

Key Points

- Sports orthoses may facilitate balance in subjects with ankle instability.
- Balance is unlikely to be compromised in able-bodied subjects wearing sports orthoses as a prophylactic measure.
- Performance on balance tasks is dependent upon AFO design.
- Rigid AFOs can facilitate static balance but are likely to compromise dynamic balance.
- Leaf-spring orthoses can facilitate both static and dynamic balance in certain populations.

Scope of Review

This Evidence Note summarizes the effects that AFOs have on balance as reported in peer-reviewed studies. AFOs studied can be divided into two groups:

1. Sports orthoses—any device providing external support to the ankle to prevent injury or stabilize the joint after an isolated injury.
2. Ambulatory orthoses—devices intended for individuals with pathological conditions requiring an AFO to influence alignment, improve posture, or compensate for a neuromuscular deficiency.

This Evidence Note considered published research only if it described subjects fitted with an AFO and utilized a clinical- or laboratory-based balance measure as an independent variable.

Balance Theory

Balance is a complex skill necessary to maintain the body's center of gravity (COG) within the base of support while stationary (static balance), and to control the center of mass in dynamic situations, such as walking or when subject to a destabilizing event (dynamic balance). Recent theories suggest that to maintain balance, a multi-system approach be used that involves a combination of cognitive, motor, cerebellar, vestibular, and proprioceptive systems.¹⁻³ The relative contribution of each of these systems in maintaining balance is context dependent and also influenced by age and pathol-

ogy.³ One of the most important biomechanical constraints on balance is the base of support and the ability to move the center of mass with respect to this base of support (limits of stability).² Limitations to joint range of motion (ROM), muscle strength, and sensory input can all significantly affect stability limits.

Summary of the Evidence

A single systematic review describing the effects of AFOs on balance formed the basis of this Evidence Note.⁴ This systematic review was part of the tenth State of the Science Conference of the American Academy of Orthotists and Prosthetists (the Academy), and summarized research from 37 research articles, of which 18 related to sports orthoses and 19 related to ambulatory orthoses.

Orthoses for Sporting Applications

The major goal of orthoses designed for sporting applications is to provide mechanical support for the ankle-joint complex. There is also some suggestion that circumferential pressure applied by orthoses can facilitate balance by improving proprioceptive input. The majority of research addressing the influence of sports orthoses on balance utilized either lace-up and/or semi-rigid off-the-shelf designs and these designs seemed to perform similarly.

Studies utilizing able-bodied subjects were most common⁵⁻¹¹

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use of an orthosis to facilitate proprioception and subsequently enhance balance.^{5,9} Unfortunately, study design limitations in both papers preclude any conclusive statements.

Ambulatory Orthoses

There is low to moderate evidence suggesting that performance on certain balance-related outcome measures is dependent upon the specific biomechanical design of the AFO. Of particular interest is that use of rigid orthoses tended to result in either no change or in improvement of performance on static balance tests; however, their use was associated with a deterioration in performance under dynamic test conditions for persons with gait abnormalities.^{17,18} Results from several studies suggest with a high level of confidence that leaf-spring orthoses may have positive effects on balance in adults with stroke-induced hemiplegia.¹⁸⁻²¹ Results about the use of supramalleolar orthoses suggested with a moderate level of confidence that they can enhance balance for children diagnosed with cerebral palsy.²²⁻²⁴



and indicate that sports orthoses are unlikely to compromise balance in this population. A smaller number of studies have been conducted on persons with diagnosed ankle instability.¹²⁻¹⁶ The results suggest with a moderate level of confidence that sports orthoses can facilitate balance in this cohort. Two papers were identified that specifically addressed the

General Comments and Future Research

This Evidence Note focuses solely on studies utilizing outcome measures of balance. No consideration has been given to other variables that may be affected by the use of an AFO (e.g., gait mechanics). Balance is just one factor that should be considered by clinicians when prescribing an AFO, and findings reported in this Evidence Note must be weighed against other potential benefits or disadvantages associated with the use of an orthosis.

Additional research is needed to investigate the relative effects that AFOs have on proprioception, the relationship between proprioception and balance, and the impact of AFO design on balance. It is important to recognize that performance on balance-related outcome measures may be dependent not only on orthotic design but also on the subject group selected for study. To generate appropriate prescription criteria, a wide variety of patient diagnostic groups must be investigated.

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