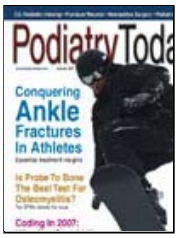

Continuing Education: Key Insights On Writing Orthotic Prescriptions

- By Lawrence Huppin, DPM, and Paul Scherer, DPM

Extolling the importance of using pathology-specific custom orthoses, these authors review key considerations in writing an effective orthotic prescription and facilitating improved treatment outcomes.

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Continuing Education Course #138 January 2006

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I am pleased to introduce the latest article, "Key Insights On Writing Orthotic Prescriptions," in our CE series. This series, brought to you by the North American Center for Continuing Medical Education (NACCME), consists of regular CE activities that qualify for one continuing education contact hour (.1 CEU). Readers will not be required to pay a processing fee for this course.

To prescribe an effective orthotic, one must address patient symptoms as well as the pathology which produced the dysfunction. With this in mind, Lawrence Huppin, DPM, and Paul Scherer, DPM, emphasize the value of custom orthotics and provide a step-by-step guide to selecting appropriate materials and getting the most out of orthotic additions and modifications.

At the end of this article, you'll find a nine-question exam. Please mark your responses on the enclosed postcard and return it to NACCME. This course will be posted on *Podiatry Today*'s Web site (www.podiatrytoday.com) roughly one month after the publication date. I hope this

CE series contributes to your clinical skills.

Sincerely,

Jeff A. Hall
Executive Editor
Podiatry Today

INSTRUCTIONS: Physicians may receive one continuing education contact hour (.1 CEU) by reading the article on pg. 68 and successfully answering the questions on pg. 74. Use the enclosed card provided to submit your answers or log on to www.podiatrytoday.com and respond via fax to (610) 560-0502.
ACCREDITATION: NACCME is approved by the Council on Podiatric Medical Education as a sponsor of continuing education in podiatric medicine.
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DISCLOSURE STATEMENTS: Dr. Huppin has disclosed that he is the Medical Director for ProLab Orthotics/USA. Dr. Scherer has disclosed that he is the CEO and a major stock shareholder in ProLab Orthotics/USA.
GRADING: Answers to the CE exam will be graded by NACCME. Within 60 days, you will be advised that you have passed or failed the exam. A score of 70 percent or above will comprise a passing grade. A certificate will be awarded to participants who successfully complete the exam.
TARGET AUDIENCE: Podiatrists.
RELEASE DATE: January 2006.
EXPIRATION DATE: January 31, 2007.
LEARNING OBJECTIVES: At the conclusion of this activity, participants should be able to:
• discuss the general goals of prescribing pathology specific orthotics;
• discuss the differences between vacuum formed and direct milled polypropylene;
• describe the potential impact of orthotic width;
• discuss the rationale for considering or not considering a rearfoot post; and
• discuss the use of the “sweet spot” modification and how it can be beneficial in orthotic treatment of adult-acquired flatfoot or posterior tibial dysfunction.

Sponsored by the North American Center for Continuing Medical Education.

When it comes to an effective prescription for custom foot orthoses, podiatrists must consider the dysfunction of that particular patient's foot in order to achieve a satisfactory clinical outcome. Addressing the specific needs of the pathology producing the dysfunction as well as the symptoms the patient is experiencing makes the difference between treatment success and failure.

Dispensing the same prescription orthotic for posterior tibial dysfunction and plantar fasciitis will not produce the same successful outcomes as a colleague who prescribes pathology specific orthoses.

A systematic approach to constructing the most effective orthoses for a patient's specific pathology takes only a little more time and effort than making generic orthoses. The following five-step system can help clinicians select the most appropriate components for an orthoses. These steps include embracing the concept of pathology specific orthoses and then prescribing correct material flexibility, positive cast modifications, posting, intrinsic accommodations and special additions.

Step One: Understanding The Benefits Of Custom Orthotics

Stop thinking in terms of generic custom orthoses and embrace the concept of pathology specific orthoses. Selecting custom orthoses with disregard for the particular pathology or foot type of the patient is as effective as selecting an antibiotic without regard to the pathogen or the physiologic condition of the patient.

