Dynamic Chiropractic

ORTHOTICS & ORTHOPEADICS

# The Scientific Validation of Orthotics

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Spinal pelvic stabilizers are externally applied devices that support or enhance function. They are recommended for stabilizing joints, providing better joint positioning, reducing pain, preventing deformity and increasing function. The goal of this article is to review the literature regarding the benefits of orthotic use. This includes treatment responses, biomechanics and different aspects of foot orthotic applications in the clinical domain. Their effect on different variables of lower extremity biomechanics also will be discussed.

Epidemiologic studies on the use of orthotics report numerous successes for the treatment of foot, ankle, knee, hip, low back and other skeletal alignment problems. Foot orthotics have been used successfully to treat various lower extremity symptoms including knee pain, plantar fascitis, shin splints and iliotibial band syndrome. Additional studies confirm the use of foot orthoses to treat low back pain.[1] Orthotics with metatarsal pads have proven to be an inexpensive and effective means of reducing metatarsalgia secondary to the plantar prominence of the metatarsal heads.[2] Orthotics are required in almost all cases of chronic metatarsal and heel pain in order to institute permanent relief.[3] And according to one study, eight out of 10 athletes with sesamoid pain were treated successfully with custom-fitted orthotics.[4]

There are studies that clarify areas of medically significant points as related to orthotic use in practice. These include patient satisfaction with orthotics, effectiveness of orthoses in relieving the chief complaint, effectiveness of orthoses with overweight patients, and surgery prevention. Orthotic use has been shown to adequately relieve patients' chief complaints, especially with respect to the conditions of hallux valgus and hammer toe.

Satisfaction is high for patients receiving custom orthotics (83.1 percent according to some data). Effectiveness of orthotics for relieving the chief complaint after two weeks of use has been shown to be 29.9 percent completely resolved, 58.5 percent partially resolved and 11.6 percent unresolved. After six weeks of use, 47.9 percent of patients stated their problem was completely resolved, 47.1 percent partially resolved and 5 percent unresolved. At the 14-week interval, 62.5 percent had their chief complaint completely resolved, 32.8 percent partially resolved and 4.7 percent unresolved. It should be noted that patients with unresolved conditions suffered from osteoarthritis, diabetes and excessive body weight.[5]

Overweight patients were seen as being +5 percent of the highest normal weight recommended for age, height and sex. Of the overweight population receiving orthotics, 55.7 percent had their condition completely resolved, 35.6 percent partially resolved and 8.7 percent unresolved.[5]

In 73 of 453 cases, podiatric physicians indicated surgery was a possible treatment. After 14 weeks,

during which time their patients wore custom orthotics, the clinicians changed their minds in all but two cases. More specifically, of the 453 subjects, 66 had hallux valgus, 68 had hammer toe and 57 suffered from both conditions. Orthotics reduced or delayed the need for surgical treatment in these cases by relieving the chief complaint.[5]

Biomechanical abnormality has been widely considered as an important etiological factor predisposing running athletes to overuse injury. A decrease in arch height of the foot renders athletes more prone to lower-extremity overuse injuries. The mechanisms underlying the high incidence of running injuries are not well-established.

The successful management of many sport-related injuries by the use of orthotics, as reported in some clinical studies, has lent further support to the belief that abnormal foot positioning during the contact phase of running could influence the function of the lower extremity.

A higher risk of injury among physically active people has been reported for both low- and high-arched feet. It's common knowledge that a low-arched foot tends to be more flexible and subject to increased pronation during the contact phase of walking and running. In contrast, a high-arched foot is more rigid and places the runner at a higher risk for injury.[6]

Excessive pronation has been linked most commonly to overuse injuries including an increased incidence of shin splints, plantar fascitis and iliotibial band syndrome. The higher velocity of pronation during walking and running has been considered as another determinant factor of abnormal foot biomechanics. The proposed mechanism is that abnormal subtalar pronation associated with pes planus results in an unstable foot at the time when a rigid lever is required at toe-off, imposing a greater load on the body. Consequently, a high-arched foot structure causes hypomobility of the subtalar joint with a decrease in the ability to absorb the forces imposed on the foot.

Generally, patients with high arches underpronate and have a less flexible or even a rigid foot. Less flexibility in the foot can lead to reduced shock absorption, resulting in overuse injuries. These injuries include tibial and femoral stress fractures, Achilles tendonitis and plantar fascitis. Patients with flat or low-arched feet generally have foot hypermobility, which predisposes them to overpronation. When the foot is in a pronated and unstable position, the weight of the patient's body shifts to the medial part of the foot, putting stress on it. This could result in tibial rotation, which increases medial foot, leg and knee stress known to be associated with patellofemoral pain, popliteal tendinitis, posterior tibialis tendinitis, Achilles tendinosis, plantar fascitis and metatarsal stress fractures.[7]

In general, a satisfactory level of symptom relief from the use of orthotics has been reported in overuse injuries. Orthotic use has been reported to effectively reduce pain by 80 percent in patients with plantar fascitis. Orthotic use also has been reported to shorten injured runners' recovery time, returning them faster to fullfunction.

Orthotics have been reported to modify selected variables of lower-limb kinematic behavior during the stance phase of walking and running. Orthotics have been used to bring pronation in an injured foot closer to that of the normally aligned foot. By using orthotics, patients experience reductions in maximum pronation and calcaneal eversion. Orthotic use reduces maximum pronation velocity, as well as the time it takes to reach maximal pronation and total rearfoot motion.[8]

Results seem to indicate orthotics are effective in that they improve the alignment and movements of the subtalar joint, and ankle and knee joints, thus reducing the degree and duration of abnormal pronation. It potentially could decrease strain on the plantar ligaments and reduce abnormal rotation.

It is believed orthotic intervention influences the pattern of lower extremity movement through a combination of mechanical control and biofeedback mechanisms. It has been proposed that orthotics placed under the midfoot and forefoot might increase the afferent feedback from cutaneous receptors. This, in turn, may lead to reduced eversion due to the muscular contraction of inverting muscles.

Orthotic use seems to conform to the concept of "minimizing muscle activity," which has been proposed to explain the effect of applying inserts and orthotics in sports. A signal seems to be processed in the central nervous system to produce a dynamic response based on the participant's specific conditions. The core of the concept is the assumption the skeleton has a preferred pathway for any given movement task.

Orthotic use is an intervention that supports and facilitates this path with an outcome of decreased muscle activity and increased feelings of comfort. Stabilizing joints and minimizing soft-tissue vibration are important strategies for accomplishing this. There has been significant progress in the understanding of recommendations and benefits of orthotic use by clinical professionals.

In spite of this fact, there remains disagreement and confusion regarding the beneficial mechanisms of orthotic use. Part of this is due to a lack of controlled studies on orthotic use. There is a multifactorial etiology of injuries to the lower extremities complicated by inconsistent use of descriptive terms that often are confusing, making comparison and interpretation of literature difficult.

In conclusion, this review is intended to assist health care professionals in understanding the appropriate clinical use and benefits of including custom-made orthotics in your clinical practice procedures for the benefit of your patients.

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