

Comparison of the Inverse Kinematic Output of Statistical Shape Models and General Scaled Models

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Background

Computer modelling of the lower musculoskeletal system has many important clinical applications, such as examining patients' gait and testing orthopaedic implants [1]. Subject specific models are the preferred model type, as they generate results with a higher degree of accuracy than general models. Unfortunately, subject specific models are expensive and time consuming to make [2]. MAP Client offers a user friendly and effective method of generating subject specific statistical shape models (SSMs) with greater bone geometry accuracy than scaled generic models [3].

Aim: to evaluate the consistency of estimated inverse kinematics between scaled generic models and SSMs created by MAP Client.

Methods

Participants

- 12 adults.

Model Generating

- Workflows created in MAP Client to generate subject specific SSMs.
- Scaled generic models created by linearly scaling the Gait2392 model (fig. 1) using OpenSim [5].

Simulations

- Inverse kinematics simulations carried out in OpenSim to calculate joint angles (fig. 2).

Statistical Testing

- Shapiro-Wilk test to test data for normal distribution
- Paired t-tests to determine if differences between scaled generic models and SSMs were significant, results plotted (fig. 3).

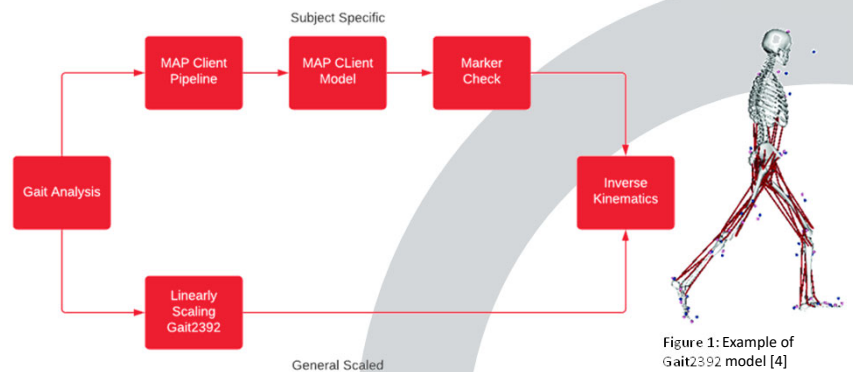


Figure 1: Example of Gait2392 model [4]

Results

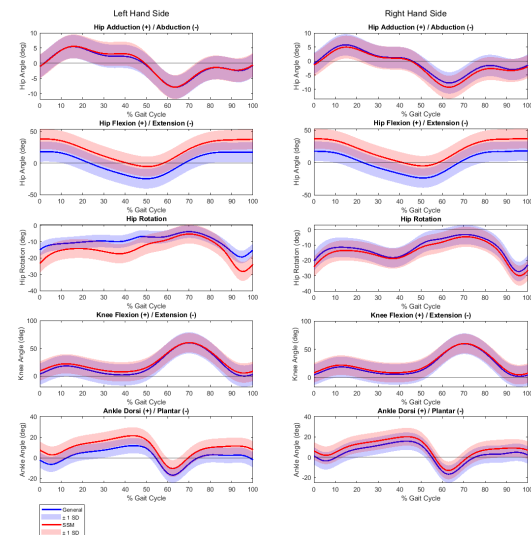
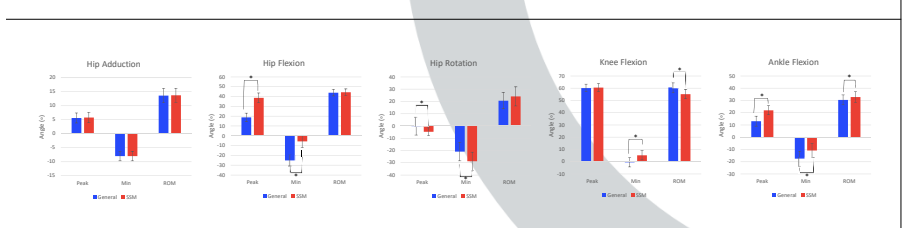


Figure 2: Comparison between average inverse kinematics of scaled generic models (blue) and SSM (red). The relative shaded areas show ± 1 standard deviation.

Conclusions

- Average joint angles for SSM and scaled generic modelling followed the same profile, with a generally significant offset between the two.
- MAP Client statistical shape modelling is a viable method of generating subject specific models in a time and cost effective way, with potential for clinical use.

Left Lower Limb



Right Lower Limb

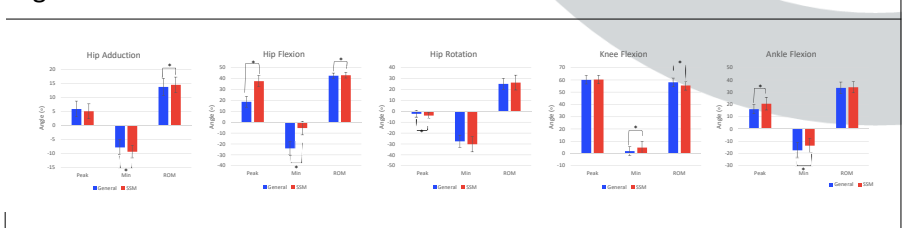


Figure 3: Comparison of joint peak angle, minimum angle and range of motion between scaled generic models and SSMs. Asterisk indicates significant difference.

References

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