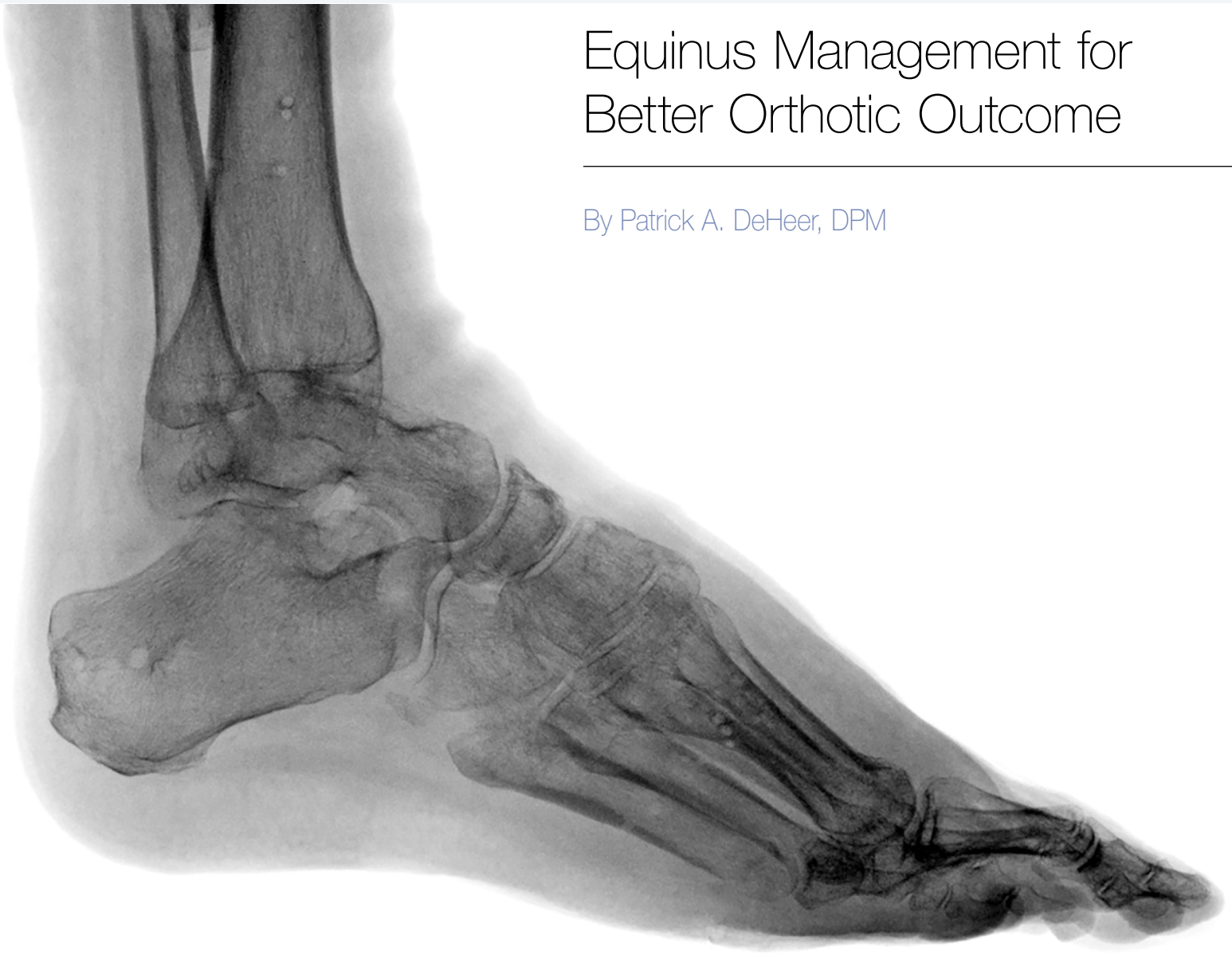

Equinus Management for Better Orthotic Outcome

By Patrick A. DeHeer, DPM

Ever had a patient complain that the arch on your orthoses was killing them when you know it wasn't that high? It may have nothing to do with your device. Dr. Deheer discusses some of the research done on equinus and explains why that may be the culprit. This article is available for *Continuing Education Unit* (CEU) credit.

