

TROUBLESHOOTING SUPINATION INSTABILITY IN FOOT ORTHOSES

Custom foot orthoses can be a highly effective therapeutic treatment option for mechanically-based pathologies of the foot and lower extremity. Unfortunately, in some instances, they can also cause problems for patients which may, over time, lead either to discomfort or gait pathologies. One of the more common problems that can be seen with foot orthoses is that the patient reports that their feet are being “rolled outward” or that they are “walking on the side of their feet” by their foot orthoses. In other words, their custom foot orthoses are causing them to supinate too much, or what I call “supination instability”.

Supination instability occurs when the foot orthosis causes too much supination moment, or supination rotational force, across the subtalar joint (STJ) axis so that the patient is visibly more supinated during gait and/or the patient reports that their foot feels as if it is being rolled uncomfortably toward the lateral side of their foot when wearing their orthoses. Supination instability can occur in either one or both feet of the patient and is surprisingly common once the podiatrist becomes more aware of the signs and symptoms of its presence. In addition, supination instability can occur when foot orthoses are made both for feet with a higher medial longitudinal arch (MLA) and in feet with a lower MLA.

Since pronation-related symptoms such as posterior tibial tendonitis and plantar fasciitis are much more common than supination-related symptoms such as peroneal tendinopathy and chronic inversion ankle sprains, then it is much more common to use custom foot orthoses to treat symptoms related to excessive STJ pronation than excessive supination. Regardless of whether the feet we are treating are “over-pronated” or “over-supinated”, the goal of foot orthosis therapy is to increase the STJ supination moments in the “over-pronated” foot or increase the pronation moments in the “over-supinated” foot so that the patient’s symptoms are relieved, their foot and lower extremity gait biomechanics are optimized, and no other symptoms occur as a result of orthosis therapy (Kirby KA: Troubleshooting functional foot orthoses. In Valmassy RL(ed), *Clinical Biomechanics of the Lower Extremities*, Mosby-Year Book, St. Louis, pp. 327-348, 1996.).

There are both symptoms and signs of supination instability that the podiatrist needs to be aware of. The most common symptom of supination instability seen in foot orthosis therapy is that the patient will complain that they are walking more on their lateral foot than normal and/or that their ankles feel “rolled outward”. They may also say that, while walking on an uneven surface, their orthoses make them feel as if they are more likely

to twist, or even sprain, their ankles. Less commonly, the patient also may note that their peroneal muscles and/or tendons are becoming symptomatic when wearing the orthoses.

The most obvious sign of supination instability is that the patient’s rearfoot and forefoot appear to be more inverted than normal when wearing their foot orthoses in their shoes. This “over-inverted” appearance of the foot inside the shoe may occur both in standing and in walking and is quite common.

It is important here to emphasize the fact that shoes can have a very large influence on whether an individual has supination instability when wearing their custom

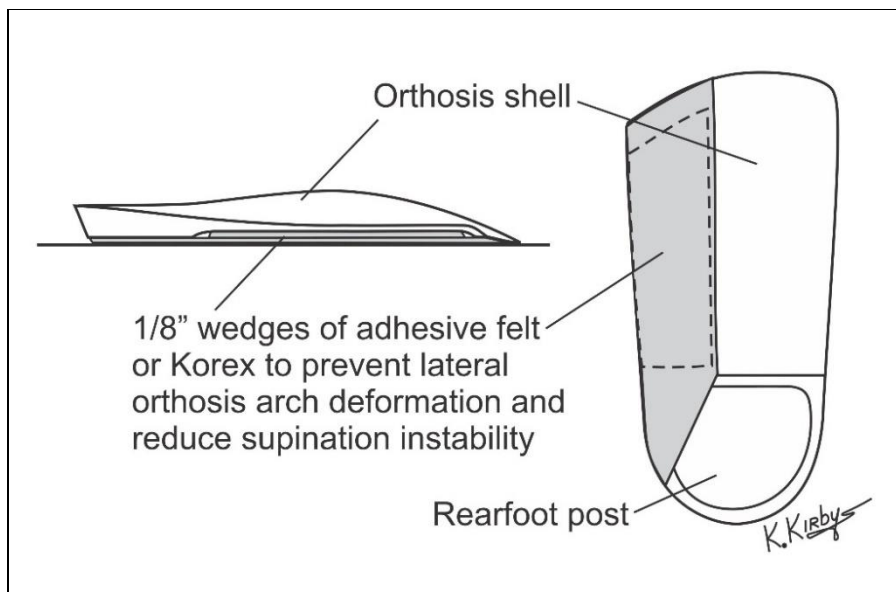


Figure 1. In many cases of supination instability seen in custom foot orthosis therapy, adding a layers of 1/8" adhesive felt or Korex to the lateral aspect of the plantar orthosis shell to evert the orthosis and prevent lateral arch deformation of the orthosis can be quite helpful for the patient.

