

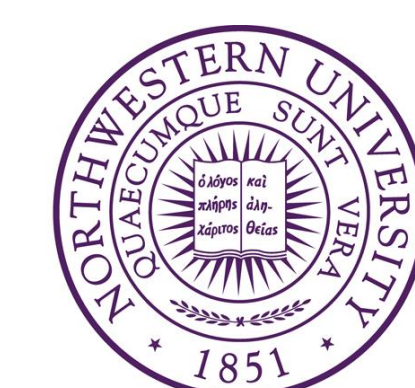
EFFECTS OF WEARING AN UPPER LIMB PROSTHESIS ON STANDING BALANCE



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Introduction

- Whole-body composition influences postural control with the arms playing a key role in the regulation of standing balance [1, 2].
- Nearly half of persons with upper limb (UL) loss fall once per year [3] and prosthesis use may impose a postural disturbance [1,3].
- Understanding the effects of wearing an UL prosthesis on balance may inform intervention strategies to enhance postural control.

Purpose: Evaluate the acute effects of wearing an UL prosthesis on standing balance, particularly the impact of matching the mass of the impaired (prosthetic) limb to the sound limb.

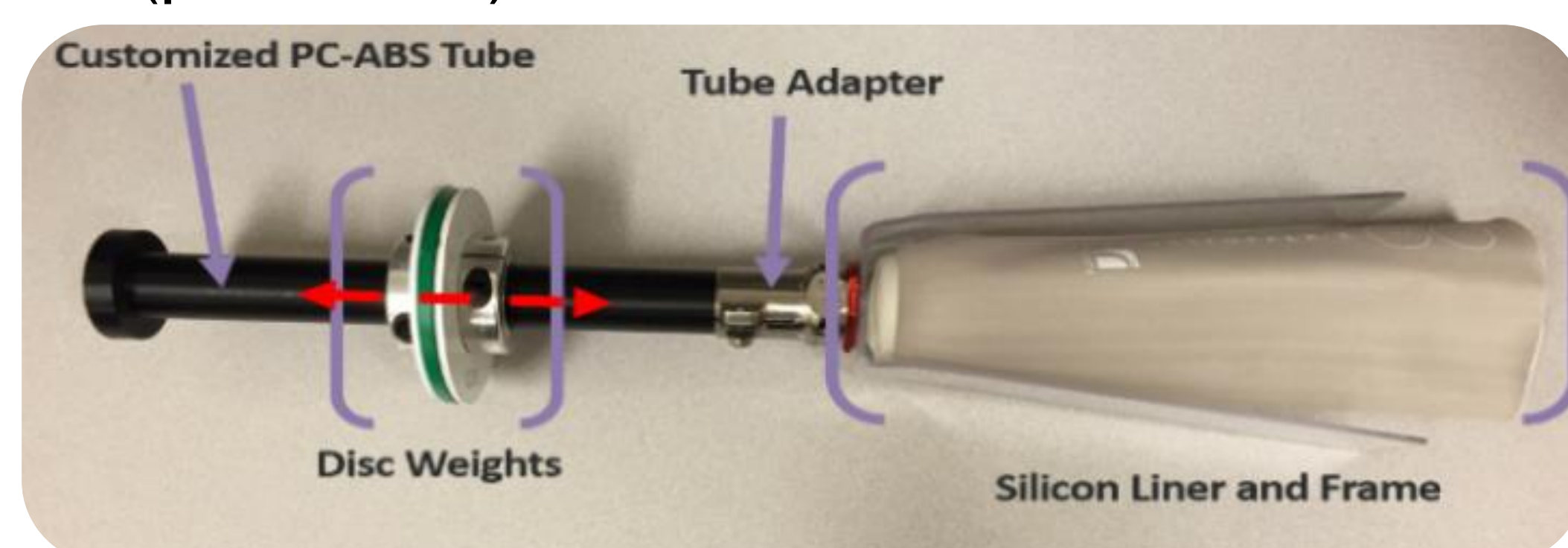
Methods

- **Design:** Repeated-measures study; 11 subjects with unilateral UL loss (8 transradial/3 transhumeral; 50±18yrs; 175.1±7.4cm; 79.6±22.6kg).

