INTRODUCTION

The role of microprocessor regulated knee joints in amputee rehabilitation has been extensively studied. Knee units which utilize microprocessors to regulate both swing and stance phase characteristics have been associated with improvements in energy efficiency (Seymour, 2007), decreased stumbles and falls (Hafner, 2007) improved balance (Kaufman, 2007) increased walking velocities, increased activity levels (Kaufman, 2008) and higher reported scores across quality of life indicators (Seymour, 2007; Hafner 2007). While the functional value of microprocessor regulated knee mechanisms has been well established, very little comparative analysis has been done between the microprocessor knees of different manufacturers (Johansson, 2005).

METHOD

Subject: 30 y/o male, long left transfemoral amputation of 26 years. Medicare K4 level ambulator who jogs daily for exercise. Experienced in the use of the Otto Bock C-leg (12 months) and Plie 2.0 (4 months).

Apparatus: Six minute walk test, Borg’s perceived exertion scale.

Procedures: 6 minute walk test performed with C-leg and Axion foot in a level parking lot followed by administration of the perceived exertion scale. Ten minute rest period as the socket was maintained while Plie 2.0 and Renegade foot were installed. Six minute walk test was repeated, followed by a second iteration of the Borg.

RESULTS

The subject walked equivalent distances and reported identical perceived exertion values in each of the two prosthetic systems, with distances of 463 meters and 457 meters observed in the C-leg and Plie system respectively.

DISCUSSION

By comparison, Gailey et al observed six minute walk test values for a cohort of K4 level ambulators at both transtibial and transfemoral levels, reporting a mean performance value of 412 meters (2002). Thus, the case subject in question was able to perform the timed walking test at comparatively higher velocities with both of the microprocessor regulated knee systems.

In an attempt to ensure that any bias due to fatigue favored the more conventionally utilized technology, the Plie 2.0 assessment was intentionally conducted following the C-leg assessment. Despite this potential bias, the Plie 2.0 facilitated comparable velocity and energy consumption values.

There are several limitations to the conclusions that can be drawn from this preliminary data. While the six minute walk test is a well validated outcome instrument in rehabilitation, it is limited to an assessment of a patient’s self-selected walking speed and does not measure any differences at faster velocities. The subject in question has often described the Plie 2.0 as being the “more dynamic” prosthetic knee joint. Therefore, assessments of energy expenditure at higher velocities may better distinguish between the performance capabilities associated with the two knee joints. Additionally, the case subject has consistently commented on the lighter weight of the Plie 2.0 prosthetic system. Because of the case subject’s high physical activity level, differences in the weight of the two prosthetic systems and the associated effects on energy consumption might be better observed with more physically demanding protocols.

CONCLUSION

The pilot data collected suggests that the Plie 2.0 microprocessor regulated knee joint facilitates gait velocity and energy expenditure comparable to those observed with more established C-leg. These equivalent performance values were observed in spite of study protocols that seemed to favor the C-leg test condition. During the assessments, the Plie 2.0 with the Renegade prosthetic foot was described as both lighter and more dynamic than the subject’s previous prosthesis. These qualities are likely a combination of comparative differences in both the knee and foot components of the newer prosthesis.

REFERENCES


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