

# Orthoses and Balance in the Aging Patient: A Review



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## Abstract

We tend to take our feet for granted until we are presented with some sort of foot pathology. Whether its pain, numbness/tingling, sprains/strains, or stress fractures, anything that threatens our mobility, it instantly becomes the single focus of our lives. As our age advances, the body experiences many changes. Some come on slowly and are barely noticeable until the cumulative losses result in a major problem, while others happen quickly such as in a fall.

## Introduction

Musculoskeletal, neurological, and organ system failures can affect balance, posture, perception, awareness, and gait patterns [1]. In addition to age, sex (females vs males), intrinsic causes such as body and foot type, and obesity can contribute to foot pathology [2]. Extrinsic factors such as excessive exercise, living conditions, and even improper footwear can contribute to foot pathologies [3,4]. As patients age, the number of visits to a podiatrist or other healthcare professionals that treat the foot and leg increases steadily [5]. Approximately 80% of patients over the age of 65 present with some sort of foot pathology and related impairment which affects their daily lives and physical performance. In addition, patients who have underlying systemic diseases such as diabetes, non-diabetic neuropathy, cardiovascular disease, or inflammatory disease are even at higher risks [1]. Post-menopausal women and a large group of patients that are on long term proton pump inhibitors are at great risks of osteoporosis leading to fragile and brittle bones and a higher risk of injuries. According to the National Osteoporosis foundation, 80% of the people with osteoporosis are women and 50% of women over the age 50 will break a bone due to osteoporosis [6].

In order to improve ground contact, accommodate boney prominences, and stabilize skeletal imbalances seen in the elderly, foot orthoses and shoe modifications are often the best solution for patients who are unable to compensate for changes that occur with age. Orthoses are key components of a treatment plan to reduce pain and improve ambulatory function [7,8]. Minor skeletal or neuromuscular abnormalities that are easily accommodated in the young such as over pronation produce cumulative stresses that lead to osseous and muscular pathologies. Imagine that you over pronate or supinate with every step. Over a lifetime thousands of steps can lead to secondary

osteoarthritis, bunions, hammertoes, recurrent plantar fasciitis, Achilles tendonitis, and other tendon dysfunctions. Foot and ankle orthotics designed to address problems such as over pronation can correct imbalances that lead to pathology and reduce the patient's need to compensate.

A study by Budiman-Mak, et al. [9] they found that foot orthoses may be able to prevent or slow the progression of hallux valgus deformity in patients with rheumatoid arthritis. In addition a Cochrane review concluded that although there is limited evidence on which to base clinical decisions regarding the prescription of custom-made foot orthoses for the treatment of foot pain alone, there is gold level evidence for treating painful pes cavus and silver level evidence for treating foot pain in JIA, rheumatoid arthritis, plantar fasciitis and hallux valgus.

Research and development as well as technological advancements since the 1940's have paved way for significant advancement in not only understanding how orthoses work but also how to make custom orthoses that fit the individual's needs. University of California (Berkeley and San Francisco) have conducted studies on human ambulation patterns which have become the standards in studying gait patterns as well as orthotic production [7,8]. New advances in biomechanics have helped practitioners tailor orthotic materials and designs to address the specific imbalances and abnormalities seen in the aging population, not to mention the numerous over the counter devices now available to the public.

## Foot Orthoses to Improve Balance and Postural Stability

Foot orthoses are custom made or custom fit foot shoe interfaces that allow for control of abnormal biomechanics that may be producing pain with standing and ambulation. In other words foot orthoses provide a balanced foot shoe interface that

reduces compensations made by the foot and ankle complex for abnormal positions or movements that are causing pain. The concept of restoring the foot to a neutral or “normal” position has been replaced with providing a balanced position that allows for pain free standing and ambulation. This “balanced position” will allow the foot to move and work with the rest of the body by providing appropriate pain free proprioceptive input for better posture and balance. By decreasing the amount of pressure and force on any one area of foot, orthoses allow for the redistribution of pressure across the entire plantar surface. Anytime that you have an uneven distribution of weight and pressure on a part of the body (for example in the foot); other joints that are adjacent to the abnormal functioning joint have to compensate and carry the load.

Over time these other joints also become pathological due to being overworked and overused. The foot and ankle can then be realigned to reduce compensatory positions that are producing pain with standing and ambulation. Foot orthoses have been shown to improve somatosensory input by stimulating foot plantar mechanoreceptors that reduce pain and improve posture and stability [10]. In a study conducted in by Donatelli, et al. [11] 70% of the patients treated with orthoses reported that they were able to return to normal everyday activity. Gross et al investigated the effects of foot orthoses on balance in adults age 65 or older. The study included elderly patients who have had at least one fall in the previous year [12,13]. They concluded that custom foot orthoses can indeed improve balance in both standing phase and moving phase of gait [14]. Aboutorabi A, et al. [15] evaluated the effects of foot orthoses on balance control in older adults. Their results showed that foot orthoses improve postural stability via somatosensory or biomechanical effect. Footwear alone with the proper features can be an appropriate initial intervention to address pain and reduce falls in the elderly [15]. They also are the foundation for any orthosis and therefore as important a component of the prescription as the orthotic itself. de Morais Barbosa, et al. [10] deduced that foot orthoses were effective for improving balance and for reducing pain and disability in elderly women. They also concluded that orthoses can be used as an adjuvant strategy to improve balance and to prevent falls in the elderly [16-21].

In 2018 de Morais Barbosa, et al. [10] looked at the effects of insoles on the balance in patient’s age 65+ in primary care practices. The results showed that foot orthoses were effective in improving balance and posture. Foot orthoses have historically been beneficial in alleviating patelloferomal pain and helping correct the pathology in children. Collins NJ, et al. [22] wanted to investigate and find out if anterior knee (Patellofemoral) osteoarthritis in the elderly could also be managed with orthoses. They found that foot orthoses compared to shoes alone dramatically reduced pain during walking and during step-downs [22]. In a related study, Gross and his colleagues investigated whether flat feet are a cause of knee pain and cartilage damage in older adults. They looked at 1903 patients

and concluded that those with flat feet were 1.3X more likely to have knee pain and 1.4X more likely to have cartilage damage in the medial tibiofibular part of the knee [23].

Low back pain affects approximately 80% of adults at some point of their lives. Low back pain is associated with high medical costs, work time missed, as well as long term disability [24]. Shoe orthoses can be beneficial for lower back pain. Cambron and associates looked at whether foot orthoses were beneficial in treating patients with chronic lower back pain (more than 3 months). They looked at 3 groups of patients with chronic low back pain: without treatment, with orthotics only, and with orthotics plus chiropractic treatment. Their results showed that foot orthotics without chiropractic intervention improved back pain and improved function after 6 weeks. The addition of chiropractic treatment to orthotics further improved function but no difference in pain [25]. In support of this, Castro-mendez and colleagues demonstrated that back pain can be caused by foot/ankle pathology such as subtalar joint hyper pronation. They found that foot orthotics is a good short term solution for resolving low back pain [26].

### Conclusion

As we age it is important that we take good care of our bodies. Eating healthy, exercising, and keeping our mind sharp becomes more important than ever. Although changes in life style and habits are beneficial to our overall health, we cannot forget to take care of our feet; after all it is our feet that keep us moving. One of the many ways that we can take care of our feet is to make sure that we optimize function by using proper footwear and if needed foot orthoses. Orthoses help to preserve structural and functional attributes of the neuromusculoskeletal system as well as being one of the best conservative treatments for addressing existing foot pathologies and in many cases augmenting other available treatments.

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