

ABSTRACT

Sensory Feedback Effects on Lower Extremity Phantom Limb Pain with Myoelectric Prostheses: A Systematic Review

INTRODUCTION: Phantom limb pain (PLP) is pain in an extremity that has been amputated and occurs immediately or years later. Maladaptive cortical reorganization due to a prolonged absence of sensory stimulation from the amputated limb is thought to be the basis of PLP. Myoelectric prostheses that provide somatosensory feedback decrease PLP in persons with upper extremity amputation through reversing maladaptive cortical reorganization. The current use of myoelectric prostheses in the lower extremity is clinically limited. Myoelectric prostheses use the residual limb's muscle activity, detected by electromyographic surface electrodes, for the control of the distal prosthetic joint's movement. **PURPOSE:** The purpose of this systematic literature review is tri-fold: first to evaluate the strength and quality of the current research evidence for the use of myoelectric prosthetics for persons with lower extremity amputation, and secondly with the effects of the use of myoelectric prostheses on phantom limb pain, and thirdly to identify weaknesses in the current evidence and area for continued research needs.

METHODS: A systematic review of the literature published between 2007 and 2022 was performed in ESBCSO, APTA, and Pubmed data bases for peer-reviewed journals using the keywords "myoelectric prosthesis", "lower extremity", and "phantom limb pain". Articles selected for review met selection criteria and were found to be level 1 and level 2, based on the 2011 ranking system of the Centre for Evidence-Based Medicine at the University of Oxford (CEBM).

RESULTS: Initial searches yielded 237 unique articles. Upon application of inclusion/exclusion criteria, 13 articles were selected for review. Of those, all included myoelectric prostheses with 6 articles having examined lower limb amputees, 5 articles included upper limb amputees, and 2 included both upper and lower extremity amputees. Seven articles included the use of somatosensory feedback, and all found a significant decrease in phantom limb pain in amputees.

CONCLUSION: Although myoelectric prostheses with somatosensory feedback have been validated through research for the treatment of PLP in the upper extremity, research for its implications in lower extremity amputees is lacking. The success of somatosensory feedback prostheses with upper extremity amputees and the knowledge of their effect on cortical reorganization warrants further research into the lower extremity amputee population. Further level 1 and 2 ranked studies including randomized control trials are needed to validate the use and implementation of lower extremity myoelectric prostheses.

CLINICAL IMPLICATIONS:

The use of a lower extremity myoelectric prosthesis to reverse maladaptive cortical reorganization shows promise for the reduction of phantom limb pain for persons with lower extremity amputation which may increase their activity level and overall life participation.

Funding Sources. No funding sources were utilized. **Key Words:** myoelectric prosthesis, lower extremity, phantom limb pain.