INTRODUCTION
Comfort and function are closely related to the socket suspension and alignment, and poor suspension and alignment is usually accompanied with discomfort and skin breakdown and/or ulceration. The object of this study is to investigate the interface pressure of gel liner socket, perception of comfort and gait in unilateral transtibial amputees when socket alignment was systematically adjusted with and without locking-pin.

METHOD

Subjects: ten unilateral transtibial amputees (age (mean±SD): 56±7 yr; body height: 1.72±.12 m; body mass: 92.5±14.2 kg) participated in the study.

Apparatus: two F-socket pressure sensors were used to register the pressure distribution around the anterior and lateral sides of the residual limb (Tekscan Inc., USA). GAITRite (CIR Systems, Inc. PA, USA) was used to obtain spatiotemporal characteristics of gait.

Procedures: F-socket sensors were placed on the residual limb covering the lateral and anterior of the limb (Figure 1). The socket alignment was systematically adjusted in both sagittal and frontal planes. In total, five socket alignments were tested including neutral, flexion, extension, adduction and abduction of 5 degrees. Participants walked cross the GAITRite mat at self-paced speed and repeated three times. The same procedure was repeated with locking pin removed. In addition, a visual analogue scale (VAS), (0– 10(most comfortable)) was collected.

Data Analysis: spatiotemporal characteristics of gait were obtained directly from GAITRite and peak pressures were identified during stance phase (Figure 2). Repeated measures ANOVA was used and the significance level was set at alpha = 0.05.

RESULTS
Socket interface pressure
Socket alignment affects the socket interface pressure distribution systematically. Particularly, suspension types play an important role. For example, the peak pressure around the fibula head is significantly higher (180 Kpa) with locking pin than that without locking pin (40 Kpa).

Gait
Participants walked at comparable speeds (.62±.21 m/s to .66±.25 m/s) and cadence (70±23 to 73±21 steps/min) across test conditions. The heel-to-heel base support (HH) peaks when the socket is set at adduction (i.e. HH = .18±.04 m). The narrowest HH is achieved when the socket is set at abduction with locking pin (.14±.05 m). The stance phase as a percentage of the complete gait cycle is significantly affected by suspension types (P=0.042). Participants were in favour of conditions with locking pin and rated socket extension and abduction as the two least comfortable conditions.

DISCUSSION

Locking pin appears beneficial in improving suspension of the socket. Participants unanimously rated locking pin with neutral socket alignment as the best configuration. Hence it seems that the perceived performance of the socket might be more affected by the socket interface pressure distribution and socket security than the gait parameters.

CONCLUSION
Both socket alignment and suspension types affect spatiotemporal gait parameters and socket interface pressures.

CLINICAL APPLICATIONS
The outcome of this study might help us better understand the effects of suspension types and socket alignment and provide practitioners useful clinical recommendation.

REFERENCES