A review of the literature has shown that altering the position of the foot may contribute to improved function of some feet. Published research has described how an orthotic designed to invert the calcaneus can significantly reduce the pressure on the posterior tibial nerve in tarsal tunnel syndrome.[1] In comparison to performing a varus correction on the rearfoot, placing a greater valgus correction on the forefoot portion of the orthoses dramatically reduces pull or strain on the plantar fascia.[2] A particular design of custom foot orthoses can reduce foot pain by 20 percent and foot disability by 30 percent in patients with rheumatoid arthritis.[3] Repositioning the first ray via casting method and certain forefoot extensions can improve the range of hallux dorsiflexion in functional hallux limitus.[4]

As shown in the above table, the flexibility of a custom foot orthotic is proportionate to the weight of the patient and the thickness of the material. Note the differences in flexibility between vacuum-formed polypropylene and direct milled polypropylene.

Knowing about the new concepts and still prescribing the same custom orthoses regardless of pathology does not provide patients with quality care and optimum clinical outcomes. The goal of pathology specific orthotic therapy is understanding what foot dysfunction caused the symptoms and focusing on a device design that works to reverse the dysfunction. Spending a few moments reading

this article, attending seminars or conferences that present this information or investigating pathology specific orthoses on the Internet can dramatically improve the orthotic therapy segment of a clinical practice.

Step Two: How To Select Appropriate Orthotic Materials

Select material and flexibility for the shell of the device that meets the needs of the patient's foot type and pathology. The two most common materials used in the United States and Canada are polypropylene and graphite composite. The comparative value of these materials is not as important as the concept that each material has several thicknesses or flexibility, and each flexibility is specific to the needs of different foot types and pathology.

This article is not intended to provide the appropriate flexibility for every foot type and pathology but a few examples will give one the concept and the direction for improved outcomes. The thinner the polypropylene, the more flexible the device, depending on the weight of the patient.

One can recognize milled polypropylene CFOs by their distinctive milling line. They are slightly less flexible at a given thickness compared to vacuum-formed CFOs.

There is a difference between milled and vacuumed polypropylene. A milled polypropylene device, since it was never heated for molding, is inherently more rigid at a particular patient weight. Conversely, the polypropylene in a vacuum-formed device has been essentially melted and develops a more flexible characteristic. Orthotic laboratories that use polypropylene will either ask for the desired flexibility on the prescription form or ask for the desired thickness. Orthotic laboratories that use graphite alter the formulation to make the devices more flexible for a particular patient weight.

The following two examples show how flexibility relates to foot types and pathology. Pathology related to gastrocnemius equinus is difficult to control because the source of the deformity is such a powerful pronator and midtarsal joint deformer. Many clinicians believe that rigid devices for powerful pronators provide better control of the deformity. However, these devices actually place the foot between the proverbial rock and a hard place, producing greater symptoms from the hard orthotic than from the pathology. In this particular situation, making a more flexible device maintains some but not total control of the deformity.

The opposite of this situation is controlling the extremely pronated foot with a tarsal coalition or the peroneal spastic flatfoot. Nothing but a rigid device will control this pathology and the more the patient weighs, the thicker the polypropylene one will need to be to ensure an effective rigid device.

Step Three: What You Should Know About Positive Cast Modifications

It is important to understand and apply prescription parameters related to orthotic shape and positive cast work. This section of the orthotic prescription includes heel cup depth, orthotic width, cast fill, medial skive and positive cast inversion. With this in mind, let us look at some examples of how each of these relates to some pathologies.

As one can see here, vacuumed polypropylene CFOs are smooth and shiny in appearance, more flexible at a given thickness and adapt easier to plantar fascia grooves or intrinsic accommodations.

