Difficulty and Safety of Performing Activities of Daily Living with Two Different Microprocessor Controlled Prosthetic Knee Joints

Kannenberg A*, Zacharias B*, Bellmann M**

* Dept. Medical Affairs, **Dept. of Research, Otto Bock HealthCare, Duderstadt, Germany;

INTRODUCTION

Previous research has shown that clear biomechanical differences exist between the different microprocessor (MP) controlled prosthetic knees available on the market (1). However, it remains unclear whether these biomechanical differences translate into differences in benefits in the patient´s everyday life. The purpose of this study was to investigate differences in perceived difficulty and safety while performing activities of daily living (ADL) with two different MP controlled prosthetic knees.

METHOD

A convenience sample of 10 unilateral transfemoral amputees (all male; mean age 36.2±10.2 years; mean time since amputation 12.5±9.6 yrs; 5 patients MFCL-3, 5 patients MFCL-4; 9 traumatic, one cancer related amputation) who gave informed consent and had been using a C-leg for 5.4±2.0 years on average were enrolled to this study. They answered a questionnaire on the importance and difficulty to perform 45 ADLs with their C-leg prosthesis. Importance had to be rated “very important” (3 points.), “somewhat important” (2) or “not important” (1). Difficulty had to be rated “very easy” (6 points), “easy” (5), “somewhat easy” (4), “somewhat difficult” (3), “difficult” (2) or “very difficult” (1). Patients were then fitted a prosthesis with the Genium® Bionic Prosthetic System (Otto Bock HealthCare, Duderstadt, Germany), underwent an one day gait training and used the intervention prosthesis in their home environment for 3 months. Then they answered the same ADL questionnaire as well as a questionnaire that directly compared the perceived difficulty and safety of the 45 ADLs with both prosthetic knees. In the comparative questionnaire, difficulty and safety had to be rated “much better/safer with C-leg” (-2 points), “better/safer with C-leg” (-1), “no difference between joints” (0), “better/safer with Genium” (+1), much better/safer with Genium” (+2). Statistical analysis was conducted using the Wilcoxon signed rank test with $p<.05$ and a power of 80%.

RESULTS

The mean importance rating of the 45 ADLs was 2.58±.64 with the C-leg and 2.59±.63 with the Genium, respectively. Thus it can be assumed that the questionnaire had covered a set of ADLs that the patients perceived as very important and can make a difference to their everyday lives.

In the separate ratings of either knee joint a significant reduction ($p<.05$) of perceived difficulty by the Genium was found in five ADLs: walking up and down stairs, walking up and down inclines, walking backwards.

In the comparative survey, a difference of group average values for each ADL of 25% (i.e. +/-.5 points) or more of the maximum possible change (i.e. +/-2 points) was considered clinically significant. Statistical testing could not be done as there was only one rating each for perceived comparative difficulty and safety with both knee joints. None of the 45 ADLs was perceived safer or less difficult if performed with the C-leg. 28 ADLs were perceived safer and 24 ADLs were perceived less difficult when using the Genium as compared to the C-leg. There was a trend towards more perceived safety and less difficulty when using the Genium in the other 17 and 21 ADLs, respectively, that did not reach the predefined threshold for clinical significance of .5 points group average rating.

DISCUSSION

Technological and biomechanical differences between microprocessor controlled prosthetic knee joints may result in differences in perceived difficulty and safety when performing activities of daily living (ADL). Although the patient´s perception may not necessarily be confirmed by objective measurements of performance and safety, it may prevent the patient from performing an activity if it is perceived too difficult or too unsafe. Similarly, the fear of falling is directly correlated to activity avoidance independent of the actual objective risk of falling (2-5). Therefore, increased perceived safety and decreased perceived difficulty of a set of ADLs rated important for the amputees´ everyday life by use of the Genium Bionic Prosthetic System may improve function, independence, and participation of the patients.

CONCLUSION

This study has demonstrated that the Genium Bionic Prosthetic System may further improve perceived difficulty and safety of important ADLs in experienced C-leg users.

REFERENCES

1. Bellmann M: Arch Phys Med Rehabil 2010,91:644-652
2. Bertera EM, et al. Health Soc Work 2008;33:54-62.
3. Fletcher PC, et al. Age Ageing 2004;33:273-9.
4. Miller WC.: Arch Phys Med Rehabil 2001;82:1238-44
5. Delbaere K, et al. Age Ageing 2004;33:368-73.

American Academy of Orthotists & Prosthetists
38th Academy Annual Meeting and Scientific Symposium
March 21-24, 2012