Upper Body Kinematic Range-of-Motion and Variability of Transradial Prosthesis Users Performing Goal-Oriented Tasks

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Introduction

- Inherent redundancy of degrees-of-freedom (DoFs) of the upper body musculoskeletal architecture allows the central nervous system to select various task-equivalent motor strategies [1].
- Redundancy allows adaption to account for lost DoFs due to pathology [2], e.g. trunk/shoulder motion to compensate for reduced active distal DoFs in transradial prosthesis users [3].
- Training is aimed at refining movement quality of upper limb prosthesis users [4, 5], but little is known of the compensatory motions and associated movement variability of experienced users.

Purpose: Compare upper body movements and variability between able-bodied and transradial prosthesis users during execution of goal-oriented tasks.

Methods

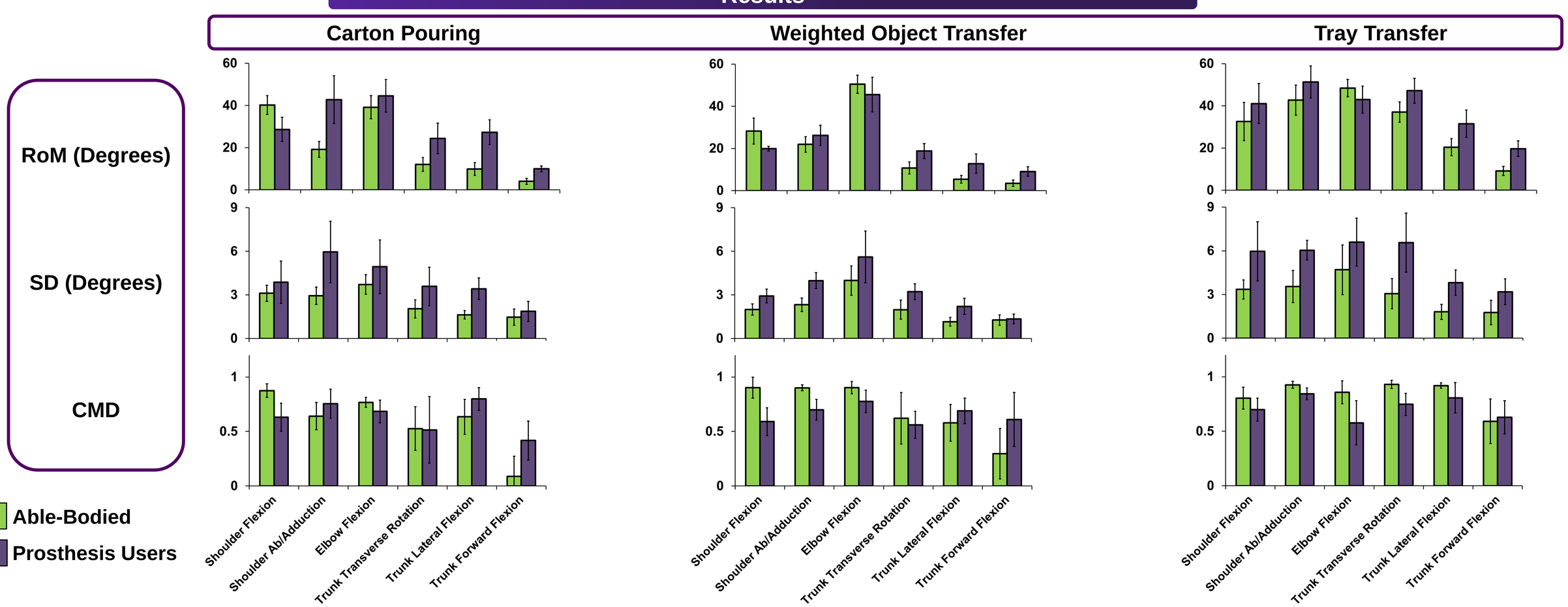
- **Design:** Group comparison between **6 able-bodied** (35±11 yrs) and **7 myoelectric prosthesis users** (49±18 yrs, prosthesis experience of 20±18 yrs) performing activities of daily living.

Procedure
Five goal-oriented tasks performed with non-dominant (able-bodied) or prosthetic limb as instructed by the Southampton Hand Assessment Procedure [6]:
- ***Food cutting***
- ***Page turning***
- ***Carton pouring***
- ***Lifting and tranferring a weighted object***
- ***Lifting and transferring a tray***

Data Collection
- **Kinematics**: Custom, upper-body marker set
- **Equipment**: 12-camera digital motion capture system (Motion Analysis Corp, Santa Rosa, CA)

Data Analysis
- DoF range-of-motion (RoM), average standard deviation (SD), and adjusted coefficient of multiple determination (CMD) estimated across five trials

Results



Conclusions

- Prosthesis users consistently demonstrated greater shoulder abduction and trunk RoM across tasks to manipulate endpoint position, but this was associated with greater variability.
- Increased variability may be reflective of healthy motor adaptation, but this may be perceived as unreliable device response and contribute to diminished perceived utility of the prosthesis.

References

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