

Orthotics Q&A:

Can Orthotics Address The Faulty Biomechanics Of Metatarsalgia?

- [Guest Clinical Editor: Bruce Williams, DPM](#)

Metatarsalgia is one of the more commonly seen complaints in any podiatry practice. Common treatments for the disorder include ice, removable metatarsal pads, antiinflammatories, injected steroids and physical therapy. While such treatments often completely resolve an acute bout of metatarsalgia, they often do nothing to remedy the true underlying biomechanical causes of the problem.

To correct the faulty foot biomechanics, DPMs rely on custom foot orthotics. Unfortunately, the devices are often no different than what one prescribes for any other foot disorder with the addition of a forefoot extension to “accommodate” the painful metatarsal head. This is a reasonable modification to any foot orthotic device but it is often unnecessary or does not address the true cause of the problem. Often, one needs to focus on areas of dysfunction within the foot and away from the primary area of pain.

Q: In your opinion, what sagittal plane foot function problems predominantly contribute to metatarsalgia?

A: Generally, Bruce Williams, DPM, always assesses the ankle joint for non-weightbearing range of motion and compares both ankles at the same time. One ankle often has much less range of dorsiflexion than the other ankle. Dr. Williams says this is often associated with limb shortness on the limited side and can also contribute to increased forefoot pressures due to the impending equinus deformity.



Orthotic modifications may be helpful in relieving symptoms of metatarsalgia. Here one can see a slot aperture for lesser metatarsalgia that can be extended to the end of the device in order to offload the affected metatarsal head that has been receiving abnormal pressure.

Stanley Beekman, DPM, says ankle equinus contributes to metatarsalgia as it reduces midstance and lengthens the propulsive phase, which increases forefoot forces. Equinus may also cause extensor substitution, which decreases digital flexion and increases metatarsal pressures, notes Dr. Beekman.

Metatarsus primus elevatus often contributes to lesser metatarsal pain, according to Jamie Yakel, DPM. When the first metatarsal head does not receive its share of ground reaction forces, Dr. Yakel says the forces must be transferred and one subsequently develops pathology under the second and possibly the third metatarsal heads.

When Dr. Yakel uses his in-shoe pressure system to evaluate a patient with an elevated first metatarsal and/or functional hallux limitus, he says peak pressures do arise under the second and third metatarsal heads. As he explains, the center of pressure (CoP) trajectory is usually lateral to the midline. Once one addresses the functional hallux limitus, Dr. Yakel notes the trajectory becomes more midline and pressures decrease. Accordingly, the patient's symptoms dissipate.

Dr. Williams will also examine the patient for functional hallux limitus and determine how far proximal and plantar the first ray is sensitive to dorsiflexory forces. If clinicians load the first metatarsal head and attempt to dorsiflex the hallux, they will usually see a limitation in motion in patients with functional hallux limitus, according to Dr. Williams. However, he notes if one continues this dorsiflexory force proximally under the first metatarsal, the functional limitation often will continue all the way to the first metatarsal base.

"If one addresses the foot from a viewpoint of sagittal plane function (i.e., facilitating motion in the metatarsophalangeal joints, the ankle joint and at heel contact), one can alleviate metatarsalgia very consistently and easily, and can often do so without a bulky forefoot extension," contends Dr. Williams.

Q: What orthotic modifications do you regularly use to treat metatarsalgia?

A: When treating sub-second metatarsal capsulitis, if the cause is an elevated first metatarsal, Dr. Yakel adds a Morton's extension, a metatarsal pad and an accommodative pad. If the sub-second metatarsal pain is secondary to functional hallux limitus, he provides a generous first ray cutout along with a reverse Morton's extension for metatarsals three to five.

"Ninety-nine percent of the time," Dr. Williams will modify his orthotics with a first ray cutout, which he takes back to where plantar pressure under the first ray no longer inhibits dorsiflexion of the first MPJ.

Dr. Yakel emphasizes the importance of plantarflexing the first metatarsal when casting orthotics. Putting more valgus into the cast allows for greater plantarflexion of the first metatarsal, according to Dr. Yakel.

