

Towards Implementation of a Home-Based Phantom Limb Pain Treatment Facilitated by Textile-Electrode System - A Case Study

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Abstract. This case study reports the use of a new textile-electrode system for self-administered Phantom Motor Execution (PME) treatment at home in one patient with Phantom Limb Pain (PLP). In follow-up interviews, the patient reported reduced pain, increased mobility, and improved mental health, and aspects such as motivation, usability, support, and treatment outcome, could be recognized from an earlier study as crucial for successful implementation and adoption of the home-based long-term treatment. The findings are of interest to developers, providers, users, and researchers planning home-based clinical studies and/or scenarios based on technology-assisted treatment.

Keywords. Phantom limb pain, Textile electrodes, Home-based, Self-administered

1. Introduction

Phantom Limb Pain (PLP) can be treated with Phantom Motor Execution (PME), which involves controlling virtual limbs based on myoelectric pattern recognition [1]. However, the conventional Ag/AgCl electrodes used to record the myoelectric signal may not be ideal for home-based treatment compliance. A pilot study showed that a textile-electrode system is better suited for PLP treatment at home [2]. This case study investigates the effectiveness of a textile-electrode system for home-based, self-administered, and long-term PME treatment, using previous user experiences from a study on neuromuscular conditions as a framework [3].

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2. Methods

The participant, John (pseudonym), was provided with a PME treatment system that included a myoelectric pattern recognition system and a custom-made textile-electrode system to use at home for 2 periods of 12 weeks each with and without a prescribed training recommendation. He had tried several treatments for his PLP with limited success but had previously used the PME treatment at a clinic with good results. Interviews were conducted after each of the two training periods. The interviews were analyzed using a deductive approach focusing on *motivation*, *usability*, *support*, and *outcome* from using the textile electrode system enabled PME treatment at home.

3. Results

John's responses to the two interviews are summarized according to findings in [3]. *Motivation*: John's primary motivation for participating in the PME treatment was to reduce his pain, but he also found motivation from being part of a research project and the enjoyment of training. *Usability*: John found the entire PME system, especially the textile-electrode-band, to be technically superior and easier to use than the conventional Ag/AgCl electrodes which he found both uncomfortable and time-consuming to use. *Support*: While John appreciated to have a physiotherapist "around" to place the electrodes during his previous treatment, he now felt empowered by being able to train on his own. *Outcomes*: John experienced a significant reduction in pain intensity and incidence, which had led to increased mobility, improved mental health and quality of life.

4. Discussion and Conclusion

This case study explores home-based, self-administered, and long-term PLP treatment with a textile-electrode system. The participant's experiences provide valuable insights on how to improve PLP treatment at home, including the importance of usability, motivation, and empowerment of patients. These insights may be valuable to developers, technology providers, researchers, and users of assistive technology on what to consider when introducing home-based treatment concepts. We believe the results to be transferable to other treatment initiatives and areas that may benefit from home-based and self-administered scenarios, such as post-stroke rehabilitation and fibromyalgia.

References

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