Beyond the Rearfoot

Here are some modifications that your sports medicine patients will love.

American Academy of Podiatric Sports Medicine

BY BRANT MCCARTAN, DPM

This article is part of a sports medicine series written exclusively for PM by members, Fellows, board members, and past-presidents of the American Academy of Podiatric Sports Medicine (AAPSM).

The AAPSM serves to advance the understanding, prevention and management of lower extremity sports and fitness injuries. The Academy believes that providing such knowledge to the profession and the public will optimize enjoyment and safe participation in sports and fitness activities. The Academy accomplishes this mission through professional education, scientific research, public awareness and membership support. For additional information on becoming a member of the AAPSM please visit www.aapsm.org.

Figure 1

In school, we learn sports medicine as it pertains to podiatrists, and not just regarding orthotics. We learn about the differences in treating the athlete vs. the non-athletic podiatric patient, the demands on athletes' entire bodies, their adherence to their training schedules. We learn about the team, not just the team that they may be playing for, but also the team of both medical and career professionals that dictates the care of this player/asset. There is no easy answer to, "what treatment is best?"—it certainly depends on circumstances, caliber of athlete, and the level at which they play, from youth sports to professional, and all the stops in-between.

One of the hallmarks of sports medicine is biomechanics and how an orthotic can alter it. What is normal gait? Is there a "normal" foot? How is the foot a mobile adapter? …and countless other questions that leave many young podiatrists thinking about a specialty in sports medicine. How much time is spent learning the 'art' of orthotics during a three-year surgical residency? The practice of making orthotics may be left at the bottom of the pile. Or, maybe you are looking to get some newer, younger patients into your office. When that athlete comes into your office with no intention of having surgery, there is something else that you can offer.

One of the hallmarks of sports medicine is biomechanics and how an orthotic can alter it.

Sports Injuries

What are common sports injuries aside from sprains, strains, and fractures? If you Google "common sports injuries" on your mobile device or computer, you will see that many sports injuries occur in the lower extremity: ankle sprains, shin splints, patellofemoral syndrome, knee arthritis. In addition, stress fractures, sesamoiditis, and neuromas frequently come up. An established sports medicine practice certainly sees patients with lateral ankle instability, cuboid syndrome, and functional hallux limitus. All of these conditions can be addressed with a custom orthotic, or some modification to the athlete's insole and sock liner until the custom device is available.

We all know that clinic days can become busy and hectic, so develop a plan once you make the diagnosis. Oftentimes, there is something you can do at the first visit to give your patients some relief—which is

Continued on page 112

Rearfoot *(from page 111)*

particularly beneficial for athletes, because they need to play now, and waiting for a custom device is just not good enough. It is great when patients have over-the-counter inserts, but even if they don't, you can modify their sock liner (Figure 1). This is the removable padding inside of the shoe that you will have them remove eventually and replace with a custom orthotic. Beginning their treatment immediately will cut down the healing time, show your patient that you understand their fear of taking time away from the sport, and give you time to modify the temporary device before writing the prescription for the custom orthotic.

Practically speaking, the first step is analyzing the shoes into which the orthotics will go. The athlete's footwear is one of the most important pieces of equipment that they possess. The dogma of: "you can tell your patients what to wear", however, is not always appropriate. Luckily, many athletes wear running-style shoes, cross trainers or more "roomy" shoes for cross training and practice. For those patients wearing cleats or skates: after an orthotic plan has been developed, it may be best to send in their footwear to the lab along with the casts or scan ti insure the best fit. Many athletes, gymnasts and swimmers for example, cannot wear orthotics during practice or competition. However, it is important to recognize that their pains may be occurring during cross training, or other activities when they wear shoes that may accommodate an orthotic. I always tell patients, when attempting to balance their foot that, in order to support or off-load a joint or prominence, I cannot add or take away something from nothing, and that I need some space to make it all work. Once the footwear is established, the plans can be drawn up for the orthotic device.

Practically speaking, the first step is analyzing the shoes into which the orthotics will go.

Figure 5

Figure 6

Figure 7

Figure 2

Figure 3

Figure 4

An over-the-counter insert is a great place to start before the custom device arrives. I have found that most non-professional athletes have tried an OTC insert, and oftentimes bring it in with them on the initial visit. In any case, an OTC insert is a great base upon which to build, and all offices should have them available for their patients. After selecting the starting point, there is more to do to customize the device for specific, common sports injuries. The following modifications can be incorporated into either a temporary over-the-counter device, or to improve a custom orthosis that your patient already has.

