A STUDY OF THE REALITY OF MYOELECTRIC PROSTHESES TO INFORM FUTURE RESEARCH

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ABSTRACT

The first clinical myoelectric prosthesis was developed in the 1960's. Since this time research has seen a number of developments, including pattern recognition of control signals, implantable electrodes, and multi-articulating hands. Of these developments, only multi-articulating hands are widely commercially available, suggesting a problem with technology translation. Furthermore, around 30% of myoelectric prosthesis users subsequently reject their prostheses [1]. Amongst the key reasons cited for prosthesis rejection are poor control and poor functionality.

One of the reasons for the very poor rate of technology translation is likely to be the focus taken by many of the research groups in this area on using intact participants in the early phases of research [2]. Of particular note, early phase studies have generally not taken account of the issues associated with transducing signals from socket-located electrodes. Saunders noted that variability in signal transduction is likely inherent to the design of current prostheses [3]. Building on this, the authors have identified three factors from the literature which may impact on prosthesis user performance. These are the skill of the user in controlling the muscle signals, the unpredictability of hand response introduced by a poor electrode fit, and the delay in the hand response due to inherent electromechanical delays. A protocol was developed to assess each of these factors to establish their relative impact on prosthesis user functionality and everyday use of their myoelectric prosthesis [4].

For this study we are recruiting a range of prosthesis users encompassing those who are both satisfied and dissatisfied users of their prostheses, both wearers and non-wearers. Consequently multiple centres across the UK have been involved in the study.

Here we will present preliminary results demonstrating how each of the control factors (skill, unpredictability and delay) relate to measures of user functionality (including task success, task duration, gaze patterns, hand aperture patterns, and movement variability) and everyday prosthesis use (assessed using activity monitoring over the course of a week).

Early results suggest that unpredictable device response is a key factor. Users whose hand reacted unexpectedly were also more reliant on visual feedback as to the hand state, and less likely to wear their prosthesis during the week in which they were monitored.

REFERENCES

[1] Biddiss and Chau (2007); Prosthet. Orthot. Int.; 31:3

[2] Vujaklija et al. (2017); Frontiers in Neurorobotics; 11:7

[3] Saunders and Vijayakumar (2011); J. Neuroeng. Rehabil; 8:60

[4] Chadwell et al. (2016); Frontiers in Neurorobotics; 10:7