The effect of simplifying the scaling method of an upper limb musculoskeletal model on the joint angles

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Why?

The conventional method of scaling cadaver-based musculoskeletal models can be time-consuming and difficult for individuals with cervical level of spinal cord injury.

How?

Here, we simplified the scaling methods and investigated the simplifying effect on kinematics of an upper limb musculoskeletal model.

What?

Our simplified method can produce similar accuracy of scaling with 3D marker coordinates

Introduction

- Scaling cadaver-based musculoskeletal models of the upper limbs is an important step prior to performing musculoskeletal analysis.
- These models are commonly scaled using three-dimensional (3D) optical marker data.
- However, this approach can be time-consuming and difficult for individuals with cervical level of spinal cord injury.

Aim

The aim is to investigate the effects of simplified scaling methods on kinematics of an upper limb musculoskeletal model.

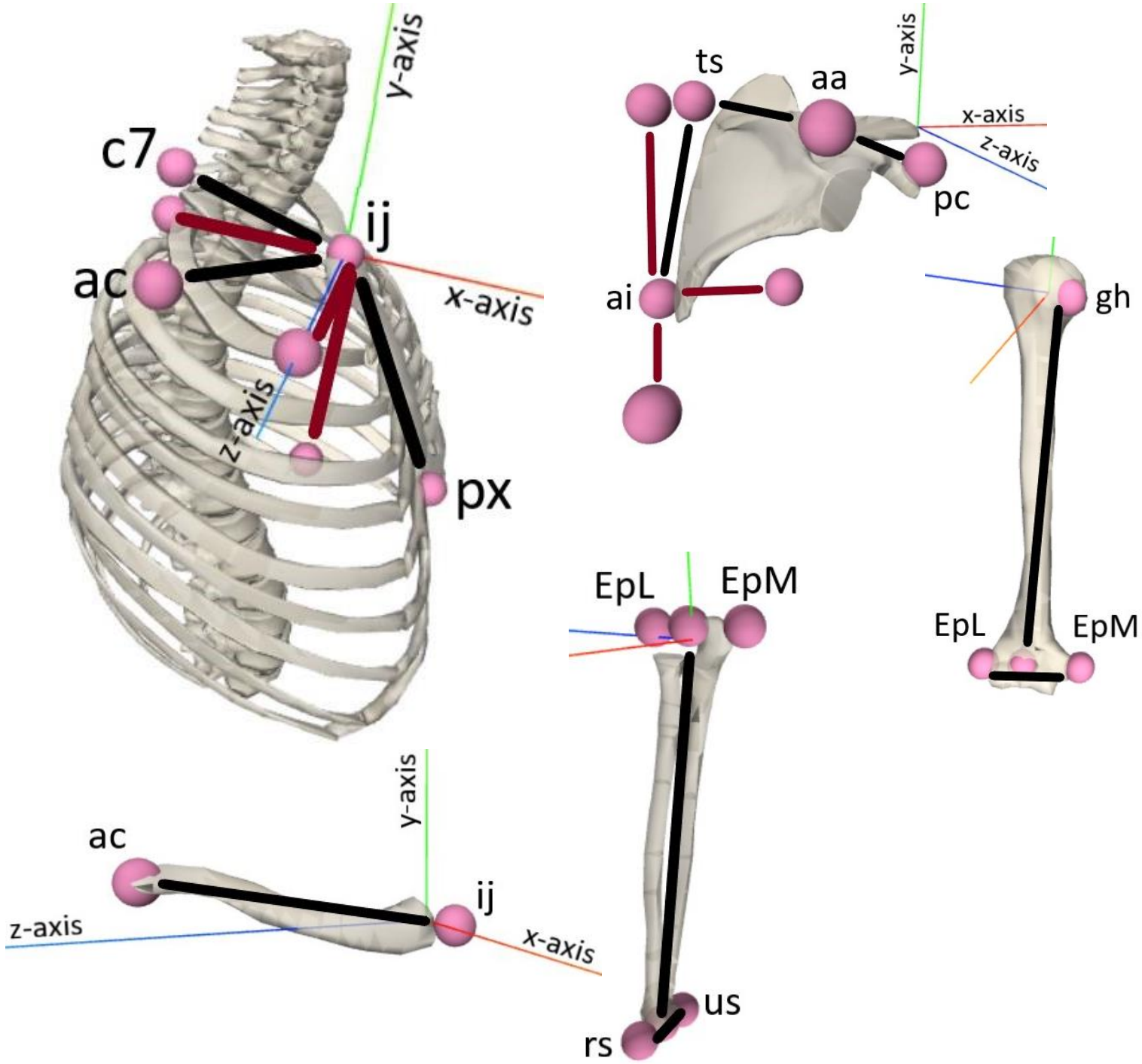
Objectives

1. To develop simplified scaling methods → **2.** To apply the scaling methods on the models → **3.** To evaluate the effect of simplified scaling on joint kinematics

Methods

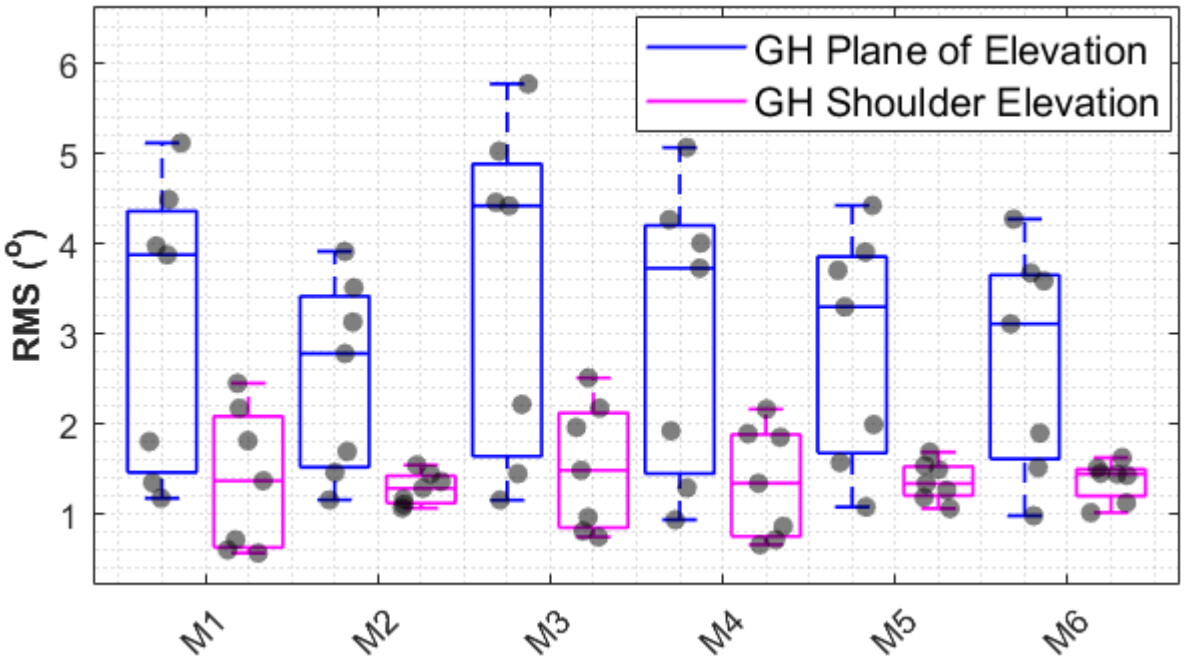
- Two able-bodied individuals participated in upper limb repeated trials.
- Marker clusters to track motions and scale an upper limb model in OpenSim 4.1
- Joint angles and RMS errors between scaling methods were calculated.