Modifications

A first ray cutout will allow the first ray to plantarflex more when wearing the orthoses. By grinding away the distal medial aspect of the shell, this can easily be accomplished (Figure 2). There has been a lot published on the benefits of a first ray cutout in patients with functional hallux limitus.[1,2] In addition, it can be employed on patients with sesamoiditis. If you notice that

Continued on page 113

Rearfoot (from page 112)

the patient's arch height is too low in his/her existing insert or orthotic, fabricating a first ray cutout will allow the first metatarsal to plantarflex and ultimately help increase the surface contact of the foot on the device. The more the device conforms to the foot, the better it will function. Some patients suffering from metatarsalgia and even metatarsal stress fractures have a concomitant hallux elevatus. Adding this shell modification is a great option for those patients having lesser metatarsal pathologies.

I rarely use a varus extension on my athletes, because it increases the height to the medial forefoot (thickest) and gets thinner laterally.

There are several different forefoot extensions that can be added as well. A Morton's extension can alleviate painful hallux rigidus (Figure 3). This extension can also alleviate pain from turf toe; however, a thinner graphite or steel shank to the medial side is less bulky and fits into a greater variety of shoe gear, and is thus more commonly used. For patients with functional hallux limitus, the opposite, or a reverse Morton's extension, with or without a first ray cutout, is great. This allows further plantarflexion of the first ray, offering similar benefits to a first ray cutout. It is paramount to have the Morton's extension all the way to the distal end of the hallux. In contrast, a reverse Morton's extension can have desirable affects even if ending at the sulcus (Figure 4). In patients with metatarsalgia/metatarsal stress fractures as a result of hallux elevatus/functional hallux limitus, this modification helps current symptoms and may minimize repeat injury.

Next, you can add total forefoot extensions and valgus extensions. Total forefoot extensions (Figure 5) not only add some cushioning beneath the foot for conditions such as metatarsalgia, shin splints and neuromas, they can also help increase surface contact of the foot onto the orthotic. This will help off-load the metatarsal heads and decrease the chance of stress fractures.[4,5] Not only can extra cushioning be used, but a wedge effect can be added to the forefoot. I rarely use a varus extension on my athletes, because it increases the height to the medial fore-

Continued on page 114

Rearfoot *(from page 113)*

foot (thickest) and gets thinner laterally. On the other hand, a forefoot valgus post—which is the opposite of a varus extension and starts thickest on the lateral aspect and gets thinner medially (Figure 6)—can be used for several conditions. For lateral ankle instability, a forefoot valgus post can be included with the medial flange, which is a shell modification employed on a custom device. For those suffering from medial knee osteoarthritis, a larger lateral flange will take off pressure on the inner knee joint (Figure 7).[3]

Lastly, final additions can be incorporated just below the top cover. In layman's terms, you can add to the top cover or take away.

Final Additions

Lastly, final additions can be incorporated just below the top cover. In layman's terms, you can add to the top cover or take away. Punches, areas to off-load, can help off-load large prominences, or metatarsal heads in more rigid feet, or plantar plate injuries and sesamoiditis. First, you need to add material distal to the orthotic shell, then remove, or create a pot hole, beneath the painful areas or prominences. Metatarsal bars also start at the distal end of the shell, and are added beneath all metatarsals for metatarsalgia and stress fractures (Figure 8). Metatarsal pads can be added for patients having multiple forefoot neuromas (second and third interspaces) (Figure 9) or specifically a neuroma pad can be placed between metatarsals for a single interspace neuroma (Figure 10). Lastly, a cuboid pad can be placed beneath the cuboid with patients suffering from cuboid syndrome or dislocation. Due to the proximal location, this needs to be placed on top of

FIGURE 12:

Common Sports Injuries Treatable with Orthotic Shell Accommodations

Shell Accommodations	Pathologies
Medial flange	Posterior Tibial Tendon Dysfunction Shin splints (as a result of over pronation) Lateral Ankle Instability (lateral ankle sprain)
1st Ray cut out	functional hallux limitus sesamoiditis stress fractures or metatarsalgia as a result of hallux elevatus

Extensions	Pathologies
Complete forefoot	metatarsalgia neuroma
Valgus forefoot	lateral ankle instability
Valgus	medial knee osteoarthritis
Morton's extension	painful hallux rigidus
Reverse Morton's extension	functional hallux limitus sesamoiditis stress fractures or metatarsalgia as a result of hallux elevatus

Extra Additions	Pathologies
Metatarsal bar	metatarsalgia
Metatarsal pad	multiple interspace (2,3) neuromas
Neuroma pad	isolated (2,3 or 4th) webspace neuroma
Cuboid pad	cuboid dislocation calcaneal cuboid syndrome

Continued on page 115

Rearfoot *(from page 114)*

the shell (Figure 11).

I reserve adding a medial flange to the shell of a custom device, because it cannot be easily added to an insert in the office. It must be incorporated to the shell during the orthotic lab's fabrication process. This is a great addition for those athletes having a history of ankle sprains or lateral ankle instability.[6] In the past, it was believed that adding a lateral flange would help block excess lateral motion in patients with recurrent inversion ankle sprains. However, it has been determined that adding a medial flange, which increases the surface contact of the foot with the orthotic, is better, and helps the foot push off the device, thereby decreasing inversion. In addition, patients suffering from shin splints as a result of overpronation will benefit from a medial flange by encouraging supination.