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The use of custom foot orthoses is a conventional therapy for a multitude of lower extremity pathologies. Patient satisfaction with these devices can be problematic and frustrating for both practitioner and patient. The underlying conflict lies with the amount of required correction not tolerated by the patient. The source of the complaint is frequently attributed to the orthoses itself, be it the amount of correction or arch height. The fact of the matter is that rarely is the orthoses the root of the problem. There is not too much correction, and the arch is not too high. The problem lies on the patient side of the equation if the form of untreated equinus deformity.

DiGiovanni et al. described equinus as ankle joint dorsiflexion of less than 5° of ankle joint dorsiflexion with the knee extended.1 Proper evaluation technique is critical in this definition. Barouk and Barouk described the correct method to examine ankle joint dorsiflexion by either placing the hindfoot in a neutral position or in varus to eliminate dorsiflexion at the midfoot level allowing for primarily dorsiflexion to occur in the hindfoot while applying the proper amount of dorsiflexion force to the forefoot.[2] See *figures 1-6* for correct deformity evaluation technique.

Hill in his landmark article on the frequency of equinus made some fascinating comments on the relationship between equinus and orthoses.[3] I would like to look at some of these statements and address them individually.

"Treating apparent biomechanical problems that have an underlying equinus deformity with

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rigid functional orthoses is a major reason for unsuccessful orthotic treatment."—*This statement is accurate, and I agree with it.*

"Equinus patients who receive orthoses as their sole treatment may not be capable of accepting orthotic control."—*This statement is accurate, and I agree with it.*

"A rigid orthotic will prevent the foot from pronating. The result is arch irritation from excess friction against orthoses."—*This statement is inaccurate, and I disagree with it. I will provide a sound evidence-based argument on why this statement is incorrect.*

Thoradson et al. examined which structures stabilized the arch and deformed the arch by applying increasing loads to various extrinsic foot tendons and the plantar fascia.[4] The Achilles tendon was found to have the most significant deforming force on the medial arch in both the sagittal and transverse planes.[4] The authors noted 3.3° and 3.7° of medial arch decrease at 350N and 750N respectively in the sagittal plane.[4] Additionally, there was significant abduction in the transverse plane for both load amounts.[4]

The exact location where the arch flattens was answered by Johnson and Christensen in part five of their series of articles on the medial

"Equinus patients who receive orthoses as their sole treatment may not be capable of accepting orthotic control."

DEFORMITY EVALUATION TECHNIQUE

Figure 1 — *Correct sagittal plane* positioning of the foot in supination to evaluate ankle joint dorsiflexion locking the midtarsal joints and neutralizing the hindfoot position

Figure 2 — *Correct frontal plane* positioning of the foot in supination to evaluate ankle joint dorsiflexion locking the midtarsal joints and neutralizing the hindfoot position

Photos: Courtsey of Dr. DeHeer

column in 1999.[5] The authors placed sensors on each of the bones of the medial column of the foot (1st metatarsal, 1st cuneiform, navicular, and talus) recording the movement of each bone with increasing loads applied the Achilles tendon.[5] The normal role of the Peroneus Longus tendon to evert the medial column of the foot into the central column of the foot was dampened.[5] This dampening effect led to the unlocking of the midtarsal joint and hypermobility with the arch flattening at the naviculocuneiform joint.[5] The first metatarsal and first cuneiform dorsiflexed and the navicular and talus plantarflexed.[5] This explains why frequently on lateral x-ray views there is a navicular-cuneiform sag.

Amis examined the effect of equinus dynamically during gait.[6] Using video at 250 frames per second (FPS), Amis demonstrated the exact time sequence during the gait cycle when the destructive leveraged forces occur on foot. Amis termed this the "split second effect."[6] The pathological force created last for approximately 1/200 ms (1/10 second).[6] The split-second effect occurs during the last half of midstance when the swing phase foot pass starts to pass the planted foot before heel lift on the planted foot.[6] This fourth rocker at the naviculocuneiform joint is the active version of Johnson and Christensen findings.