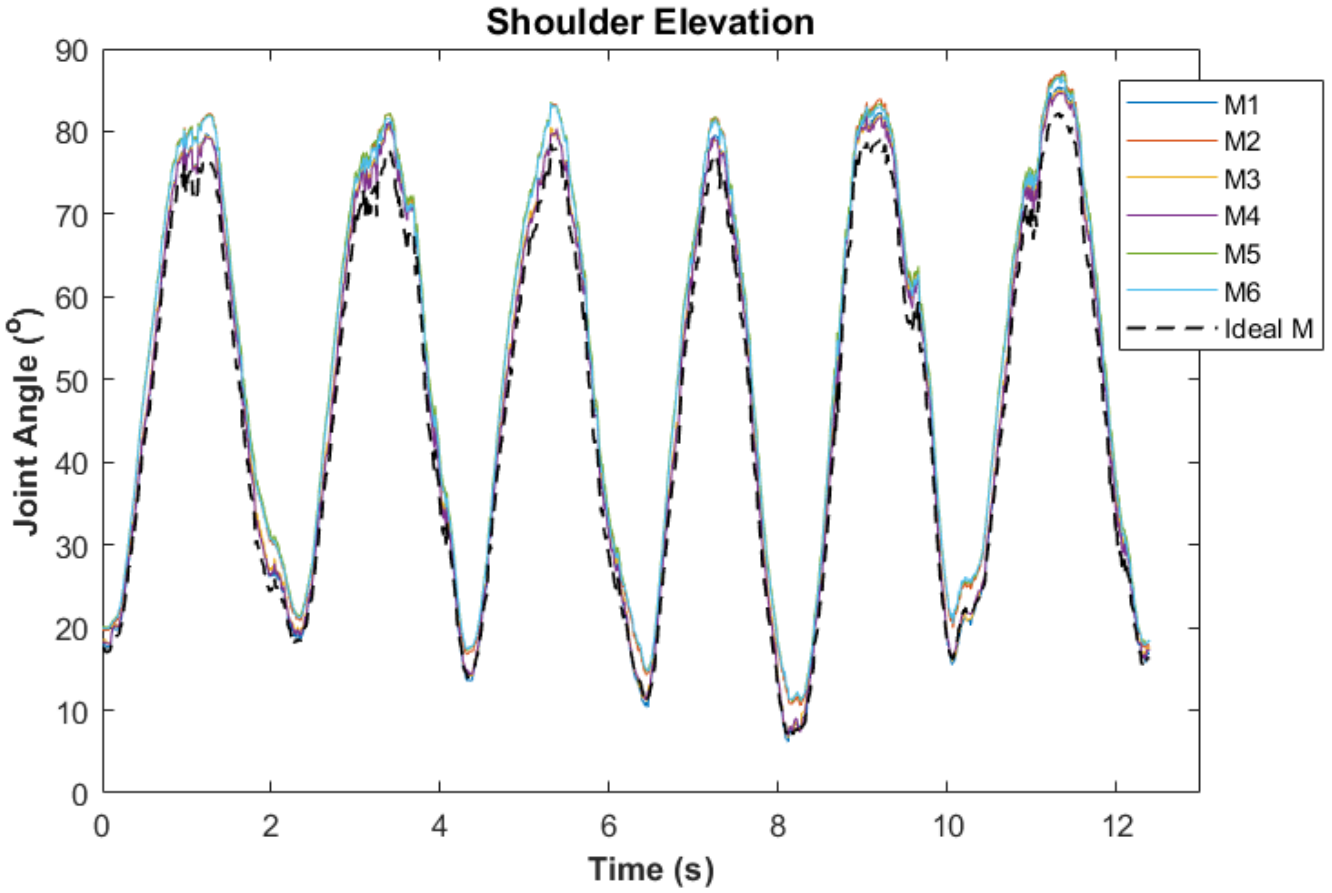
Segments		Ideal Method	Method 1
Thorax	x	ij_proj_c7 & ij	c7 & ij
	y	ij_proj_px & ij	px & ij
	z	ij_proj_ac & ij	ac & ij
Scapula	x	ai_proj_aa_x & ai	pc & aa
	y	ai_proj_ts & ai	ts & ai
	z	ai_proj_aa_z & ai	ts & aa



Results

For both participants, method one showed small RMS errors compared to the other methods.





Conclusions

Measurements estimated with a tape and caliper can be used in scaling an upper limb musculoskeletal model with similar accuracy of models scaled with 3D markers.