

CURRENT ISSUES WITH MULTI-DOF MYOELECTRIC HAND PROSTHESES AND INDICATIONS FOR TESTING PATTERN RECOGNITION BASED CONTROL

Andreas Franzke ¹, Raoul Bongers ², Barbara Pobatschnig ³, Fabian Unglaube ³, Andreas Kranzl ³, Alessio Murgia ², Corry van der Sluis ¹

1 University of Groningen, University Medical Center Groningen, Department of Rehabilitation Medicine, Groningen, the Netherlands

2 University of Groningen, University Medical Center Groningen, Center for Human Movement Sciences, Groningen, the Netherlands

3 Gait and Motion Analysis Laboratory, Orthopaedic Hospital Speising, Vienna, Austria

BACKGROUND

Pattern Recognition (PR) might facilitate intuitive prosthesis control [1], which in return should ease the execution of activities of daily living (ADLs) with a prosthesis. Tests to evaluate PR based control and its implementation in daily use are currently not available but are required. These tests should ideally reflect realistic prostheses utilization, based on ADL tasks that users of modern multi degree-of-freedom (DOF) prosthetic hands perceive as relevant or difficult. AIM The aim was to describe control issues with current multi DOF prostheses and to identify pertinent ADLs from the perspective of patients and therapists who are experienced with such prostheses.

METHOD

This qualitative study was carried out in the form of semi-structured interviews with 16 adult patients and 7 therapists who were experienced with multi-DOF myoelectric prosthetic hands. Patient inclusion criteria were unilateral amputation at transradial or wrist level and at least six months of experience with the above mentioned prosthetic hands. Therapist inclusion criteria were at least six months of experience with the treatment of such patients. Moreover we included patients and therapists who already had experience with PR based myoelectric prostheses. The interviews were recorded and transcribed by an independent person. Data was analyzed according to a 5-step framework approach based on (1) Familiarization, (2) Creating a thematic framework, (3) Indexing, (4) Charting, and (5) Mapping & Interpretation.

RESULTS

Myoelectric control was often described as too slow, fatiguing and requiring strong mental effort due to non-intuitive trigger signals, such as co-contraction. This also led to the selection of a small number of employed grip/movement modes. Relevant and difficult ADLs differed between individuals, but recurrent domains were mostly preparation of food, eating and dressing. Many patients perceived their multi-DOF prosthesis as a tool which should be able to support the sound hand in bimanual tasks, when these become very difficult or impossible to perform with one hand. Patients mainly choose a multi-DOF myoelectric hand because they expect additional functionality in comparison to conventional myoelectric prostheses, which is not always experienced in the end. Furthermore, persisting problems with current multi-DOF prostheses were low technical robustness and poor manufacturer support (e.g. long waiting times for replacement of parts).

DISCUSSION & CONCLUSION

This study revealed several aspects worth considering when testing future (PR based) myoelectric prostheses. The test should involve bimanual tasks related to preparing food, eating or dressing, where the prosthetic hand works to assist the sound hand. Next to completion time and quality of movement, variables such as ease of use, mental effort and grip type variety might indicate whether PR holds benefits for the patient in myoelectric prosthesis control.

REFERENCES

1. Jiang; 2014 IEEE Trans Neural Syst Rehabil Eng.