Orthotics & Biomechanics

10 Orthotic Modifications You Can Perform in the Office

These simple fixes will lead to happier patients.

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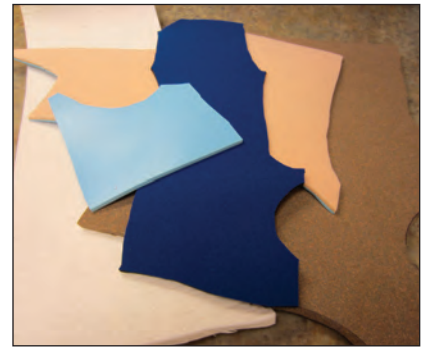
As podiatrists, we see pairs of functional foot orthoses in the office daily and, with that, patients with painful feet. You probably ask yourself, "What can I do to this particular orthotic right now to start helping this patient?" This article will review ten orthotic modifications you can perform in the office. These are simple solutions that any podiatrist can do.

There are a few supplies you really need in the office in order to successfully perform orthotic modifications. First, you need a grinding wheel. This is important in order to smooth out any rough spots on the device or the other materials added.

Figures 1: Orthotic modification equipment, including from left, heat gun, grinding wheel, and glue.

You also need glue to attach the individual parts together and ventilation to help with the odor. Additionally, a heat gun is nice to speed up glue drying (Figure 1). For materials, you can use Spenco for top covers, Poron and Korex for soft or more firm modifications respectively, and a diabetic soft and multi-density material such as Diaba-sheet (Figure 2). This gives you some flexibility in the office. There are other types of materials to add to the collection as you become busier with this aspect of the practice.



Figures 2: Orthotic materials from left, felt, Poron, Spenco, dual density diaba-sheet (Plastizote/Poron), and Korex.glue.

So, why perform orthotic modifications in the office? There are several reasons, but primarily for patient satisfaction. First, your patient does not need to go without his or her orthotics. You perform the modification and adjust it as necessary right away and return it to the patient. It's a win-win for you and your patient in that they do not need an additional ap-

Figures 3: Construction of a plantar fascial groove (a)Mapping the location of the plantar fascia with an iodine solution (b)Transfer of the iodine solution to the Korex (c)removal of the Korex in the location of the iodine transfer, as this is the location the plantar fascia groove will be to reduce irritation to the tissue.

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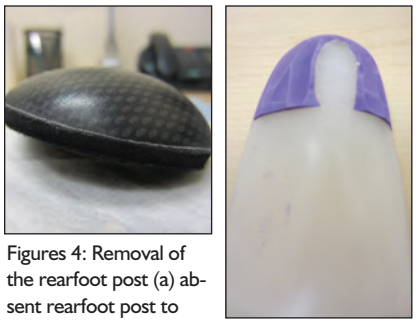

Figures 4: Removal of the rearfoot post (a) absent rearfoot post to the carboplast low profile device (b) a ground-down EVA rearfoot post from a polypropylene functional foot orthotic.

pointment to pick up the device with the additional co-pay, and missed time from work to get the device back, and you get instant feedback.

With that, this article is going to assume that the patient is presenting to you with a pair of functional foot orthotic devices and will be guiding you on modifications to troubleshoot pain relief with that particular pair of devices in mind. When devices do not contour the arch well, you must be aware that modifications to the device may not be as effective in properly offloading stress areas and redirecting pressures. Finally, this article is not referring to orthotic prescription writing when you are molding the patient for the initial device.

Figures 5: Addition of forefoot padding with Poron, beveled on the device and extended to the sulcus level.

1. Problem: New Plantar Fibroma Formation or General Plantar Fascia Irritation

Periodically, you will see folks in the office with "lump in the arch" pains and patients with simple arch irritation when wearing their devices. Most of these patients also have prominent plantar fascia bands with forefoot loading. The friction between the fascia and the orthotic device seems to be the driving force here to create the irritation and/or resultant fibroma. What can you do to the orthotic today? How can you reduce the friction between the plantar fascia and the orthotic device?

Answer: Create a plantar fascia groove.[1] To do this, paint iodine solution or lipstick on the patient's foot in the distribution of the plantar fascia. Then, remove the top cover of the device and map out the distribution of the plantar fascia on the orthotic by having the patient stand on the orthotic. Next, use 1/8" thick felt, Poron, or Korex to raise the entire orthotic surface higher, minus the region of the prominent fascia (Figure 3). Finally, recover the orthotic with a fresh top cover. Patients do really well with this modification. The arch irritation stops, and the next time the patient needs a new pair of orthotic devices, you can integrate the groove into the prescription.

