GAIT COMPARISON OF A PERSON WITH AN OSSEOINTEGRATED PROSTHESIS AND AN ABLE- BODIED PERSON

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INTRODUCTION

Within lower limb prosthetics, the socket is responsible for linking the patient and his/her componentry to the ground. Various configurations of the socket have been developed for the transfemoral amputee with the hope of accomplishing a reduction in energy expenditure (Gailey et al., 1993), an improvement in function and stability, and a positive report of comfort and cosmesis (Schuch and Pritham, 1999). The late twentieth century saw the advent of connecting the patient directly to the prosthesis, thus bypassing the socket with osseointegrated prosthesis.

Osseointegration is a two-stage surgical process involving the use of titanium implants to anchor the prosthesis to the patient's residual femur. This procedure is generally considered after the patient has had little success in achieving rehabilitation with conventional sockets (Sullivan et al., 2003). This study was designed to analyze the gait and satisfaction of a patient currently using an osseointegrated prosthesis.

METHOD

Subjects: One male with a unilateral transfemoral amputation with osseointegration; age: 27, height: 5'9", weight: 205 lbs, time with amputation: 6yrs, and time with osseointegration: 1yr, 3 mon. One able-bodied male; age: 23, height: 6'4", and weight: 178lbs.

Apparatus: The subject's prosthetic componentry consisted of a transverse rotation unit, an Ottobock Genium X3 knee, and an Ottobock Triton foot.

Procedures: The participant walked on an instrumented dual belt treadmill at 1.2 m/s [Gait Real-time Analysis and Interactive Laboratory (GRAIL) from Motek Medical Inc.]. Kinematic data was recorded with a twelve camera motion capture system (100Hz) and ground reaction force data (1000Hz) was collected simultaneously. The participant then filled out the Prosthesis Evaluation Questionnaire (PEQ).

Data Analysis: Gait data was analyzed with the Gait Offline Analysis Tool (Motek Medical Inc.) then exported to Matlab to time normalize ten strides to 100 data points and compile for statistical analysis. A two tailed t- test was completed to ascertain if there is a significant difference ($p<0.05$) between the gait of an able-bodied person and a person with an osseointegrated prosthesis.

RESULTS

No significant statistical difference was found between the subject with osseointegration and the able-bodied subject regarding hip power ($p=0.161$) during the loading response and midstance of the gait cycle (12-31%). Results from the PEQ indicated a generally positive response to osseointegration, seen in Table1.

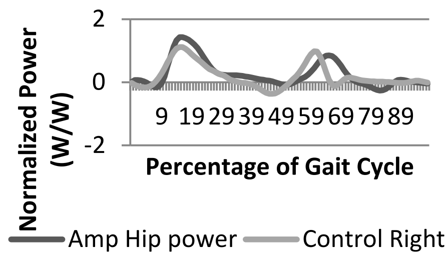

Figure 1. The hip power measured by the GRAIL throughout the patient's gait cycle

Category	Score
Ambulation	83.375
Appearance	100
Frustration	100
Perceived Response	100
Residual Limb Health	100

Table 1. PEQ Scale Scores

DISCUSSION

A normalized comparison of the data was done to determine if any significant differences caused by the prosthesis, with hip power being used as an indicator of amputee energy expenditure. The PEQ was performed to provide a measureable form of subjective feedback.

CONCLUSION

Data suggests the subject with osseointegration can produce similar hip power to an able-bodied person. This Along with the positive PEQ response, makes osseointegration a viable prosthetic interface. Future studies should incorporate gait of a subject who uses a prosthesis with a socket.

CLINICAL APPLICATIONS

This data will provide more information to assist in critical decisions regarding osseointegration.

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