

## LATERAL HEEL SKIVE ORTHOSIS TECHNIQUE, BIOMECHANICS AND CLINICAL USE

In the last two ProLab Biomechanics and Orthotic Therapy Newsletters, the biomechanics, clinical use, and clinical pearls regarding the medial heel skive technique were described (Kirby KA.: The medial heel skive technique: improving pronation control in foot orthoses. JAPMA, 82: 177-188, 1992). About two years after the medial heel skive technique had been developed, I started experimenting with the *lateral heel skive orthosis technique*, which is a positive cast modification incorporating a valgus wedge into the heel cup of the resultant orthosis. When I started experimenting with the lateral heel skive technique in about 1992, I was initially unsure of its clinical utility. However, in the three decades I have now been using the lateral heel skive, it has become apparent that this orthosis modification can be very important in treating a number of pathologies where an extra pronation moment is required to produce the best therapeutic result for the patient.

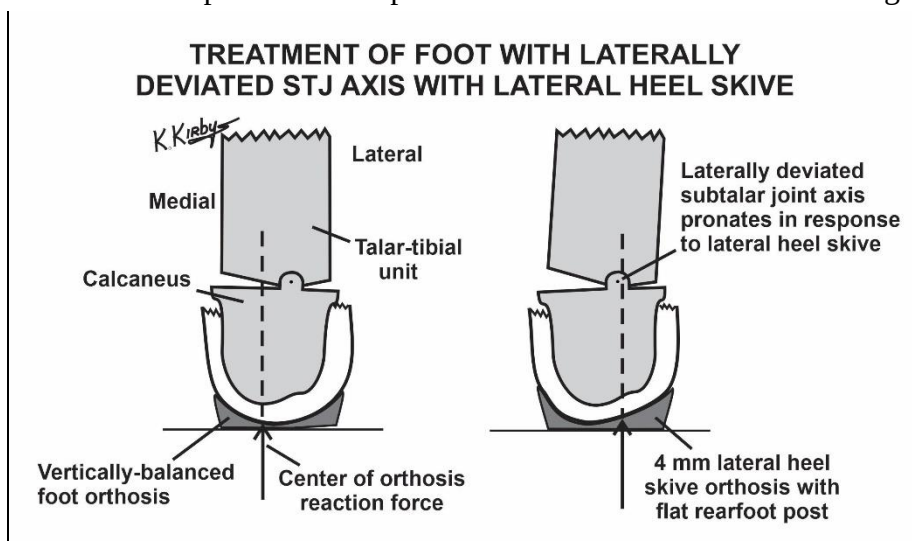
The lateral heel skive technique is relatively similar to the medial heel skive technique in that the plantar heel of the positive cast of the patient's foot is skived to produce an increase in frontal plane angulation of the orthosis heel cup in order to achieve the intended mechanically-therapeutic results. The only difference between the two techniques is that the medial heel skive involves removing plaster from the medial aspect while the lateral heel skive involves removing plaster from the lateral aspect of the plantar heel of the positive cast. In other words, while the medial heel skive produces an intrinsic varus heel cup shape in the custom foot orthosis, the lateral heel skive will produce an intrinsic valgus heel cup shape in the orthosis.

Overall, the biomechanical effect of the lateral heel skive orthosis technique is to increase the pronation moments acting across the subtalar joint (STJ) by shifting ground reaction force (GRF) more laterally on the plantar heel of the patient's foot (Fig 1). Because of this ability to increase STJ pronation moments, pathologies such as peroneal tendinopathy, chronic inversion ankle sprains, lateral-dorsal midfoot pain, lateral metatarsalgia and lateral-plantar forefoot calluses may respond very favorably to the lateral heel skive technique's ability to pronate the foot to resist the excessive STJ supination moments or to reduce stresses on the lateral aspect of the midfoot and forefoot that are causing the patient symptomatology.

When creating the lateral heel skive in the positive cast, a 15° skive angle within the frontal plane is used to create the valgus angulation within the heel cup of the orthosis. The depth of the lateral heel skive determines how much of the plantar heel cup of the orthosis is converted into a valgus angulation. A 2 mm lateral heel skive

is recommended to create a mild increase in STJ pronation moment correction, while a 4 mm lateral heel skive is recommended to create a moderate increase in STJ pronation moment.

