CORRELATIONS BETWEEN ANTHROPOMETRICS AND JOINT MOMENTS IN SITTING AND STANDING OF TRANSFEMORAL AMPUTEES

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INTRODUCTION
Transfemoral amputees’ (TFA) hip and knee moments are asymmetrical between sound and prosthetic sides in standing and sitting. This causes increased sound side reliance and loading, contributing to complications such as overuse. Presently, no studies have been performed to determine if correlations exist between residual limb length (RLL) and hip or knee moment on the prosthetic side. A positive correlation could justify supporting maximal RLL preservation at amputation. This study investigated whether correlations exist between hip or knee moment and the following anthropometric values: (1) RLL, (2) body height, (3) mass, and (4) combined height and weight during sit to stand and stand to sit.

METHOD
Subjects: USF’s IRB approved this cross-sectional protocol. Twenty-one TFAs consented, mean age 46±15, mean BMI 26±4. There were 7 C-Leg, 7 Power Knee, and 7 Mauch knees used. Inclusion criteria: unilateral TFA, community ambulator, no assistive device or prosthetic adjustments for ≥90d prior to data collection.

Apparatus: 3D Motion Analysis (VICON); 2 6-axis Force Plates (AMTI)

Procedures: The seat height was adjusted to a 90±5° initial knee flexion angle. Motion analysis recorded kinetic and kinematic data from subjects sitting down and standing up three times. RLL(% of sound femur), Height(m), Body mass(kg), and Height times Weight (m*N), were evaluated for correlations with sagittal hip and knee moments.

Statistical analysis: SAS software was used to calculate correlations. Pearson product-moment correlations determined relationship strength. Significance was set at p≤0.05.

RESULTS
Mean RLL was 73% of the sound side femur. Prosthetic feet and suspension mechanisms varied. Weak correlations occurred in sit to stand between RLL and hip and knee moments. A moderate correlation between prosthetic side hip moment and height was the only significant correlation observed on the prosthetic side in sit to stand. For stand to sit, weak correlations occurred between RLL and hip and knee moments. Strong correlations occurred between sound side hip moment and combined height & weight and body mass. Weak correlations occurred between prosthetic side knee moment and body mass and combined height & weight.

DISCUSSION
Sound side hip joint moments correlated well with anthropometrics. All six relationships were highly significant (p<0.01), two were strongly and four moderately correlated.

No significant correlations between RLL and joint moment were observed. The relationship of RLL and functional strength may not be fully accurate at face value. However, limb length likely has value in terms of improved surface area for load distribution, proprioception and prosthetic control. Future studies should investigate these factors for preserving as much anatomy as possible in elective amputations.

Limitations include: (1) subjects’ strength was not measured, (2) potential errors and variation in joint moment calculation, (3) entire sample evaluated as a single group as opposed to comparing by knee type, and (4) data analyses by age group and amputation etiology were not possible due to inadequate sample size and distribution.

CONCLUSION
Anthropometrics correlated well with sound side moments but were weaker with prosthetic side moments. Hip and knee moments demonstrated the weakest correlations with RLL of all anthropometric to kinetic relationships evaluated. Despite poor correlation of RLL to transitional movement kinetics, there may be other factors to consider when determining RLL within an amputation level.

CLINICAL APPLICATIONS
TFAs develop secondary complications such as sound limb overuse. Study of joint moments on both prosthetic and sound sides, with respect to RLL and other anthropometrics has implications for amputation surgery and rehabilitation.

REFERENCES
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