Dr. Williams also routinely utilizes unilateral heel lifts to accommodate for limb length differences, noting the shorter limb is usually consistent with the more painful side of metatarsalgia. As a last resort, Dr. Williams says one can achieve "great" results by employing a properly placed accommodation or a reverse Morton's extension.

If one has sub-second metatarsal capsulitis as a result of rearfoot pronation, Dr. Yakel balances the heel of the cast inverted, incorporates a deep heel cup and medial heel skive, and leaves the anterior edge of the orthotic at its full thickness.

Dr. Yakel will also commonly treat sub-second metatarsal capsulitis with a metatarsal pad and adds a full-length extension with 1/8 inch of Vlyte or Korex as an accommodation for the sub-second metatarsal. He describes this modification as a combination of a Morton's extension and a reverse Morton's extension, which permits the second metatarsal head to "float."

To compensate for the lack of bone compression strength that can be associated with a geriatric foot and metatarsalgia, Dr. Beekman uses metatarsal pads and/or toe crests to distribute pressure over a larger area than just the metatarsal heads. He says leather orthotics help him visualize the metatarsal to metatarsal relationships. Dr. Beekman then utilizes this information to even out the pressures among metatarsals (balance padding).

Q: What non-orthotic modifications will you use in conjunction with custom foot orthotics to help alleviate metatarsalgia symptoms?

A: For arthritic patients with restricted metatarsophalangeal joint range of motion, Dr. Beekman makes a rocker platform modification to their shoes. He says this eliminates the need for the foot to go through a propulsive phase. Dr. Yakel is also a fan of rocker bottom shoes, noting that the offloading is effective in decreasing forefoot pain. Dr. Beekman adds that some patients need a soft insole to absorb shock.

When a patient has an elevated first metatarsal, Dr. Yakel notes one can add a Morton's extension to the shoe insert if one has not already been added to the orthotic. If fat pad atrophy or displacement is the cause of metatarsalgia, Dr. Yakel suggests using additional cushioning in the shoe, orthotic or topcover, or adding a gel metatarsal pad. For patients with pre-dislocation syndrome, Dr. Yakel will use a Budin toe splint along with NSAIDs.

Dr. Williams regularly uses a manipulation technique, promoted by Howard Dananberg, DPM, to increase ankle joint range of motion.¹ As he notes, coupling that

technique with proper Achilles tendon stretching exercises usually eliminates the equinus deformity as long as the patient uses custom foot orthotics.

Dr. Beekman treats equinus with physical therapy, which entails pre-fatiguing the gastrocnemius and soleus, and having the patient stretch. While he recently began using a modification of the aforementioned Dananberg manipulation of the ankle joint, Dr. Beekman found that some patients had a recurrence of equinus on the next visit.

To determine the cause of recurrence, Dr. Beekman examined the ligaments and retinaculum, and used applied kinesiology to determine which ligament and/or portion of the retinaculum was involved, and the direction in which to mobilize it. "I found that the equinus reduced without the manipulation and this did not recur on subsequent visits," says Dr. Beekman.

Soft tissue massage to the peroneus longus insertion can help this muscle function, according to Dr. Beekman. Additionally, he manipulates the foot using a technique by Kevin Miller, DPM. Dr. Beekman says Dr. Miller's theory is that the third metatarsal and lateral cuneiform migrate proximally, causing a separation of the navicular and cuboid. As Dr. Beekman explains, this alters the function of the midtarsal and Lisfranc's joint, which causes a dorsiflexed first and fifth metatarsal. He notes that he confirms this effect by using applied kinesiology testing.

Dr. Yakel rarely uses steroid injections or physical therapy to treat metatarsalgia. He says biomechanical control often reduces or eliminates symptoms of the condition.

Dr. Williams is a Fellow of the American College of Foot and Ankle Surgeons, and is board certified by the American Board of Podiatric Surgery. He is a member of the American Academy of Podiatric Sports Medicine. Dr. Williams practices in Merrillville, Ind.

Dr. Beekman is a Past Diplomate of the American Board of Podiatric Orthopedics and Primary Podiatric Medicine, and the American Academy of Podiatric Sports Medicine. He is board certified by the American Board of Podiatric Surgery.

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Reference

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Podiatry Today - ISSN: 1045-7860 - Volume 18 - Issue 6 - June 2005 - Pages: 28 -