Summary from the Academy's Seventh State-of-the-Science Conference on Knee-Ankle-Foot Orthoses for Ambulation

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ABSTRACT

This article summarizes the results from deliberations by an international multidisciplinary group of experts convened by the American Academy of Orthotists and Prosthetists to review the State-of-the-Science regarding use of custom-made knee-ankle-foot orthoses (KAFOs) to assist in ambulation. Based on a comprehensive review of peer-reviewed literature from the past decade, only four articles on this topic were identified as controlled trials, with only three investigating the use of KAFOs by clinical populations. The participants concluded that there is currently no substantive evidence at the highest level of scientific certainty regarding the use of KAFOs and hip-knee-ankle-foot orthoses (HKAFOs) for ambulation, but there are a number of core assumptions supported by expert opinion and peer-reviewed publications that can be considered clinical hypotheses about these orthoses. These rehabilitation beliefs can and should be tested in future research applications. Six primary research priorities and associated implications were identified. The panelists concluded that scientific research into these questions would significantly advance our understanding about the optimal application of KAFOs and HKAFOs to assist in ambulation.

KEY INDEXING TERMS: ambulation, hip-knee-ankle-foot orthosis, HKFAO, KAFO, knee-ankle-foot orthosis, lower limb orthoses

This State-of-the-Science Conference was convened to examine the body of peer-reviewed evidence related to the use of knee-ankle-foot orthoses (KAFOs) to assist in ambulation. The goal was to establish what is known, what is believed to be true, and what needs to be known to optimize the application of these orthoses. Evidence reviewed was based on both unilateral and bilateral KAFOs, including those incorporated into more extensive lower limb orthoses such as hip-knee-ankle-foot orthoses (HKAFOs) and the various reciprocating gait orthoses (RGOs). Prefabricated items intended to be worn for less than one year were excluded from this review, as were orthoses not used primarily to enhance ambulation, such as fracture braces and postoperative immobilization devices.

BACKGROUND

Although KAFOs have been prescribed long-term to treat a broad range of physical disabilities for many centuries, their use has rarely been the subject of controlled studies. Retrospective reviews have suggested that the long-term use rate of KAFOs is significantly lower than that for ankle-foot orthoses (AFOs), although the reasons for this disparity are not well established and vary among different diagnostic cohorts.

Energy efficiency studies have repeatedly shown that immobilizing the knee markedly increases the energy requirements for ambulation in normal subjects, and there is some evidence that this is also true for certain individuals with physical disabilities.[1] Recent technical advances have resulted in the availability of stance control knee joints that provide stability under weight bearing while allowing knee flexion in swing, which has the potential to eliminate the historic requirements for a stiff-knee gait when walking with a KAFO.

This new biomechanical class of KAFOs (which can also be incorporated into HKAFOs) appears to be more broadly applicable than the traditional locked knee devices and might result in more frequent prescription of KAFOs in the future. Many of the conclusions in the current literature are based on the assumption that use of a KAFO implied that the knee was locked in extension throughout the entire gait cycle, including swing phase. The increasing usage of stance control technology raises questions about the validity of many long-held beliefs about these orthoses and about the applicability of the results from studies based on earlier KAFO designs.

The multidisciplinary group of experts who convened in Chicago, February 11–12, 2006, prepared individual papers on assigned topics that were presented and discussed in the course of deliberations to collectively answer four key questions:

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