Low Back Pain and Orthotic Support
When patients turn to Chiropractors for relief from back pain, few, if any, expect their feet to be involved. Yet in 7 out of 10 patients, postural fatigue and spinal strain are the cause of their discomfort.¹ This stress can often be traced directly to altered foot biomechanics that can lead to pelvic and spinal distortion.² Orthotic therapy is a valid component of Chiropractic care when imbalance exists in the body’s pedal foundation.

Comprised of one-quarter of the body’s bones, the feet are vulnerable to structural deficits such as malalignment of bones and connective tissues leading to excessive pronation or supination.³

The foot is constructed with 3 arches (see Fig. 1) which, when properly aligned, give exceptional supportive strength. The medial longitudinal arch (A to C) extends from the calcaneus through the first 3 metatarsals. It is the longest and highest arch and is the most important during static support, movement and shock absorption. The keystone of the medial arch is the navicular bone. The lateral arch (B to C) extends from the calcaneus through the last 2 metatarsals. It is shorter and lower than the medial arch. Its keystone is the cuboid. Subluxation of the cuboid is a common cause of lateral foot pain. The metatarsal or anterior transverse arch (A to B) is the hollow in the inner part of the sole just proximal to the tarsometatarsal articulation. Precise placement of metatarsal pads under this arch is one of the most effective treatments for metatarsalgia, the most common pain syndrome of the forefoot.⁴

Symptoms
Over the years, weightbearing radiographic guidelines have developed and can be a useful tool in formulating a diagnosis of irregular pedal biomechanics. Numerous angles of a normal lateral weightbearing foot and ankle radiograph can be considered. These angulations take into account the normal weightbearing foot should be allowed to pronate 4–6° while standing stationary, 6–8° while walking and 8–12° while running.⁵

Figure 2 illustrates several which pertain to the medial arch. Though different people’s feet—and sometimes even the right and left foot of the same person—will vary as to height and length measurements, the angulations should fall within these acceptable ranges. It must be kept in mind...
that as with any radiograph, they may demonstrate static malalignments and areas of stress but they do not reveal the dynamics of foot movement.

If the degree or duration of pronation or supination exceeds established norms, consequences can extend to the spine itself. The spine is one link in a biomechanical Kinetic Chain where alignment and/or movement at one joint influences alignment and/or movement at other joints in the chain. The bioKinetic Chain extends from the feet through the ankle, tibia, knee, femur, hip joint, pelvis and spine up through the occiput.

Patients who can benefit from orthotic therapy are not likely to complain of pain in the feet, even though the stress points in the bioKinetic Chain originate in the pedal foundation (see Fig. 3). Symptoms may be referred to structures away from the feet, such as:

- Low back pain, especially in the presence of leg length inequality
- Shin splints, leg cramps, patellafemoral disorders, hip pain
- Chronic myofascial trigger points secondary to postural distortions

The diagnosis of “lumbosacral strain/sprain” is probably used more than any other clinical diagnosis related to low back dysfunction; yet it can be difficult to authenticate by standard radiographic orthopedic and laboratory diagnostic procedures. Acute conditions are, in general, easier to diagnosis and manage. “Custom-made orthotics,” according to the Agency for Health Care Policy and Research (AHCPR) Guideline #14: “Acute Low Back Problems in Adults,” may be effective for patients with acute low back problems, especially if they stand for long periods of time.

Causes of chronic strain remain controversial; however, a typical chronic strain patient will have poor posture, poor muscle tone and is usually overweight. Lack of stability in the pedal foundation can lead to serial distortions and muscular stretching all the way up the spine. Therefore, it is imperative to check all areas of the Kinetic Chain for discrepancies. Pronation of the feet, anterior translation of the pelvis, thoracic extension and anterior cervical translation are common findings (see Fig. 4).

