

# AAOP State-of-the-Science Evidence Report: The Effect of Ankle-Foot Orthoses on Balance—A Systematic Review

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## ABSTRACT

Ankle-foot orthoses (AFOs) are typically designed to limit the motion of the ankle joint in one or more planes. Given that balance may be compromised when joint range of motion is restricted, an understanding of the relative effects of AFOs on balance performance is clinically relevant. The aim of this systematic review was to evaluate existing evidence related to the effects of AFOs on static and dynamic balance. A search of appropriate medical databases was conducted, and 37 articles were found to satisfy predetermined inclusion criteria. Articles were categorized under two main areas: those investigating the use of AFOs designed for sporting applications (sports orthoses, 18 studies) and those investigating orthoses that are intended to facilitate ambulation in subjects with locomotor disorders (ambulatory orthoses, 19 studies). Combined results suggest that sports orthoses may facilitate certain aspects of balance in subjects with ankle instability and that balance is unlikely to be compromised when able-bodied subjects wear AFOs as a prophylactic measure. No evidence exists to suggest that any one design of sports orthosis is superior to another in terms of performance on balance measures. Results of studies involving ambulatory orthoses indicated that their effects on balance were largely dependent on the design characteristics of the orthosis used. Rigid AFOs seemed to facilitate static balance tasks, although the level of confidence in this outcome was relatively low. Under dynamic conditions, rigid AFOs seemed to compromise balance for the tested populations; confidence in this outcome was rated as moderate. A high level of confidence was ascribed to the statement that leaf spring AFOs, which allow controlled motion in the sagittal plane, seemed to facilitate both static and dynamic balance in the studied cohorts. (*J Prosthet Orthot.* 2010;22:P4–P23.)

**KEY INDEXING TERMS:** ankle-foot orthoses, balance, postural control

Ankle-foot orthoses (AFOs) are commonly prescribed for pathological conditions affecting joint stability, positioning, pressure distribution, and neuromuscular insufficiencies. They have been demonstrated to affect numerous gait parameters including temporospatial variables,<sup>1,2</sup> joint kinematics and kinetics,<sup>3,4</sup> and energetics.<sup>5–7</sup> Given that AFOs, by design, limit the motion of the ankle joint in one or more planes of motion, an understanding of the relative effects that they may have on balance is of clinical importance. The aim of this article is to systematically review literature related to AFOs and the relative effects they may have on static and dynamic balance.

## BACKGROUND

For the purposes of this review, an AFO is defined as “an orthosis which encompasses the ankle joint and the whole or part of the foot” (ISO 8549-3:1989). Based on this definition, the term AFO encompasses a wide range of devices of varying

construction and design. These range from flexible elastic supports to rigid plastic or carbon fiber designs.

AFOs are often used in the management of various pathological conditions that affect normal functioning of the ankle joint complex. Such conditions include stroke, cerebral palsy, multiple sclerosis, rheumatoid arthritis, and both functional and mechanical ankle instabilities. They are also widely used by athletes as a prophylactic measure to avoid ankle injuries or to stabilize the ankle joint after an isolated injury. In this review, the authors make the distinction between articles investigating sports orthoses and those investigating orthoses that are required to facilitate ambulation because of an underlying pathological condition (ambulatory orthoses).

For the purposes of this review, sports orthoses are classified as any device that provides external support to the ankle with the aim of stabilizing the joint after an isolated injury or with the aim of preventing injury. The mechanism by which this is achieved can be mechanical (i.e., the orthosis is designed to enhance stability) and/or neurophysiological (i.e., the orthosis is designed to enhance proprioceptive feedback). AFOs for sporting applications are typically designed as variations of three general constructions with increasing stiffness; elastic supports, lace-up canvas orthoses, or semi rigid orthoses.

When patients have a pathological condition and the major function of the AFO is to influence joint alignments, improve posture, or compensate for neurological deficiencies, the authors choose to group the orthoses under the term ambulatory orthoses. Numerous orthotic designs can be categorized under this heading. Designs most commonly described in literature are presented below:

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