Most orthotic labs offer heel cup depth in varying sizes that include shallow (10 mm), standard (14 mm), deep (18 mm) and extra deep. When choosing heel cup depth, the primary concept to remember is the deeper the heel cup, the greater the surface area of plastic and the greater the control of the rearfoot. If the calcaneus is everted, a deep heel cup will provide greater control. The only reason to use a standard or shallow heel cup in the presence of an everted calcaneus is to accommodate the patient's shoe selection or because the pathology originates distal to the midtarsal joint. Attempting to treat posterior tibial dysfunction with an orthotic that has a shallow heel cup is an effort in futility.

Orthotic width generally refers only to the width of the distal edge of the orthosis and the resulting breadth of the arch area. Width determines the stability of the orthotic in the shoe during and after midstance and control over the first ray. The longest horizontal support against frontal plane motion of the orthotic in the shoe is the distal edge. The wider the orthosis, the less likely it will tilt with pronation at midstance. When treating pathology that involves excessive midtarsal joint motion, like plantar fasciitis and functional hallux limitus, a wider front edge withstands the deforming forces that are present in a dysfunctional foot.

An orthosis raises the base of the first metatarsal to increase hallux dorsiflexion in functional hallux limitus. If the orthosis is narrow, it will barely touch the base of the metatarsal. A wide front edge is rarely a shoe problem with the exception of extreme styles. Insist on choosing an orthotic width appropriate for the patients' pathology rather than allowing the orthotic lab to default to narrow so the CFO fits in any shoe.

Merton Root, DPM, originally introduced cast fill as a technique intended to blend the forefoot correction into the arch of the positive cast.[5] An orthotic lab should offer several cast fills to address the need of a specific pathology. An orthosis made from a positive cast with minimum fill will conform close to the arch of the foot. Minimum fill offers the most control over arch collapse and is essential for symptoms produced by cavus feet and hard to control, pronated feet.

One can prescribe various heel cup depths as a balance between the needs of the pathology and the type of shoe the patient is willing to wear.

Standard fill lowers the arch slightly and makes the orthotic less "tight" against the foot in stance. This is useful when there are secondary issues with the foot like limitations of motion secondary to osteoarthritis or insensate feet, both of which require a more gentle control of the foot. Maximum fill for equinus, muscle spasm or tarsal coalition is a strategy that allows for just some control in situations where the least control can produce enough symptom reduction without creating other problems.

It is critical that practitioners control how much cast fill they add to the positive cast. Adding excessive cast fill is a common lab error practice since it produces a more forgiving CFO with less potential to cause arch irritation. However, while this is somewhat less likely to cause arch irritation, making an orthosis from a positive cast with excessive fill will result in inadequate control since it ameliorates the corrective forces that an orthotic device creates. If you prescribe a minimum fill, confirm that the orthosis matches the arch of the foot closely when holding the foot in casting position before dispensing.

The medial skive technique was probably one of the most significant and effective developments in orthotic design. Developed by Kevin Kirby, DPM, this contribution to the custom functional Root type design allowed for the manipulation of ground reactive force to provide better control of the rearfoot.[6] Treating pediatric flexible flatfoot or PT dysfunction without this modification usually produces a less than optimal result.

The minimum cast fill is the original design (left). Standard cast fill (center) is necessary for some pathologies that will not tolerate the neutral position shape. One would use maximum fill (right) to make the custom orthosis more comfortable albeit less effective.

Podiatrists can treat most pathologies that include an everted calcaneus in stance more successfully with this technique, which produces a rise in the medial side of the heel cup by 2 mm, 4 mm or 6 mm. Clinicians frequently discover significantly improved clinical outcomes when they add this modification to the prescription for a patient's pathology related to an everted calcaneus. This modification is not effective with a shallow heel cup. It requires a deep or standard depth. Most labs do not charge for this additional modification.

Step Four: Should You Use Rearfoot Posts?

Select the most appropriate rearfoot post. The original design, during the introduction of orthoses, included this hard plastic foundation for the rear portion of the device. The intended

purpose of the rearfoot post was to stabilize the orthosis in the shoe during midstance and not to invert the device nor correct for heel varus or valgus. There is no proven benefit or purpose for a varus rearfoot post and logically, it does not make any sense to invert the front edge of the orthotic by increasing the varus rearfoot post.

