Prevalence of Balance Compromise in Commonly Treated Patient Populations: An Introduction to the Academy's State of the Science Conference on the Effects of Ankle-Foot Orthoses on Balance

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ABSTRACT

*Balance compromise is frequently encountered among those patient populations commonly treated with ankle-foot orthoses. While this compromise can be measured and quantified using laboratory techniques and clinically accepted outcome measures, it also can be appreciated by considering such things as fall rates, associated injuries, balance confidence and activity limitation. The impact of these variables on the patient populations of stroke, acquired brain injury, incomplete spinal cord injury, multiple sclerosis, post-polio and peripheral neuropathy are briefly considered. An overview of the manuscripts included in the conference proceedings is presented. (*J Prosthet Orthot. *2010;22:P1–P3.)*

The ultimate value of any discussions of the possible effects of ankle-foot orthoses (AFOs) on balance is predicated on a full appreciation of the balance compromise that exists within many of the patient populations commonly treated with this modality. Balance deficiencies can be observed in several ways. In addition to quantifiable laboratory parameters and clinical outcome measures, the more immediate effects of balance compromise are observed in stumble and fall rates, reports of reduced confidence and the fear of falling, activity restriction, and decreased societal participation. As the magnitude of these deficits is more fully appreciated, the importance of balance considerations in the provision of AFOs becomes clearer.

For example, during the acute inpatient phase of stroke recovery, 10% to 47% of stroke survivors will experience a fall.[1] Among community-dwelling patients with chronic stroke, 43% to 70% will have fallen in the first year with fall rates ranging from 1.4 to 5.0 falls per person per year.[1] The fear of falling is reported among 88% of these "fallers"[2] with nearly half of these subsequently restricting their activity.[3]

In a recent survey of individuals recovering from acquired brain injury, 54% reported having experienced at least one fall in the past 6 months including 25% who reported a fall-related injury.[4] (In both cases, reports were corroborated by treating staff and therapists.) Reports of feeling unsteady during standing and walking were recorded at 42% and 33%, respectively.[4] Even among community-dwelling subjects with traumatic brain injury, all of whom had unremarkable neuromuscular examinations, survey data found relative compromise to balance-related physical performance, emotional well-being, and task-specific functional abilities relative to matched controls.[5]

Among a cohort of ambulatory patients with incomplete spinal cord injury, 75% reported having experienced at least one fall in the past year including 18% who experienced a fall-related fracture.[6] Nearly half of the study participants reported that fall-related injuries restricted their ability to get out into the community and engage in productive activity.6 Similar fall and injury rates in this population have been corroborated by a later, unrelated prospective publication.[7] Survey data suggest that among middle-aged and older adults with multiple sclerosis, over half have reported an injurious fall and 64% reported experiencing at least two falls per year.[8] Sixty-four percent report a fear of falling, almost all of whom report an associated curtailment of activity.[9]

In a recent survey of patients with postpolio, 64% reported at least one fall in the past year, 61% reported experiencing a fall that required medical attention, and 35% had sustained at least one fall-related fracture.[10] A second, unrelated survey found that 61% of respondents with postpolio reported a fear of falling with significant decreases in activity observed among fallers relative to activity rates observed among "nonfallers."[11]

In a prospective analysis of older adults with peripheral neuropathy, 65% experienced at least one fall during the 1-year observation period and 30% sustained a fall-related injury.[12] In an unrelated survey of adults with diabetes mellitus, 35% reported at least one fall during the previous year with peripheral neuropathy present in 86% of these fallers. Reduced strength of ankle dorsiflexors and reduced gait velocity were strong predictors of these fallers.[13]

Given these collective observations, the importance of balance as a core consideration in the management of patients who will wear an AFO cannot be overstated. The so-called ankle strategy is of seminal importance in any discussion on human balance. By crossing the ankle joint and affecting the resultant joint kinematics, kinetics, and proprioceptive inputs, AFOs, by their very nature, will have positive and/or negative affects on balance across a host of activities and tasks.

In the best case scenarios, AFOs can compensate for existing balance deficits, reducing fall risks, improving confidence, and facilitating greater activity and participation. However, AFOs also have the potential to further compromise balance with the undesirable sequalae of possible falls and related injury, an increased fear of falling, and subsequent activity restriction.

To this end, the American Academy of Orthotitsts and Prosthetists hosted a State-of-the-Science Conference on the Effect of Ankle-Foot Orthoses on Balance in which a multidisciplinary, international team of orthotists, therapists, and biomechanists from clinical, educational, and research environments convened to discuss this very relevant topic.

The cornerstone of the proceedings is the systematic evidence review in which the authors have synthesized the findings of available literature as it pertains to AFOs and balance across a range of patient presentations and device characteristics. The review examines the literature according to broad categories of AFO design and their respective effects on both static and dynamic balance activities.

Following the review is a very relevant discussion on clinical considerations in the provision of AFOs as they pertain to questions of balance. Topics included in this discussion are assessing the relative priority of different task domains for individual patients, awareness and management of the center of mass through the AFO interface, assessment and consideration of fatigue and its effects on safety and balance, the role of the

area-of-contact of the distal limb segments as they relate to enhancing a subject's base of support, and the optimization of performance across activities outside of normalized walking.

The next section is devoted to enhance our current understanding of the possible effects of AFOs on lower-limb proprioception in the presence of sensory compromise. This allows for further considerations of the various mechanisms by which AFOs may impact the core components of human balance and balance recovery.

Although the primary aim of the conference was to synthesize the available knowledge from the literature and inform clinical decision making, it was also intended to guide future research efforts. To this end, two complimentary sessions were held to discuss the topic of balance assessment in both the clinic and laboratory environments, respectively. The content of these articles can facilitate a deeper appreciation of the evidence review as they discuss several of the assessment techniques that were cited from original AFOrelated balance research. The document on clinical balance assessment also provides clinicians with recommendations on how to better assess and monitor the impact of AFO interventions on balance. The document on laboratory balance assessment helps to define what information can be derived from this environment and leads naturally to the concluding section on research recommendations.

In this final section, the authors attempt to synthesize the group recommendations that were derived during the course of the conference as they pertain to the ongoing need for future research in this area. In this conversation, consideration is given to both static and dynamic balance assessment across a range of daily tasks where balance is a relevant concern. The impacts of AFO design considerations and patient presentation characteristics are also discussed. Also included is a conversation on the need to use a broad selection of outcome measures to inform on balance characteristics and the impacts of balance compromise and restoration on factors such as confidence, fear of falling, and activity levels. Thus, the conference proceedings represent a comprehensive consideration of the possible effects, both positive and negative, that AFOs may have on balance

Balance compromise is frequently encountered among those patient populations commonly treated with ankle-foot orthoses. While this compromise can be measured and quantified using laboratory techniques and clinically accepted outcome measures, it also can be appreciated by considering such things as fall rates, associated injuries, balance confidence and activity limitation. The impact of these variables on the patient populations of stroke, acquired brain injury, incomplete spinal cord injury, multiple sclerosis, post-polio and peripheral neuropathy are briefly considered. An overview of the manuscripts included in the conference proceedings is presented.

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