A Step-Wise Approach to Orthosis Decision-Making

Here's a paradigm for prescribing these biomechanical devices.

BY CHERRI S. CHOATE, DPM

Although many practitioners use custom orthoses as treatment, the decision-making process when writing the prescription is often a challenge. Typically, a patient presents with either foot pathology or foot pain, and the physician attempts to either ameliorate the pathology and/or decrease the pain. For many years, the options in orthotic prescription writing were few, and therefore, the process was quite straightforward. In today's medical world, we have more pathology to address, more patient demands, and more choices for orthosis therapy. As the choices have increased, so too has the complexity of decision-making.

Figure 1: Adult-acquired flat foot with medial column overload

Figure 2: Pes cavus foot type with metatarsal overload

In today's medical world, we have more pathology to address, more patient demands, and more choices for orthosis therapy.

In addition to the plethora of choices, we also have increasing expectation due to current economic circumstances.[5] Some options may affect the cost of the orthosis for you, the patient and the insurance company. Even adjustments and refurbishments need to be ordered strategically in order to be effective and efficient. This article will offer a logical step-wise reproducible approach to the orthotic decision-making process. For many, this will be supplemental information, but for some, this may help create a decision pathway that will lead to more effective orthotic therapy.

Recognizing Patterns

The emphasis of the majority of medical literature is on pathology. Some pathologies, such as adult-acquired flat foot,[1] (Figure 1) are newer additions to the realm of foot and ankle pathologies, while plantar fasciitis has been recognized in lower extremity biomechanics for generations. With a little more attention to the overall picture, patterns within pathologies begin to arise. For example, sets of pathologies may lead to excessive strain along the medial column of the foot, affecting the first metatarsophalangeal joint, the metatarsocuneiform joint, the naviculocuneiform joint, or the talonavicular joint.[13] Therefore, orthosis therapy will be most effective if the medial column is off-loaded[4], or in other words, excess pressure is shifted away from the medial column to allow the joint segments to function with less stress. Other pathologies, such as rheumatoid arthritis, may lead to increased pressure on the metatarsals,[2,3] so all the orthoses for these patients will benefit from techniques that take pressure off the metatarsal heads.

This recognition leads the practitioner to face orthotic decision-making at a more goal-oriented level. The entire discipline of critical thinking[6] starts with the idea of recognizing a problem, then information is gathered, and a process is established to address this problem. In the case of orthoses, we need to determine the goals in treating each individual patient and then choose options within an orthotic prescription that helps us address the goals.

Continued on page 126

Decision-Making *(from page 125)*

Determination of Goals

When discussing goals in orthotic management, practitioners tend to focus a little too closely on the specific complaint or pathology. It takes a more discerning eye to recognize the patterns of biomechanical dysfunction of each individual patient. Consider a patient who presents with adult acquired flatfoot. Traditionally, a practitioner would focus on the flatfoot and the prominent talonavicular area. A step back would lead the practitioner to address the severe overloading of the medial column of the foot, which should actually be the target of orthotic therapy. The traditional approach would lead the practitioner to order a wide orthosis with a sweet spot. The more critical approach would consider all options available to address medial column overload, and then choose the options that fit the severity of the problem, the patient's lifestyle, and the footgear.

Continued on page 127

TABLE 1:

Common Patterns and Orthotic Prescription Options

Pattern	Goals	Common Pathology	Orthosis Options	Possible Issues
Medial Column Overload	1) Off-load medial column 2) Decrease pronatory forces 3) Increase supinatory forces 4) Increase stability along medial column	• Adult-Acquired Flat Foot • Functional Hallux Limitus • Equinus • Medially deviated STJ axis[9] • Pes Planus	1) Medial Skive[7] 2) Inverted cast correction[8] 3) Deep Heel Cup 4) Semi-rigid plate 5) Minimal fill in cast correction to increase arch height of orthosis 6) Wide plate 7) Medial flange[10] (Figure 3) 8) Sweet spot for boney prominences 9) Flat post	• Too wide for shoes • Arch height intolerable
Lateral Column Overload	1) Off-load lateral column 2) Increase pronatory forces 3) Decrease supinatory forces 4) Increase stability along lateral column	• Peroneal Tendonitis • Chronic lateral ankle sprains • Laterally deviated STJ axis[9] • Pes Cavus	1) No lateral bevel on rearfoot post 2) Reverse Morton's Extension (Figure 5) or FF Valgus wedge Extension 3) Lateral flange[11]	• Shoe fit in toe box due to forefoot additions
Increased Metatarsal Head Pressure	1) Redistribute forces away from metatarsal heads 2) Off-load metatarsal heads (all or specific)	• Pes Cavus • Equinus • HAV	1) Minimal fill in cast correction to increase arch height of orthosis 2) Metatarsal bar (Figure 4) 3) Metatarsal pad[12] 4) Forefoot extension with soft padding 5) Forefoot apertures/cutouts to off-weight specific metatarsal heads 6) Heel lift	• Shoe fit in toe box due to forefoot additions • Intolerance of metatarsal bar or pad
Unstable Ankle Joint Complex	1) Stabilize ankle joint	• Chronic Ankle Sprains • Adult-Acquired Flat foot • Arthritis • Charcot • Severe flat foot • Tarsal Coalition • Equinus	1) Brace to cross ankle joint 2) Very deep heel cup 3) Flat RF post 4) Medial and or lateral flange	• Shoe fit • Fixed deformity prescribed non-fixed brace
Poor Postural Stability	1) Provide stable interface between foot and ground	• Imbalance with aging process • Painful arthritis • Tarsal Coalition • Peripheral Neuropathy	1) Wide plate 2) Flat RF post 3) Deep heel cup	• If too bulky, the height may lead to increased instability