foot orthoses. Many of today's athletic shoes have thick, soft midsoles which can deform quite rapidly or undergo "compression-set". The result is that the lateral midsole compresses permanently within months of purchasing the shoe which, in turn, also causes the heel counter of the shoe to become progressively more inverted relative to the ground.

Because of their very thick and soft midsoles, maximalist running shoes (e.g., Hoka) are more susceptible to lateral midsole compression-set which can force the rearfoot more inverted as the shoe midsole permanently becomes thinner laterally. If the patient then places their foot orthoses into a shoe that already has an inverted sole and heel counter, it is even more likely that the foot may appear much more supinated than if the patient were to wear their orthotic in a shoe with a non-deformed sole and vertical heel counter.

To determine whether the orthosis is the cause of the supination instability where the shoe sole may be deformed into a varus orientation, it is helpful to take the orthoses out of the patient's shoes, place the orthoses on the ground and have the patient stand on their orthoses on the ground to see if the foot still appears or feels to be "over-supinated". This test allows the patient to feel the difference in their "over-supinated sensation" caused by their inverted shoe sole and helps them understand the importance of wearing the foot orthoses in a non-deformed shoe that has a vertical heel counter.

Once the podiatrist suspects that supination instability is occurring with foot orthoses, there are a number of relatively easy solutions for the problem. First of all, as noted earlier, the shoes must be carefully inspected to make certain that the shoe sole has not been deformed into a varus shape and to ensure that the shoe heel counter is vertically-oriented. This is easily observed by placing the shoes on a horizontal surface (e.g., table top) and making certain the shoe heel counter is vertical. If the shoe heel counter is inverted, then a new shoe needs to be purchased by the patient before orthosis adjustments are made.

Secondly, the orthosis may need to be adjusted so that it is causing less STJ supination moment when worn in the patient's shoe. One of the easiest solutions to reduce the patient's supination instability is to grind the medial aspect of both the plantar forefoot (i.e., anterior edge of orthosis) and plantar rearfoot (i.e., rearfoot post) of the orthosis so that the dorsal surface of the orthosis becomes less inverted inside the shoe. Grinding "more eversion" into the orthosis in this fashion decreases the MLA height of the orthosis while still maintaining the height of the orthosis lateral longitudinal arch.

Another method of modifying the orthosis to create more eversion force on the foot is to add lateral wedging to the plantar aspect of the orthosis. One of the easiest ways to do this in the office-setting is to adhere one or more layers of 1/8" adhesive felt to the plantar aspect of the orthosis lateral longitudinal arch. This modification prevents the lateral longitudinal arch of the orthosis from deforming during weightbearing activities which, in turn, places more orthosis reaction force on the lateral forefoot (i.e. lateral to the STJ axis) which increases the STJ pronation moments. If this modification is found to be helpful at the next orthosis follow-up visit, then the layers of 1/8" adhesive felt can be replaced with more durable 1/8" Korex (Fig. 1).

Another orthosis modification that can greatly help with the treatment of supination instability is to add some form of valgus forefoot extension to the plantar topcover of the orthosis. The forefoot extension may be comprised of a layer of 1/8" adhesive felt (as a temporary modification) or a layer of 1/8" Korex (as a permanent modification) added plantar to the 4th and 5th metatarsal heads or plantar to the 2nd through 5th metatarsal heads. Alternatively, a valgus shaped wedge (i.e. thicker laterally than medially) may be added plantar to the 2nd through 5th metatarsal heads to increase the STJ pronation moment and treat the unwanted supination instability being caused by the foot orthosis. Regardless of whether a uniform thickness of lateral forefoot wedging or a valgus-shaped lateral forefoot wedging is used as a forefoot extension, both of these types of forefoot extensions act to increase the ground reaction force acting lateral to the STJ axis so that STJ pronation moments are increased and the patient's supination instability is reduced.



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