Experimental Protocol

Three trials of 30 seconds of quiet standing under **three prosthesis conditions:**

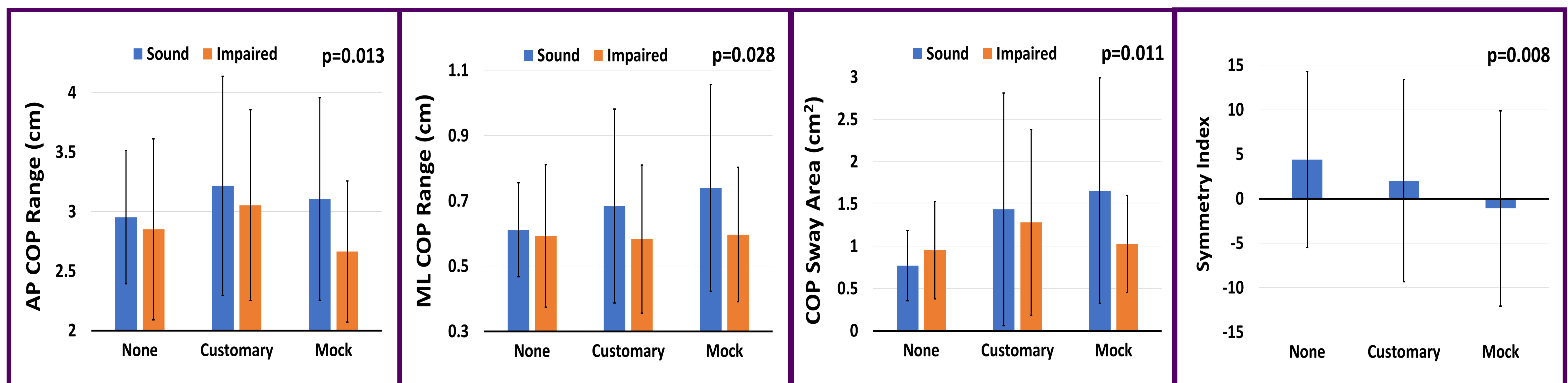
- 1) Without wearing a prosthesis;
- 2) Wearing the subject's customary prosthesis; and
- 3) Wearing a mock prosthesis that matched the mass of the impaired (prosthetic) limb to the sound limb.



Equipment and Data Analysis

- **Equipment:** 2 embedded force plates that collect instantaneous Center-of-Pressure (COP) location.
- **Measures:**
 - Mean COP anterior-posterior/medial-lateral (AP/ML) range, and sway area for each side (impaired, sound).
 - Sway area estimated using the Khachiyan Ellipsoid Algorithm with a tolerance of 0.001 cm.
 - Symmetry Index estimated weight distribution between sides (>0=sound side bias; <0=impaired side bias).
- **Fallers** defined as falling at least once in past 12 months.
- **Mixed ANCOVAs** performed on COP range, sway area, and Symmetry Index (side*condition*Faller/Non-Faller group).

Results



Anterior-Posterior COP Range

Medial-Lateral COP Range

COP Sway Area

Symmetry Index

Error Bars = 95% Confidence Interval; p-values correspond to between-condition analyses

Conclusions

- Wearing an UL prosthesis may improve weight symmetry in persons with unilateral UL loss, but generally increased COP excursion.
- Increased COP excursion reflects greater sway of the whole-body center-of-mass and increased demands on postural control [4].
- No difference in COP parameters were significant ($p \geq 0.07$) between subjects categorized as Fallers or Non-Fallers.
- Further research is needed to explore relationships between COP excursion and fall risk in persons with UL loss.

References

- [1] Imaizumi S, et al. *Conscious Cogn* **45**, 75-88, 2016. [3] Major MJ. *16th ISPO World Congress*, 2017.
[2] Shafeie M. *IEEE EMBS*, San Diego, CA, 2012. [4] Winter D. *Gait Posture* **3**, 193-214, 1995.

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