Figure 3: Medial flange with sweet spot

Decision-Making *(from page 126)*

Options

By recognizing biomechanical patterns and the options that address the patterns effectively, the process becomes a more objective approach to a set of goals, instead of a random set of orders based on instinct and hope. Table 1 is a series of common patterns and orthotic prescription options.

These are just a few of the most common patterns recognized in lower extremity foot and ankle practices. Some practices see a heavy focus on one particular patient population, so the options become more familiar to the practitioner. This same thought process might be used in orthotic adjustments. When attempting to adjust an orthosis, first the goal of the adjustment must be determined, then the choices are considered, and a plan for action is taken. Adjustment can be done quickly and easily in-office just to determine which of the modifications elicits the most positive response from the patient. The practitioner can either apply one adjustment at a time, or multiple adjustments. Once the patient and the practitioner are satisfied with the adjustment, a permanent modification can either be made by the practitioner, or at the lab. A logical, step-wise approach may save a great deal of time and money. Table 2 shows two common orthosis adjustment scenarios.

It takes a more discerning eye to recognize the patterns of biomechanical dysfunction of each individual patient.

Case Studies

Two cases will be presented that allow the practitioner to apply these decision-making steps in writing orthotic prescriptions.

Case 1

HPI: Patient is a 72-year-old female who has a history of pain under the ball of her foot, which has been increasing over the past 20 years. She denies any histo-

Continued on page 128

Decision-Making
(from page 127)

ry of trauma. She has had orthoses before, but they didn't fit in her shoes and they made her wobble, so she stopped wearing them. She wears walking shoes most of the time now.

Physical Examination (Pertinent positive findings): Moderate rigid pes cavus foot type (Figure 2) with fat pad atrophy in submetatarsal area; ankle joint dorsiflexion 7 degrees, diffuse pain on palpation of 2nd metatarsal head B/L

Gait: short strides, early heel off, wide base of gait, apropulsive

Pattern: Metatarsal overload with postural instability

Associated Pathology: Pes Cavus, Equinus, Postural changes related to age

Goals: Off-load metatarsal heads
Stabilize foot on ground

Individual Factors to Consider: age, previous discomfort, shoes

Continued on page 129

TABLE 2:
Common Orthosis Adjustment Scenarios

Pattern	Goals	Orthosis Options	Possible Issues
Orthoses for Dress Shoes	1) Decrease width 2) Decrease bulk of orthosis	1) Narrow width 2) Thin plate material (e.g., graphite) 3) Thin topcover 4) Very limited forefoot materials 5) No rearfoot post	• Shoe fit

(continued on page 130)

Decision-Making *(from page 128)*

Orthosis Options:
- Metatarsal pad or bar ⇨ off-loads metatarsal heads
- Semi-rigid plate ⇨ stable base for possible postural changes
- Standard width ⇨ shoe fit
- Forefoot extension ⇨ offers forefoot padding to replace atrophy
- Aperture sub 2nd ⇨ off-load 2nd metatarsal head
- Rear foot post flat ⇨ stable base at heel contact

Case 2

HPI: Patient is a 19-year-old female who presents with complaints of flat feet. She has occasional pain in her arch and she feels like there is a bone in her arch that is sticking out more. She is a competitive trailer runner. She has a family history of bunions and flat feet. She has not had orthoses previously. She is currently wearing a motion controlling running shoe and a rigid hiking boot.

With the ever-increasing expectations of patients and insurance companies, it is vital that our prescriptions for orthoses be efficient and effective.

