



5.074 Refining Criteria in the Assessment of Capacity for Myoelectric Control for Multi-articulating Hands

Kristi Turner¹, Wendy Hill², Eric Earley^{3,4}, Maria Munoz-Novoa⁵, Liselotte Hermansson^{6,7}, Helen Lindner⁸

¹Center for Bionic Medicine, Shirley Ryan AbilityLab, Chicago, USA. ²Institute of Biomedical Engineering, University of New Brunswick, Fredericton, Canada. ³Bone-Anchored Limb Research Group, University of Colorado, Aurora, USA. ⁴Department of Orthopedics, University of Colorado School of Medicine, Aurora, USA. ⁵Center for Bionics and Pain Research, Mölndal, Sweden. ⁶Dept of Prosthetics and Orthotics, Faculty of Medicine and Health, Örebro University, Örebro, Sweden. ⁷University Health Care Research Center, Faculty of Medicine and Health, Örebro University, Örebro, Sweden. ⁸School of Health Sciences, Örebro University,, Örebro, Sweden

BACKGROUND

Multi-articulating hands offer increased functionality compared to single degree of freedom prostheses. While users prefer their enhanced features¹, mastering these hands presents challenges. The Assessment of Capacity for Myoelectric Control (ACMC), originally designed for single-DOF hands, evaluates myoelectric control in bimanual activities. However, it lacks items to assess the nuanced control required for multi-articulating hands, such as grip-switching. New assessment items are needed to capture these advanced control skills.

AIM

We developed three new ACMC items to assess multi-articulating hand control skills. Video analysis and expert consensus was used to evaluate these items across individuals with various multi-articulating hand prostheses.

METHOD

Four experienced raters (occupational therapists and researchers) developed new ACMC items for multi-articulating hands: (1) Ability to switch grips; (2) Positioning the hand appropriately for grasping; and, (3) Choosing a secure grip for function. Two additional certified raters provided feedback based on their research experiences. The process involved:

- I. Initial meetings to refine item definitions
- II. Ethical approval for sharing ACMC videos.
- III. Independent scoring of videos by raters.
- IV. IV. Compilation of scores and justifications by a facilitator.
- V. Group discussions of results led by the facilitator.

This collaborative approach aimed to create comprehensive assessment items for advanced prosthetic hand control.

RESULTS

During consensus meetings, raters discussed individual scores in relation to item wording and rating scale definitions. For instance, the initial definition of "Ability to switch grips" focused on mechanics of switching and accessing available grips consistently and accurately. Video analysis revealed instances of unintended or delayed grip switching due to unfamiliarity with the prosthetic hand, limited control ability, or missed opportunities to switch grips. Initially, raters scored these instances as 1 or 2 on the 0-3 point rating scale. Through collaborative discussions, raters with diverse experiences refined their understanding of the assessment criteria. This process led to a more unified interpretation of the rating scale. After deliberation, all raters reached a consensus, agreeing on a score of 2 for the examples discussed, reflecting a shared understanding of the assessment criteria.

DISCUSSION AND CONCLUSION

We refined new ACMC item definitions for evaluating multi-articulating hand control using video analysis and consensus methods. This process, involving raters with diverse backgrounds, strengthened the definitions and clarified assessing multi-articulating hand function. The improved definitions include more comprehensive language, examples, and specific scoring details, enhancing item interpretability. The next step is validating these new items alongside existing ones with multi-articulating hand users in an international, multi-center study.

REFERENCES

1. Widehammar et al. 2021, J Rehabil Med