Adding a top cover to the orthotic is going to add padding and comfort to the ball of the foot.

2. Problem: Heel Popping Out of the Shoe

Both men and women present with shoes where the orthotic sits high in the heel region. Unfortunately, this results in the patient sitting higher in the shoe and popping the heels out of the backs of the shoes during gait. This can be really irritating and result in heel blistering and pain. What can you do?

Answer: First, see if the shoe has a removable insole. If so, remove it and put the orthotic back in the shoe. Now the orthotic device sits lower in the shoe. If you were not so lucky, remove the rear foot post and create a spot grind type of post (an intrinsic rear foot post, (Figure 4). To do this, use your grinding wheel and remove the rearfoot post and then proceed to grind the shell of the orthotic as thin as possible without making a hole in the device—this drops the heel down in the shoe to stop the patient from popping out. Be careful while grinding the heel thin. You must keep the orthotic in a balanced position and not invert or evert the device. Also, avoid grinding a full hole in the orthotic. Provide a nice and smooth dorsal surface to the heel cup of the device that contacts the patient's foot.

You just constructed a lower profile device that your patient can wear in additional shoes and you completed this while the patient waited!

3. Problem: Diffuse Lesser Metatarsal Head Callusing and/or Forefoot Fat Pad Atrophy

Several patient populations present with this, including the aging population who simply have compressed/atrophied forefoot fat pads, cavus foot with forefoot overload and/or hammertoes. This results in distally displaced plantar forefoot fat pads into the toe sulcus region, and the general equinus population who are over-loading their forefoot region creating diffuse callusing and associated pain. What can you do to the orthotics to minimize discomfort and callusing?[1]

Answer: Adding a top cover to the orthotic is going to add padding and comfort to the ball of the foot. If there is already a cover, simply reinforce it with a forefoot extension of Poron to the sulcus or toe tip level (Figure 5). Patients enjoy the additional padding and the pain level decreases. A warning: this is going to take up space in the shoe. Ask patients in which shoes they are wearing the orthotics, and make sure there is space to add the top cover and associated reinforcement layers. Patient education on expectations is essential.

4. Problem: First Metatarsal-Phalangeal Joint Sesamoid Pain

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When patients present with sesamoid pain, the goal is to offload or decrease stress to the area, after ensuring there is no fracture and the acute inflammation is down. What can you do to this pair of functional foot orthotics? The goal is to decrease stress and overload, specifically to the small sesamoid bones.

Answer: Again, if there isn't a top cover, add one. Sometimes, patients improve with the simple addition of padding. However, I also add a Reverse Morton extension to the sulcus level using Korex and add Poron beneath the 1st metatarsal head to the sulcus level for reinforced padding (Figure 6). These materials are 1/8-1/4" thick; again, use the grinding wheel to thin out the distal edge of the modifications. Educating the patient on expectations of the thickness of the finished product and shoe fit is important here also.

Figures 6: Offloading the Sesamoid apparatus with a higher density forefoot extension beneath the lesser metatarsals and more soft Poron plantar to the hallux sesamoids.

5. Problem: Functional Hallux Limitus

You probably see quite a bit of grade one first MTPJ (metatarsal-phalangeal joint) osteoarthritis, or hallux limitus, in the office. Many of these patients simply pronate the hindfoot and, with that, overload the medial column of the foot and restrict dorsiflexion through the 1st MTPJ in ambulation. This results in persistent pain to the jammed 1st MTPJ. What can you do with the orthotic to allow motion through the joint?[1-3]

Answer: In this case, you must allow plantarflexion of the 1st metatarsal in order to allow motion to occur through the 1st MTPJ. The addition of a reverse Morton's extension to the sulcus level works great to further off-load the 1st MTPJ and allow increased dorsiflexion range of motion in stance and gait (Figure 7). Use 1/8" thick felt, Poron, or Korex. Certainly, the Korex lasts the longest, but many patients prefer the padded materials. The purpose of starting with felt material in various orthotic modifications is that the self-adhesive backing allows the patient to remove it on his/her own if the modification is not tolerated or causes pain.

Figures 7: Addition of a reverse Morton's extension to allow plantarflexion of the first metatarsal and reduction of stress through the first metatarsal phalangeal joint for functional hallux limitus.

Periodically, trial a modification with felt and, pending the outcome for patients, you can convert them to a more dense material such as Korex.