Physical Examination (Pertinent positive findings): Flexible STJ range of motion; medially deviated STJ axis; no pain on ROM or palpation of STJ or talo-navicular joint

Gait: late midstance pronation

Pattern: medial column overload

Associated Pathology: Pes planus, medially deviated STJ axis

Goals: Decrease pronatory forces
Stabilize rearfoot and midfoot

Individual Factors to Consider: age, activity, family history

Orthosis Options:
- Medial skive 4-6 mm ⇨ increases supinatory forces across STJ axis
- Semi-rigid plate ⇨ stabilizes motion at STJ and MTJ
- Wide width ⇨ increases supinatory forces
- Minimal cast fill ⇨ younger, flexible feet more likely to have soft tissue adaptation ability
- Deep heel cup ⇨ increases supinatory forces
  Rear foot stability

Summary

Treatment of lower extremity pathology with orthoses is a common but somewhat complex aspect of practice. With the ever-increasing expectations of patients and insurance companies, it is vital that our prescriptions for orthoses be efficient and effective. In order to optimize orthotic resources, the practitioner can apply a stepwise approach to prescription writing founded on the principles of critical think-

Continued on page 130

Decision-Making
(from page 129)

ing. The first step is the recognition of certain patterns of biomechanical dysfunction. These patterns commonly respond to similar components within an orthosis, which we may be thought of as "options". Once the pattern is recognized, goals of treatment can be determined, and a set of options prescribed within the orthosis to address the goals. By considering the severity of the problem, the patient's lifestyle and the footgear, practitioners can then begin to develop a reproducible, effective pathway to improve quality of life for their patients and clinical outcomes for their practice. **PM**

TABLE 2:
Common Orthosis Adjustment Scenarios *(Continued)*

Pattern	Goals	In-office Adjustment Options	Possible Issues
Following orthotic break-in period, it is determined that orthoses are too aggressive in correction of medial column overload.	1) Decrease pronatory control	1) Thin orthosis plate in arch area to make more flexible 2) Add lateral wedge to distal edge of plate or rear foot post 3) Make orthosis plate narrower 4) Add heel lift	• May modify appearance of device • If top cover originally glued down, then may need to send to lab for correction in order to avoid destruction of top cover • In-office adjustment success may lead to more permanent adjustment by lab

References

[1] Richie DH. Biomechanics and clinical analysis of the adult acquired flatfoot. Clin Podiatric Med Surg 24:617-44, 2007.

[2] Turner DE, Helliwell PS, Emery P, Woodburn J. The impact of

Continued on page 131

Decision-Making *(from page 130)*

rheumatoid arthritis on foot function in the early stages of disease: a clinical case series. BMC Musculo Disord 21: 102, 2006.

[3] Turner DE, Woodburn J Characterizing the clinical and biomechanical features of severely deformed feet in rheumatoid arthritis. Gait Posture 28:574-80, 2008.

[4] Sella EJ, Barrette C. Staging of Charcot neuroarthropathy along the medial column of the foot in the diabetic patient. J Foot Ankle Surg. 38:34-40, 1999.

[5] Oddo AR. Healthcare ethics: a patient-centered decision model. J Bu Ethics 29:125-34, 2001.

Figure 4: Metatarsal bar

Figure 5: Reverse Morton's extension

[6] Paul R, Elder L. Critical Thinking: Tools for Taking Charge of Your Learning and Your Life. Pearson Prentice Hall. pg. 53-85, 2006.

[7] Kirby KA The medial skive technique: Improving pronation control in foot orthoses. J Am Pod Med Assoc 82:177-88, 1992.

[8] Ferguson H, Blake RL. Update and rationale for the inverted functional foot orthosis. Clin Podiatr Med Surg. 11:311-37, 1994.

[9] Kirby KA Subtalar joint axis location and rotational equilibrium theory of foot function. J Am Pod Med Assoc. 91:465-87, 2001.

[10] Starrett CJ. Historical review and current use of the Whitman/Robert's orthoses in biomechanical therapy. Clin Podiatric Med Surg 11:231-9, 1994.

[11] Subotnick SI. Achilles and peroneal tendon injuries in the athlete: An expert's perspective. Clin Podiatr Med Surg. 14:447-58, 1997.

[12] His WL, Kang JH, Lee XX. Optimum position of metatarsal pad in metatarsalgia for pressure relief. Am J Phys Med Rehabil. 84:514-20, 2005.

[13] Morton DJ. The Human Foot: Its Evolution, Physiology and Functional Disorders: Dorsal Hypermobility of the First Metatarsal Segment. Columbia University Press. 1948.

Dr. Choate is Associate Dean and Assistant Professor, California School of Podiatric Medicine at Samuel Merritt University.