



Effect of Transtibial Prosthetic Malalignment on Socket Reaction Moments

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INTRODUCTION

Alignment is central to optimal prosthetic function (Pinzur 1995). The effect of prosthetic alignment has been investigated using a gait laboratory (Jia 2008) or instrumented prosthetic pylons (Sanders 1999). Usually, prosthetists adjust the alignment of a prosthesis based on observational gait analysis. However, Zahedi et al. provided compelling evidence that they could not reproduce what they felt was optimal alignment for a given amputee (Zahedi 1986). Therefore, a tool that can assist prosthetic alignment would be valuable. In this study, a novel instrumented prosthesis alignment component was developed that could measure sagittal and coronal socket reaction moments at the bottom of the socket. The aim of this study was to investigate the effect of transtibial prosthesis malalignment on socket reaction moments measured by the instrumented prosthesis alignment component.

METHOD

Subjects: Eleven subjects with transtibial amputation were recruited from the community.

Apparatus: An instrumented prosthesis alignment component (Boone 2005).

Procedures: Socket reaction moments of a transtibial prosthesis were measured during ambulation under various alignment conditions, including nominally aligned using conventional clinical methods and angular perturbations of ± 3 degrees and ± 6 degrees in the sagittal and coronal planes referenced from the nominal alignment.

Data Analysis: The socket reaction moments collected from each subject were averaged. Aligned versus maligned conditions were compared with a repeated measures analysis of variance.

RESULTS

Socket reaction moments revealed a systematic statistical change ($P < 0.05$) due to angular alignment perturbations (Figure 1).

DISCUSSION

The effect of coronal alignment perturbations on coronal socket reaction moments was sensitive enough to detect 3 degrees angular perturbations. The effect of sagittal alignment perturbations on sagittal socket reaction moments was less sensitive

than coronal alignment perturbations on the coronal socket reaction moments.

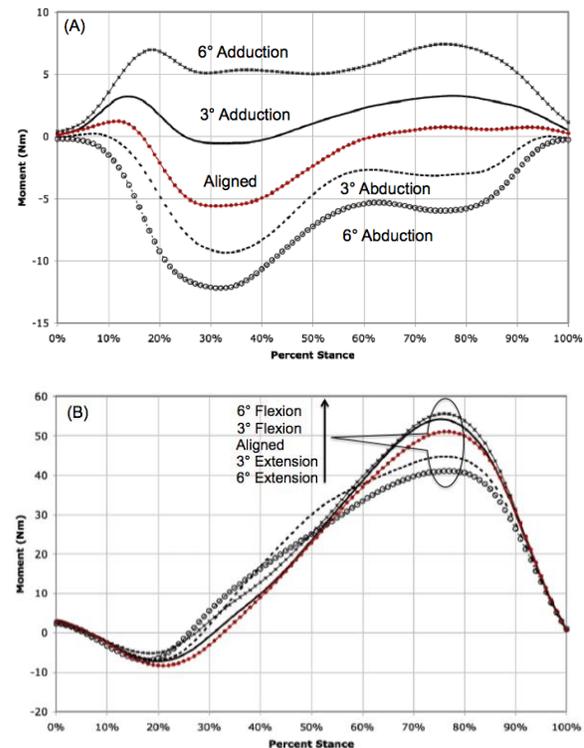


Figure 1. The effect of alignment angular perturbations on the averaged socket reaction moments in the coronal (A) and sagittal (B) planes in 11 subjects.

CONCLUSION

Socket reaction moments measured by the instrumented prosthesis alignment component proved to be affected systematically by transtibial prosthesis angular alignment perturbations in the sagittal and coronal planes.

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