Function and Walking Capabilities of Hip Disarticulation Amputees with the Helix^{3D} Prosthetic Hip Joint.

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INTRODUCTION

Prosthesis rejection is a common phenomenon after hip disarticulation (HD) and hemipelvectomy (HP). Main reasons are low walking speed and dependence on walking aids. Physical therapy, component selection, and enhanced comfort of the pelvic socket increase the acceptance of a prosthesis. Thus far, the benefits of new prosthetic hip components have been shown in case reports only. Therefore, the aim of this study was to evaluate changes in walking capabilities, function, and independence by use of the Helix^{3D} prosthetic hip joint.

METHOD

Thirteen HD-amputees and three HP-amputees were enrolled and gave informed consent to participate. They underwent a baseline interview that contained the Locomotor Capabilities Index (LCI-5) (1) as well as a set of 6 activities of daily living that are considered explicitly challenging to HD and HP amputees. These activities were evaluated using the rating scale of the LCI-5. Moreover, clinical mobility tests such as the validated 10 m walk test and the time to complete a stairwell of 8 steps and an 11° grade 7 m slope were conducted. After the interview and tests with their existing prosthesis the participants were fitted a new prosthesis with the Helix^{3D} hip joint and a C-Leg. The pelvic socket was made and the prosthesis aligned according to the instructions of the manufacturer. After a mean acclimation period of 11±6 (mean ± SD) weeks, the subjects underwent the same interview and tests. Statistical analysis was conducted using the Wilcoxon signed rank test with $p<.05$ and a power of 80%.

RESULTS

13 subjects (1 MFCL-1, 7 MFCL-2, 5 MFCL-3) with a mean age of 44±17 years completed the survey part of this study, whereas only 10 subjects completed the clinical tests with both prostheses. Significant improvements by use of the new hip prosthesis were demonstrated for the Locomotor Capabilities Index-5 ($p=0.003$) and the activities explicitly challenging to HD and HP amputees ($p=0.008$). The time required for walking down a defined ramp and staircase was also significantly reduced with the new prosthesis ($p=.009$ and $p=.011$, respectively).

DISCUSSION

The primary target criterion of this study was the LCI-5. Unfortunately, the present results cannot be compared with others in the literature as comparable studies in subjects with pelvic socket prostheses are not available. The basic ambulation skills of the LCI-5 could be performed almost equally well with either hip prostheses as they consist of activities that are typically done by patients with lower mobility levels similar to those enrolled in this study who demonstrated a median MFCL-2 mobility grade with their previous prosthesis. The results for the advanced ambulation skills and ambulation skills that were considered explicitly challenging to this amputee group, however, showed a significant improvement with the Helix^{3D}. This may be explained by the hydraulically controlled swing phase dampening of the Helix^{3D} Hip Joint that provided for a constant step length of the prosthetic leg which has been proven highly effective for amputees (2). Moreover, the Helix^{3D} Hip Joint supports the swing phase by means of integrated polyurethane (PU) elements (2, 3) that facilitate walking on uneven ground while minimizing necessary visual control.

Some of the improvements found may in part also be attributed to the additional function provided by the C-Leg which, at the time of this study, was the only prosthetic knee approved for use with Helix^{3D} by the manufacturer (3). That is especially likely for activities requiring knee flexion in the weight bearing condition such as reciprocal gait when walking downstairs and sitting down with weight on both legs.

CONCLUSION

The new prosthetic hip joint system improved mobility and independence of subjects with hip disarticulation and hemipelvectomy.

CLINICAL APPLICATIONS

Hip disarticulation and hemipelvectomy amputees may benefit from the hydraulic control of the Helix^{3D} Hip Joint System in terms of mobility and independence which may result in improved acceptance of pelvic prostheses.

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