The Kirby skive or medial skive is a technique that raises the medial side of the heel cup (left cross section) to increase ground reactive force and decelerate pronation by increasing the moment on the medial side of the subtalar joint axis.

Is a rearfoot post necessary for every pathology? No one knows. A prospective study to treat plantar fasciitis demonstrated a positive outcome in 85 percent of the patients treated with low dye strapping and subsequent functional semi-rigid orthoses.[7] None of the orthoses in this study had a rearfoot post. If one uses a rearfoot post to stabilize the orthoses, a rigid polypropylene post seems to be the most durable option. Some labs offer a variety of shock absorbing materials but today's athletic shoes are engineered to serve this purpose more effectively. Some labs offer soft posts but within a few months, the plantar surface of a soft post has rounded and loses its stabilization quality.

For most pathologies, anecdotal evidence seems to indicate that a hard plastic rearfoot post stabilizes the orthosis by increasing the plantar surface area, reinforcing the shape of the heel cup and extending the life of an orthosis.

Step Five: A Primer On Choosing Effective Additions And Extensions

Select the forefoot extensions and special additions that make the orthoses specific to the needs of the particular pathology and the patient. Although there are literally hundreds of combinations of extensions and additions developed over the last 50 years, several are very important to understand if one treats by pathology. This is especially the case when it comes to treating functional hallux limitus, metatarsalgia and posterior tibial dysfunction.

Functional hallux limitus has been accepted as the precursor pathology to the deformities of hallux valgus and hallux rigidus since Pat Laird, DPM, first described it in 1972.[8] The concept is that some people have a decreased "stiffness" of their first ray that dorsiflexes in response to increased ground reactive force at the first metatarsal head. This motion significantly decreases the dorsiflexion of the big toe joint. Using an appropriate orthosis for this pathology should reverse this motion by offloading the medial column of the foot and the first ray.

The reverse Morton's extension is an addition to a custom orthosis that will dramatically decrease the ground reactive force under

The reverse Morton's extension, usually made of 3 mm cork, is located under the second to the fifth metatarsal head. This allows the first ray to plantarflex and increase the range of dorsiflexion of the hallux.

the first metatarsal head and hopefully allow the first ray to plantarflex and give greater range of motion to the hallux. The reverse Morton's extension on a functional polypropylene device with a 4 mm medial skive is now classified as the pathology specific functional hallux limitus device. The research behind this concept has been accepted for publication in The Journal of the American Podiatric Medical Association.

Clinicians have treated metatarsalgia empirically with metatarsal bars on shoes for more than a century. Today, one can make the metatarsal bar of poron and add it directly to the distal edge of the orthosis. The concept behind the orthosis is the symptoms might improve if the orthosis can decrease the weight on the metatarsal heads by transferring the ground forces to the metatarsal shafts. The pathology specific orthosis for metatarsalgia includes the poron metatarsal bar, minimum fill cast work and a cushioned forefoot extension under the metatarsal heads.

Clinicians have successfully treated posterior tibial dysfunction (PTD) or adult acquired flatfoot (AAF) with foot orthoses. One study noted that in some cases, the custom foot orthosis worked as well as an ankle-foot orthosis (AFO) brace.[9] The orthosis stabilized the rearfoot and medial longitudinal arch in patients with chronic PTD.

A metatarsal bar is a cushion of poron that one places on the dorsum of the front edge of the custom orthosis as shown above. It transfers ground reactive force from the metatarsal heads to the shafts.

A common complication of treating PTD or AAF is the pressure placed under the navicular tuberosity by the rigid plastic of the orthoses, resulting in pain. An addition called a "sweet spot" seems, in most cases, to solve this complication and reduce or eliminate the pain at this region in the medial longitudinal arch. A sweet spot is an orthotic implant of poron that one depresses into the body of the orthosis while the plastic is still hot. This creates a soft cushion exactly where the navicular tuberosity touches the device. The clinician marks the area of the foot with a transfer marker, which identifies the area on the cast and allows the lab to implant the poron disk, of any size, in the exact area.