6. Problem: Hallux Rigidus

Osteoarthritis is progressive and therefore hallux limitus can later present as rigidus. Some patients will come into the office with zero motion available through the 1st MTPJ and associated pain. They do not want surgery and want options. What can you do with their orthotic? What can you do to hold a painful arthritic joint supported?[1]

Figures 8: Addition of a Morton's extension to support the arthritic great toe using Korex, and Poron plantar to the lesser metatarsal heads to level the forefoot of the device and add padding and comfort.

Answer: In these cases, use Korex and fabricate a Morton's extension (Figure 8). Again, you will first need to place a top cover, but beneath that use Korex 1/8"—1/4" thick for the modification to the sulcus or toe level (bevel the distal end for space in the toe-box of the shoes) and Poron to the lesser metatarsal heads to offer padding and also to level out the forefoot on the device. Combine this with a front rocker-type athletic shoe for better results. The purpose is to remove as much stress as possible from the stiff and painful 1st MTPJ in ambulation.

The addition of a reverse Morton's extension to the sulcus level works great to further off-load the 1st MTPJ and allow increased dorsiflexion range of motion in stance and gait.

7. Problem: Neuroma

We all have patients who present with the palpable click to an inner-metatarsal space with electrical pain diagnosed as a neuroma. What can you do to the orthotic?[1]

Answer: Most commonly, the metatarsal pads and bars are placed incorrectly. With that, both apparatuses are usually placed too far proximally. Patients come in saying how much they dislike them because they are pushing more up in the arch of the foot and causing pain, instead of more distally to lift and spread apart

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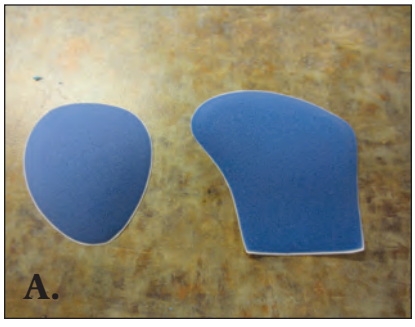
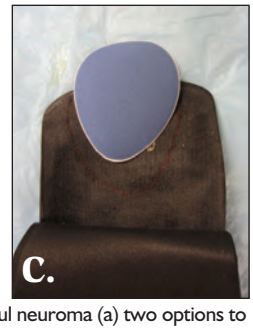
the metatarsal heads. Remove the top cover and the pad or bar and start over. These devices should be as close as possible to the metatarsal heads that we are trying to separate from each other to offload the nerve most effectively. Have patients stand on the pads and bars in the right and the wrong locations so patients understand how they should feel. This also aids in placing them correctly.

Outline the starting location of the addition on the top of the top cover or directly on the device and work from there (Figure 9). Allow patients the freedom of moving them around, but start them off in the location you feel best off-loads the appropriate region. Once the device is in the best location, the patient returns for incorporation of the addition beneath the top cover.





Figures 9: Off-loading a painful neuroma (a) two options to assist in reducing pressure to a neuroma, from left, a metatarsal pad and a metatarsal bar (b) outline the starting location of the metatarsal pad, as this is the location you feel is the best location (c) the metatarsal pad in the final location prior to application of the top cover.

8. Problem: Metatarsal Pain/Metatarsalgia/Stress Reaction

Frequently, patients will present with lesser metatarsal pain-—specifically, single metatarsal pain, which could then go on to be diagnosed as a stress reaction or metatarsalgia, or overuse type of injury. What can you do with this patient's orthotic device?[1]

Answer: Again, add a top cover to start; sometimes simply padding the forefoot will help. However, if that isn't enough, you can reinforce the forefoot portion of the device with a metatarsal pad or bar as described above or with Poron to the sulcus level of the forefoot for additional padding and comfort or construct a Korex forefoot extension with a slot cut out beneath the painful metatarsal head to decrease pressure to it specifically (Figure 10). Patients really love these slots and do well. You need to ensure proper placement of the slot so your patient isn't ambulating on the border of the slot, though, as this does tend to create additional pain.

Modifying orthotic devices in the office is a great way to build patient satisfaction by quickly adding comfort and giving pain relief to your patients.

Figures 10: Korex forefoot addition to offload a painful second metatarsal head for metatarsalgia.

9. Problem: Everted Calcaneus (continued pronation over the medial side of the orthotic—aka: under-corrected device)

You probably see a large number of under-corrected devices in the office. This results in continued over-pronation and, in some instances, continued pain for the patient. Patients will present stating that they thought the orthotic was going to reduce their symptoms, but instead, it simply takes up space in the shoes and they still have pain. What can you do today, right now, to this to a make better device?[1]

Answer: Try several options here. If the orthotic is simply not conforming to the arch and there is a gap between the foot and the arch portion of the device, start by educating the patient about the problem and attempt to fill in the gap with felt, Poron, or Korex in order to bring the arch of the device up to the arch of the patient's foot. This is accomplished by removing the top cover and placing the arch filler material on the orthotic shell and then recovering the device.