Over the last 30 years of its clinical use, I have found the lateral heel skive technique to be a very effective orthosis modification which can substantially improve the biomechanical function and symptoms of many types of mechanically-based foot and lower extremity pathologies. For example, in chronic peroneal tendinopathy, it is very common to see that the patient's foot has a laterally-deviated STJ axis (Fig. 1) which, in turn, may be caused by an increase



**Figure 1.** In a foot with a laterally deviated subtalar joint (STJ) axis (left), the foot will tend to “over-supinate” which may lead to pathologies such as chronic peroneal tendinopathy and chronic inversion ankle sprains. Treatment using a custom foot orthosis with a lateral heel skive, flat rearfoot post and forefoot valgus wedging (right) will increase the STJ pronation moment which can help treat these, and other, pathological conditions.

in medial longitudinal arch (MLA) height, an increase in metatarsus adductus deformity, and/or an increase in varus alignment of the calcaneus. Since all of these conditions increase the STJ supination moments acting on the foot during weightbearing activities, the central nervous system (CNS) of the patient will tend to compensate for this “over-supination” of the foot by increasing the contractile activity of the peroneus brevis and peroneus longus muscles which are the only extrinsic foot muscles that can create substantial STJ pronation moment.

This increase in CNS-mediated peroneal muscle contractile activity will cause increased tension force and stress within the peroneal tendons which, over time, can lead to chronic peroneal tendinopathy. Treatment of these individuals with custom foot orthoses made with a 2-4 mm lateral heel skive, flat rearfoot post, valgus forefoot extension and an extrinsic lateral arch fill (i.e., Denton modification) can dramatically reduce the symptoms seen in patients with chronic peroneal tendinopathy. Chronic lateral instability, often caused by “over-supination” of the foot, can also be effectively treated with a similar “anti-supination” orthosis design, relying on the biomechanical knowledge that any orthosis modification that can shift GRF laterally on the plantar foot will tend to prevent inversion ankle sprains.

The lateral heel skive technique is also extremely effective in treating patients with pain due to osteoarthritis (OA) in the medial compartment of the knee. One interesting research study utilizing six subjects with instrumented knee implants (i.e., knee implants that can measure internal knee joint forces) found significant reductions in medial knee compartment forces with valgus-wedged insoles (Kutzner I, et al: The effect of laterally wedged shoes on the loading of the medial knee compartment-in vivo measurements with instrumented knee implants. J Ortho Res. 29(12):1910-1915, 2011). Another study utilizing 30 subjects with medial knee OA treated with valgus-wedged orthoses had pain levels significantly reduced at three and nine weeks after orthoses application (Rubin R, Menz HB: Use of laterally wedged custom foot orthoses to reduce pain associated with medial knee osteoarthritis: A prelim. investigation. JAPMA, 95:347-352, 2005). By shifting GRF to a more lateral position on the plantar foot during walking with a lateral heel skive and valgus forefoot-wedged orthosis, a lateral shift in the GRF vector acting on the plantar foot during the early stance phase of walking will significantly reduce the compression loading forces in the medial compartment of the knee which will, in turn, reduce the pain in mild to moderate cases of medial knee OA.

In addition, the lateral heel skive can effectively reduce the pain and disability in patients suffering from Lateral Dorsal Midfoot Interosseous Compression Syndrome (LDMICS). In LDMICS, the dorsal aspects of the lateral midfoot joints (i.e., 4<sup>th</sup> and 5<sup>th</sup> metatarsal-cuboid joints, and calcaneo-cuboid joint) can become painful due to excessive weightbearing forces acting upon lateral metatarsals which, in turn, can cause increased compression forces within the dorsal joints of the lateral midfoot. After considerable experimentation, I have found the best orthosis design for treating patients with LDMICS is a 4-5 mm polypropylene orthosis with a 16 mm heel cup, a 2-4 mm lateral heel skive, a flat rearfoot post, an extrinsic lateral arch fill (i.e., Denton modification) and a valgus forefoot extension so that the lateral aspect of the plantar foot is everted away from the ground. In effect, this valgus wedging acting underneath the plantar rearfoot, midfoot and forefoot will help pronate the foot away from the lateral column which should reduce the compression forces and pain within the dorsal aspects of the lateral midfoot joints.

In conclusion, even though the lateral heel skive orthosis technique will not be used as frequently as the medial heel skive, the lateral heel skive does offer the unique biomechanical ability of increasing the STJ pronation moment to reduce the supinated/varus foot position which may be the cause of pathological conditions such as peroneal tendinopathy, chronic lateral ankle instability, LDMICS, and lateral metatarsalgia. I suggest that all podiatrists add the lateral heel skive as another orthosis treatment “arrow” in their orthosis modification “quiver” in order to better increase the effectiveness of their custom foot orthoses.



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