Author
McGrath, Mike (Basingstoke UK) | PhD
Blatchford - NPD

Title
Patient reported outcomes with a novel microprocessor-controlled knee-ankle-foot-orthosis

Coauthors
Bennett N, Duke C, Walaszek P, Zahedi S, Moser D

Summary
After assessing their habitual KAFO prescription with Patient-Reported Outcome Measures (PROMs), patients were fitted with a novel microprocessor-controlled Knee-Ankle-Foot-Orthosis (MPKAFO). After at least four weeks of regular use, patients reported improved mobility and reduced pain.

Introduction
While microprocessor-control has advanced prosthetic technology since the early 1990s, its translation to orthotics is much more recent. Conventional KAFOs will be “locked” at the knee during swing phase and “free” during swing, or locked throughout the whole gait cycle [1]. These approaches can create unnatural biomechanics [2], which could lead to mobility restrictions, safety issues and long-term health problems [3].
A novel MPKAFO has been developed to address these issues. By varying the hydraulic resistance to knee flexion, the device provides variable levels of body-weight support for different activities of daily living (ADLs) such as walking, descending stairs and sitting down. This study describes differences in patient outcomes when transitioning to this advanced orthosis.

Methods
A cohort of nine persons with lower limb deficiencies agreed to participate in the study. At the initial assessment, they were asked to provide informed consent and complete PROM questionnaires with respect to their current, habitual prescription. After, they were fitted with the MPKAFO, which was calibrated to their specific preferences by a qualified orthotist. The participants were asked to use the device as their regular, everyday KAFO for a period of at

least four weeks, before completing the same PROMs again, with respect to their experiences with the new device.

The chosen PROMs were the mobility and pain sub-sections of the Orthosis Evaluation Questionnaire (OEQ); an adapted version of the Prosthesis Evaluation Questionnaire [4] for which there is precedence in other research of microprocessor-controlled orthoses [5]. Other individual questions were selected, which related to frequency of stumbles and falls, quality-of-life and satisfaction.

Results

Substantial improvements were observed in each area of analysis. The mean score of the mobility sub-section showed a large effect size increase (Cohen's d>0.8), mainly due to improvements in the Ambulation subscale, which asks about the ability to walk and navigate environmental barriers such as slopes and stairs. This change was reflected by the patients' satisfaction with how they walked.

In terms of pain, the most common type was in the affected limb, followed by back pain and finally pain in the contralateral limb. Prior to using the MPKAFO, the most common description of pain was "moderate", while after MPKAFO use, this changed to "slight". The visual analogue scale ratings highlighted that this change was related to the frequency of pain, rather than simply intensity. Before MPKAFO use, most patients reported pain "several times a day", while after this became "2-3 times a week".

Conclusion

The use of advanced technology can bring quality-of-life improvements to people with lower limb deficiencies in much the same way that it does for lower limb prosthesis users. Improvements in patient mobility capabilities can help reintegrate patients into normal living, while reductions in pain indicate long-term health improvements. These findings were apparent after four weeks of use; it is possible that more long-term use could further improve patient outcomes.

References

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