Another option for the patient pronating over the medial edge of the device is to add a soft medial flange which will offer increased width and surface area to the device and, in the shoe, can increase arch support and decrease the pronatory torque. A medial flange is added by removing the current top cover and applying a 1/8" thick Poron or Korex flange and then re-applying a top cover to the device.

You can incorporate both the medial flange addition with arch fill on the same device with good results, and many times, the patient will be interested in a brand new device with all of this incorporated into the new prescription.

A third option is to simply invert the whole device, assuming that the heel cup of the device is deep enough to accommodate the supinatory torque that this will offer. If the heel cup depth is too shallow, patients will complain of sliding off of the lateral side of the orthotic. Inverting the device is completed by adding 1/8" thick Korex to the medial third of the plantar aspect of the rearfoot post and the leading medial edge of the distal end of the orthotic shell to fully balance the orthotic in the inverted position.

We prefer Korex for this modification since it is a durable material which maintains its thickness, and

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Figures 11: Various ways to address an under-corrected functional foot orthotic (a) View of a functional foot orthotic without additions (b) Orthotic with Korex arch fill to attempt to bring the under-corrected orthotic up to the arch of the patient to add support (c) construction of a medial flange using Korex; once in the shoe this will serve as a wider device to assist in a supinatory torque (d) Inversion of the entire orthotic device with Korex.

therefore, the correction (Figure 11). Other considerations would include the addition of a medial skive using Poron or Korex as a wedge inside the medial aspect of the heel cup of the device, but again, this assumes the heel cup is deep enough to accommodate the addition.

10. Problem: Heel Rim Callusing Since Receipt of Orthotics

Periodically, patients will present with heel rim callusing since receipt of a new pair of orthotics. These can occur both medially and laterally, and the irritation is significant enough that the patient stops wearing the devices. The causes seem to range from the orthotic being too narrow, really deep and narrow, having sharp edges, or a non-posted device with a smooth bottom and moving in the shoe creating friction. What can you do to get

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Figures 12: How to decrease friction and heel irritation and callusing to the heel rim of an orthotic (a) Poron heel lift in heel cup of the orthotic to allow patient to sit higher on the device and away from an irritating heel rim (b) topcover added to the device which extends proximally to cover a prominent heel rim of the orthotic device (c) Moleskin applied to a lateral orthotic heel rim for a patient with a lateral heel rim callus; similar can be completed with PTFE.

the patient back into the devices without pain? How can you stop or reduce callus formation on an orthotic?

Answer: Reduce the friction which causes the callusing and pain. You can do this in many ways. First, you can raise the patient's heel in the device by adding a heel pad with Poron 1/8" in the heel cup of the device and then cover it with a fresh top cover. Secondly, you can simply inspect the rim of the orthotics and smooth out the sharp edges with the grinding wheel. In addition to this, placing a top cover on the orthotic which extends proximally over the rim will cushion the patient from the heel cup of the device and therefore minimize irritation. Adding moleskin to the rim will result in a lower profile version of this option for the patient (Figure 12).

Another material to consider is called PTFE[4], polytetrafluoroethylene (www.ptfepatch.com.). This is a very low co-efficient of friction material, both when wet and dry, that can be placed in various locations on an orthotic to reduce friction, irritation, and callusing. Finally, measure the weight-bearing heel width of

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the patient and compare that to the heel width of the device, as your patient may simply need a new pair of devices that are wide enough to accommodate the heel.

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In conclusion, modifying orthotic devices in the office is a great way to build patient satisfaction by quickly adding comfort and giving pain relief to your patients. PM

Recommended Reading List

1) Scherer PR. Recent Advances in Orthotic Therapy. First Edition Lower Extremity Review, 2011.

2) Root ML, Orien WP, Weed JH. Normal and Abnormal Function of the Foot. Vol 1. Los Angeles, CA: Clinical Biomechanics; 1971. and Vol 2. Los Angeles, CA: Clinical Biomechanics;1977.

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[2] Roukis TS, et al. Position of the First Ray and Motion of the First Metatarsophalageal Joint. J Am Pod Med Ass. 1996;86(11):538-536.

[3] Harradine PD, et al. The Effect of Rearfoot Eversion on Maximal Hallux Dorsiflexion. A Preliminary Study. J Am Pod Med Ass. 2000;Sep:90(8):390-3.

[4] www.ptfepatch.com

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