UPPER LIMB MYOELECTRIC PROSTHESES: USER AND THERAPIST PERSPECTIVES ON QUANTIFYING BENEFITS OF PATTERN RECOGNITION CONTROL

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ABSTRACT

Pattern Recognition (PR) might facilitate intuitive prosthesis control, which in return should facilitate the execution of activities of daily living (ADLs) for amputees. 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 prosthesis utilization, and be based on ADLs that users of modern multi degree-of-freedom (DOF) prosthetic hands perceive as relevant or difficult to execute.

The aim of this study was therefore to describe control issues with current multi DOF prostheses and to identify pertinent ADLs from the perspective of patients and therapists.

We conducted 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 analysed according to a 5-step framework approach based on Familiarization, Creating a thematic framework, Indexing, Charting, and Mapping & Interpretation.

Myoelectric control was often described as too slow, fatiguing and requiring strong mental effort due to non-intuitive mode-switching signals. 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 may not always be experienced ultimately. Persisting problems were low technical robustness and poor manufacturer support (e.g. long waiting times for replacement of parts).

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, embodiment and grip type variety might indicate whether PR holds benefits for the patient in myoelectric prosthesis control.