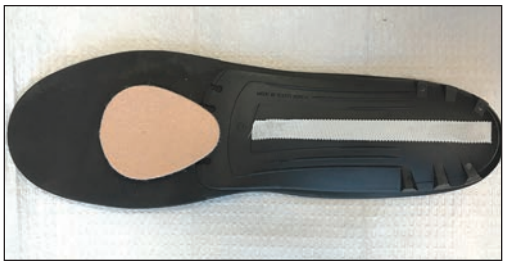

Figure 9

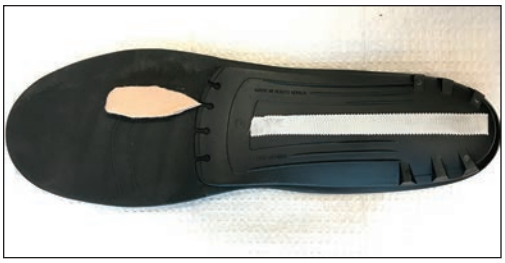

Figure 10

Helping your patients via a non-surgical method is a distinguishing characteristic of a sports podiatrist.

Helping your patients non-surgically is a distinguishing characteristic of a sports podiatrist.

There are several common sports injuries that can be treated with extensions and additions to the shell of the orthotic (Figure 12). If you are not experienced with adding an accommodation to a custom device, start by modifying an over-the-counter insert. Let your patients try out the modified insert for a couple of weeks. It is easier to make adjustments to extensions and additions that are below or on top of the top cover with 3mm felt pads/roll before they are glued down or somehow incorporated into a custom device. When patients experience pain relief from these modifications, they will be happy to see you every couple of weeks and have their temporary insert modified further until it is right, before you send out for the custom device.

Figure 8

The Prescription

After getting the temporary, fabricated insert optimized, you can proceed to casting or scanning for the permanent custom orthoses. To those not totally familiar with creating orthotic prescriptions, the type and volume of detail can be overwhelming. There are many orthotic labs that will be happy to get you started, explain their orthotic prescription sheet and detail the best way

Continued on page 118

If you are not experienced with adding an accommodation to a custom device, start by modifying an over-the-counter insert.

Rearfoot *(from page 115)*

to make casts or scans. Once they get acclimated to your style and technique, they will be able to produce the best devices for your patients. Always include your diagnosis on your prescription, as their other DPM clients may be offering ideas that you too may want to employ. Lastly,

Getting a total contact impression will allow you to truly customize the device and offer your patients the best possible pain relief.[7]

nothing can take the place of a good mold or cast of the patient's foot. If you are able to capture the foot in an ideal position, and there is full contact of the foot on the device, several pathologies can be alleviated without any additions or modifications. Getting a total contact impression will allow you to truly customize the device and offer your patients the best possible pain relief.[7]

To define orthotic making as an "art" may offend the true biomechanical scientists out there, but for the novice, or the practitioner looking to improve his or her orthotic skill set, there certainly is an art to not only diagnosing and addressing the pathology, but also finding a way to marry the device to specific feet and shoes. **PM**

Figure 11

References

[1] Dananberg HJ. Functional hallux limitus and its relationship to gait efficiency. J am Podiatr Med Assoc. 1986; 76(11): 648-52

[2] Scherer PR. Functional hallux limitus and hallux valgus. In: Schere PR (ed.); Recent Advances in Orthotic Therapy. Lower Extremity Review, Albany, N.W., 2011, pp. 57-67

[3] Kirby, K. Can foot orthoses have an impact for knee osteoarthritis? Podiatry Today. October 2015; 28(10)

[4] Mueller M. Efficacy and Mechanism of Orthotic Devices to Unload Metatarsal Heads in People with Diabetes and a History of Plantar Ulcers. Physical Therapy June 2006 vol. 86 no. 6 833-842

[5] Hsi WL, Kang JH, Lee X: Optimum position of metatarsal pad in metatarsalgia for pressure relief. Am J Phys Med Rehabil. 84: 514-520, 2005

[6] Richie DH. Chronic ankle instability: can orthotics help? Podiatry Today. 2006; 19(10): 48-57

[7] Trotter LC, Pierrynowski MR. Changes in Gait Economy between full-contact custom-made foot orthoses and prefabricated inserts in patients with musculoskeletal pain: a randomized clinical trial. J Am Podiatr Med Assoc, 2008 98: 429-435.

Dr. McCartan is a minimally invasive foot & ankle surgeon practicing in Milwaukee, Wisconsin and Littleton, Colorado. He is a fellow of the American Academy of Podiatric Sports Medicine; fellow of the American College of Foot and Ankle Surgeons; fellow of the Academy of Ambulatory Foot and Ankle Surgeons; Medical Director of Northwest Surgery Center, and Chief of Podiatry at Wheaton Franciscan Healthcare.