With the information provided by the three previously mention studies, it becomes evident why functional orthoses and an equinus deformity are adversaries. The orthoses are supporting the medial column of the foot with the medial flange and posting if present. The Gastocsoleal complex is driving the arch downward at the naviculocuneiform joint. These two forces are opposing each, with the result being arch irritation or a feeling of the medial arch being too high.

Figure 3 — *Incorrect sagittal plane* position of the foot in pronation to evaluate ankle joint dorsiflexion unlocking the midtarsal joints and pronating the hindfoot position allowing dorsiflexion to occur in the midfoot

Figure 4 — *Incorrect frontal plane* position of the foot in pronation to evaluate ankle joint dorsiflexion unlocking the midtarsal joints and pronating the hindfoot position allowing dorsiflexion to occur in the midfoot

"Conservative treatment for equinus takes approximately eight to twelve weeks."

"...The Equinus Brace™ due to several factors that make this brace uniquely qualified for the conservative treatment of equinus."

When a patient has equinus as a component of their lower extremity pathology, it is critical to address the equinus before orthoses treatment. Conservative treatment for equinus takes approximately eight to twelve weeks. The author uses The Equinus Brace™ (*figure* 7) due to several factors that make this brace uniquely qualified for the conservative treatment of equinus. The brace is the only one on the market that extends above the knee to lock the knee into full extension. Maintaining the knee in full extension is critical to stretch the gastrocnemius muscle. The brace also provides for controlled dorsiflexion of the ankle with three settings of 0°, 10° and 20°. Finally, the brace comes with a 60° toe wedge for the hallux. The wedge dorsiflexes the hallux to engage the Windlass mechanism thereby supinating the subtalar joint and inverting the hindfoot. The eliminates dorsiflexion from occurring through the midfoot while directing the force through the hindfoot. Recommended therapy is treatment one hour per day for four weeks at each setting of the brace. It is important to evaluate deformity correction with goniometer measurements during treatment. Once the deformity is corrected, most patients will require maintenance therapy. Several factors necessitate ongoing treatment to prevent recurrence, such as anatomy, aging and decreased activity level (*figure* 8).

An often-overlooked component of equinus therapy is the role of shoe drop. Shoe drop is the difference in the height of heel compared to the forefoot. For example, if the heel of a shoe is 26 mm thick and the forefoot is 10 mm, the shoe drop would be 16 mm. Stretching a patient for one hour per day while wearing a shoe with a high shoe drop eight to ten hours per day, counteracts the stretching. Most patients with an unresolved equinus deformity are unable to switch to a 0mm drop shoe without aggravating the Gastrocsoleal complex. Recommending

DEFORMITY EVALUATION TECHNIQUE

Figure 5 — *Ankle joint dorsiflexion* with the knee fully extended evaluating for Gastrocnemius equinus

Figure 6 — *Ankle joint dorsiflexion* with the knee flexed evaluating for Gastronemius-Soleal equinus

Photos: Courtsey of Dr. DeHeer

transition to a midrange drop shoe like a 4-8 mm drop shoe initially then reducing the shoe drop to a 0mm drop with equinus resolution. The shoe drop concept is very familiar in the running shoe world, but less discussed for dress shoes. For women, the recommendation should be flats instead of heels. Men's dress shoes can be problematic also and require counseling.

Appropriate management of equinus leads to improved orthoses outcomes. The timing of the two therapies is dependent upon the deformity severity. Typically, equinus deformity correction should precede orthoses therapy. Equinus correction allows the patient to fully tolerate the correction within the orthoses satisfying both the patient and healthcare provider.

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ADDITIONAL INFORMATION

Figure 7 — Learn more about the Equinus Brace and how it treats foot, ankle, and leg pain related to equinus.

— https://youtu.be/r38w_zJDZIE —

Figure 8 — Dr. Patrick Deheer demonstrates how to properly adjust and wear the Equinus Brace.

— https://youtu.be/g_kChs-SWfQ —