COMPARISON BETWEEN A NOVEL MAGNETIC LOCKING INTERFACE AND A PIN LOCKING SYSTEM FOR SUSPENSION OF LOWER LIMB PROSTHESES

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INTRODUCTION

Pin locking systems are a common choice for suspension of lower limb prostheses. Benefits of pin systems include their reliability and simplicity. However, pin systems provide less control of the residual limb within the socket compared to other suspension options, including control of vertical pistoning (Klute, 2011) and socket rotation (Ali, 2012).

We developed a new, liner-assisted suspension mechanism called the magnetic locking interface (MLI) (Figure 1). Three pairs of magnets draw the liner into the socket-mounted MLI connector. Once the male connector (attached to the liner) is seated into the distal receiver, the connection is secured with an external latch.

The purpose of this investigation was to compare the performance of the MLI connector to a commercially available pin system in individuals with lower limb amputations.

METHOD

Subjects: 5 males and 2 females (age 49 ± 18) with unilateral transfemoral amputation (1 K2, 4 K3, 2 K4 functional level) participated.

Apparatus: Two test sockets were fabricated from a single mold of each participant, one with the MLI and one with a pin and shuttle lock installed. Subjects used the same silicone locking liner with both systems. All test prostheses used a Mauch knee and a size-matched foot. Pigment transfer between the liner and socket was used to measure socket rotation relative to the liner during walking.

Procedures: Activities included walking at self-selected speeds over level ground in a laboratory, repeated donning and doffing and completing an ad hoc questionnaire.

Data Analysis: Differences between the MLI and pin systems in socket rotation during walking were determined using a paired t-test.

RESULTS

Decreased socket rotation relative to the liner was observed with the MLI (6.3 ± 1.9°) compared to the pin system (16.4 ± 6.7°) (p=0.006).

DISCUSSION

Controlling socket rotation helps maintain prosthetic components in proper alignment, facilitating better gait mechanics. Decreased socket rotation is also a possible explanation for subject reports of more secure suspension and improved comfort using the MLI. Additional practice and design improvements may facilitate easier donning with the MLI.

CONCLUSION

The MLI connector provided greater control of socket rotation during walking than a pin system. Subjects reported improved socket comfort and more secure suspension using the MLI.

CLINICAL APPLICATIONS

Control of socket rotation is a challenge in prosthetic fitting, especially for patients with significant redundant tissue on their residual limbs. The novel MLI connector could provide similar benefits as pin suspension while providing greater control of socket rotation.

REFERENCES