cramps and Sever's disease (achilles tendonitis in children with open growth plates).

What is the treatment for tight calves?

Nicholas A. Cheney, DO
Gastrocnemius Equinus Contracture

Calf tightness is best treated with stretching. It is important to stretch the gastrocnemius. This is best accomplished by doing so with the knee straight to isolate the gastrocnemius. Unfortunately, the literature has not shown great success with stretching the calf. This means that the amount of stretching obtained by performing the stretching exercises is limited. Ultimately, if you do not get enough pain relief by stretching alone, the best way to lengthen the tendon sufficiently is to do it in surgery. For heel pain, the success with surgically lengthening the calf is in excess of 94% in the literature. Those are pretty good odds for a positive outcome and relief from your symptoms.

What does the surgery involve?

The surgery can be done by itself or with other procedures (depending on how far along the arch collapse progression you are). If performed alone for heel pain or Achilles tendonitis, you will still need to go to the operating room and go to sleep. The procedure takes 5-10 minutes and you will be able to walk out of the surgery center or hospital that day in a walking boot. You will wear the boot for 2 weeks and then return for a post-operative visit. If your wound has healed, then you can go into a regular shoe and begin resuming activities as you can tolerate.

What are the potential complications?

Patients can have some residual weakness in their calf. A study done out of Cincinnati showed that patients will lose an average of 10% of their strength in the operative calf. Additionally, patients will have a skinnier calf on the operative side compared to the non-operative calf. Those two reasons are why the procedure is best avoided in patients who require explosive strength in the calves (sprinters, basketball/football players etc).

Additional information:

For as “small” a procedure as this is compared to an ankle fusion or ankle replacement, it is very powerful in terms of results the patients gain. I see little downside to the procedure with minimal risks but a significant amount to gain. Please do not hesitate to contact us with any questions.