**Purpose of Orthotics**

Orthotic are used to align and support the foot/ankle complex in a more normal physiologic position for a weightbearing foot, to prevent dysfunction and/or improve function of movable body parts. Table 1 is a practical guide of key indicators (‘red flags’) to be considered when making your clinical decision if a patient would benefit from custom-made orthotics:

- Foot flare during gait
- Internal knee rotation
- Bowed Achilles tendon
- Flat feet
- Uneven shoe wear
Does the patient have unilateral or asymmetrical, bilateral pronation or supination? Either one may be a contributing factor in pelvic unleveling and back pain (see Table 2).

If the answer to the previous question is yes, then orthotics are indicated to:

- Create a symmetrical foundation by blocking pronation or supporting supination. An asymmetrical pedal foundation is a contributing factor in pelvic unleveling and flexible scoliosis.\textsuperscript{12–15}

- Provide heel strike shock absorption; the natural shock absorption capacity of the foot/ankle complex is reduced with either pronation or supination.\textsuperscript{16–17} Pronated feet are more susceptible to metatarsal stress fractures, whereas the tibia is more susceptible with supination.

- Inhibit serial biomechanical stress up the Kinetic Chain; the inward rotation of the foot/ankle complex, tibia and fibula is a contributing factor in frequent ankle sprains, lower leg compartment syndromes, patellofemoral dysfunction, medial knee DJD, stress fractures, iliotibial band inflammation and pelvic unleveling. Foot mechanics affect all joint complexes above, including the sacroiliac joints, up to the occiput.\textsuperscript{18–19}

- Enhance neuromuscular re-education; the sensory information from the mechanoreceptors of the foot play a major role in balance, gait, reciprocal inhibition and innervation of muscles and posture.\textsuperscript{20–22}

**Casting Orthotics**

Though there are various techniques for casting the feet for orthotics, there are only 2 basic approaches, weightbearing and non-weightbearing. But whichever method you choose to go with, it is important to remember and focus on the end result: providing the patient with properly fitting custom-made orthotics.

**Non-weightbearing casting.**

The non-weightbearing casting technique has been used for years by the podiatric profession to make hard plastic, rigid orthotics.

This approach can accommodate significant structural deformities, but several documented studies have appeared which point out inaccuracies in non-weightbearing methodologies.\textsuperscript{23–26} Accuracy is paramount, as the manufacturer must reduce the negative cast to accommodate for the normal degrees of pronation which occurs with weightbearing and increases with activity. In addition, the process of making a Plaster of Paris (CaSO\textsubscript{4}) cast is time consuming and messy.
Collectively, these drawbacks may help to explain the extremely high modification rate of orthotics created by the non-weightbearing technique: in one study, 88% of the doctors had to modify 25% of their patients’ orthotics under this process. 27

Weightbearing casting.

Weightbearing casting has also been in use for many years and the reviews have been quite good. The easiest, most accurate method is a full-weightbearing foot impression in foam, which captures a real life, position-of-function image. 28

Weightbearing measurements are more accurate to take because the examiner is not required to passively move the calcaneus, thus removing some of the potential source of error from the protocol. 26

The foam material should allow for full displacement of the soft tissues and bony structure. This will take into account the mechanism of plastic deformation, the process in which tissues subjected to constant load or stress will stretch beyond the normal elastic limit, resulting in permanent deformation. After doing the cast, it is wise to see if the impression depicts the patient’s foot (see Table 3).

Orthotic Selection and Options

The responsible practitioner will evaluate the impact of patient lifestyle, physiology and clinical condition to define the individual stress level acting on the Kinetic Chain. When orthotic therapy is indicated, XP3™ or InMotion® are recommended because their state-of-the-art, custom-made design allow them to have variable degrees of support that work with the individual’s gait cycle, lifestyle, physiology and condition (see Fig. 5).

Since most people have more than one pair of shoes, an orthotics Combo is recommended for daily support. XP3™ and InMotion® orthotics are designed to fit in any kind of shoe, from lace-ups to booties, and will cover all your patients’ bases from sports to office work.

In Summary

Recent research is revealing the effectiveness of Chiropractic care in the management of acute and chronic low back pain patients. Orthotic therapy has been shown to reduce structural strains and bring about significant clinical response. 29

Reference