This is also a useful pathology specific addition for other problems like plantar fibromas and painful scars. One can place the sweet spot wherever one can draw a circle. It can be of any size without disrupting the strength or integrity of the device.

In Conclusion

Focusing orthotic treatment on a specific pathology rather than on a deformity can

One would place a sweet spot (see above) at the navicular tuberosity of pathology specific orthoses for posterior tibial dysfunction so the rigid plastic necessary for this device does not irritate this area. This is also an addition of value for plantar fibromas and painful scars.

significantly improve clinical outcomes. An understanding of the pathomechanics that produced the patient's symptoms allows the clinician to address the needs of the patient more specifically. Consider the material flexibility, advanced positive cast modifications, posting and special additions to make a better orthotic for the patient. A prefabricated orthosis meets some of the needs of all patients. A generic CFO meets some of the needs of all pathology. A pathology-specific, custom foot orthosis should meet all the needs of a particular patient with a particular pathology.

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For related articles, see "Pertinent Pearls On

Orthotic Adjustments And Casting" in the December 2005 issue or "Secrets To Fabricating Effective Custom Orthotics" in the June 2004 issue.

Also be sure to check out the archives at www.podiatrytoday.com.

CE Exam #138

Choose the single best response to each question listed below.

1. Which of the following statements is true?
a) In comparison to performing a varus correction at the rearfoot, placing a greater valgus correction on the forefoot portion of the orthoses dramatically increases strain on the plantar fascia.
b) In comparison to performing a varus correction at the rearfoot, placing a greater valgus correction on the forefoot portion of the orthoses dramatically reduces strain on the plantar fascia.
c) In comparison to performing a varus correction at the rearfoot, making a minor varus correction on the forefoot portion of the orthoses dramatically reduces strain on the plantar fascia.
d) None of the above

2. What is the goal of pathology specific orthotic therapy?
a) Providing a custom orthotic with the least amount of cast fill
b) Ensuring the most flexible combination of polypropylene and graphite composite
c) Understanding what foot dysfunction caused the symptoms and designing a device to reverse the dysfunction
d) All of the above

3. What is the difference between milled and vacuumed polypropylene?
a) A milled polypropylene device is inherently more flexible at a particular patient weight.
b) The polypropylene in a milled device is always heated for molding and is accordingly more flexible.
c) The polypropylene in a vacuum-formed device has essentially been melted and develops a more flexible characteristic.
d) None of the above

4. When choosing a heel cup depth, what is the primary concept to remember?
a) The deeper the heel cup you use, you will have a reduced surface area of plastic and greater control of the rearfoot.
b) More shallow heel cups increase the surface area of plastic and provide less control of the rearfoot.
c) The deeper the heel cup you use, you will have a greater surface area of plastic and greater control of the rearfoot.
d) None of the above

5. Which of the following statements is true about orthotic width?
a) The wider the orthosis, the less likely it will tilt with pronation at midstance.
b) It generally refers only to the distal edge of the orthosis and the resulting breadth of the arch area.
c) Width determines the stability of the orthotic in the shoe during and after midstance, and control over the first ray.

d) All of the above

6. _____ cast fill offers the most control over arch collapse and is essential for symptoms produced by cavus feet and hard to control pronated feet.
a) Maximum
b) Standard
c) Minimum
d) None of the above

7. _____ cast fill lowers the arch slightly and makes the orthotic less "tight" against the foot in stance.
a) Maximum
b) Standard
c) Minimum
d) None of the above

8. The medial skive technique …
a) is rarely used in cases of pediatric flexible flatfoot or posterior tendon dysfunction.
b) allows for the manipulation of ground reactive force to provide better control of the foot.
c) a and b
d) None of the above

9. According to the authors, the varus rearfoot post …
a) has no proven benefit or purpose other than increasing the surface area of the orthotic shoe contact.
b) helped facilitate positive outcomes in 85 percent of the plantar fasciitis patients in one prospective study.
c) plays a critical role in the correction of heel valgus.
d) None of the above

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