2024

Prosthetics in the Return to Trade Work

Jordan Chizmadia

Jennifer G. Macnie

Olivia R. Miller

Anthony L. Valentino

Myoelectric vs. Body Powered Prosthetics in Upper Extremity Amputees Return to Trade Work: A Systematic Review

Jordan Chizmadia* B.A., OTS, Jennifer Macnie B.S., OTS, Olivia Miller B.S., OTS, and Anthony Valentino B.S., OTS
Dr. Monique Dawes, OTD., OTR/L, CPAM

Abstract

Objective: This review aims to assess myoelectric and body-powered prosthetics' impact on return to physically demanding work and understand which is better suited for trade work demands and productivity.
Data sources: Journal articles searched using on October 13th, 2023. A search string was comprised of all terms related to amputations, prosthetics, and work.
Study selection and data collection: Articles meeting inclusion criteria had to be peer-reviewed journal articles written in English, published in the last seven years, participants with an upper extremity amputation using a body-powered or external powered prosthetics, and participants 18 years of age or older. Articles discussing hybrid prosthetics were not included for review. All articles were evaluated using PRISMA guidelines and risk of bias tools to determine quality.
Findings: The articles that met inclusion criteria share similar characteristics pertaining to overall prosthetic experience, context, and outcomes of returning to work, pattern recognition, and functional outcomes. Other studies included focused outcomes on vibrotactile feedback, musculoskeletal complaints, and adaptation of functional capacity evaluation test to better understand the relationship between work and prosthetics.

Methods

Databases used: EBSCO, PubMed, Sage Journals and ScienceDirect

Search string: upper extreme* OR upper limb OR upper limb amput* OR amput* OR upper extremity loss OR transradial OR trans humeral amputation OR transhumeral amputation AND voluntary opening OR voluntary closing OR pulley prosthet* OR electric motor powered prosthe* OR electric generated prosthet* OR upper body power OR body power OR external power OR myoelectric prosthe* OR myoelectric hand OR myoelectric control OR myoelectric OR artificial arm OR artificial limb AND return work OR return service OR return duty OR work readiness OR return work rehabilitation OR labor OR manual labor OR manual workers OR physical work* OR unskilled work OR unskilled labor OR common labor

Guidelines used: PRISMA, NHBLI risk of bias quality assessments, two person a priori review process to eliminate bias in article synthesis

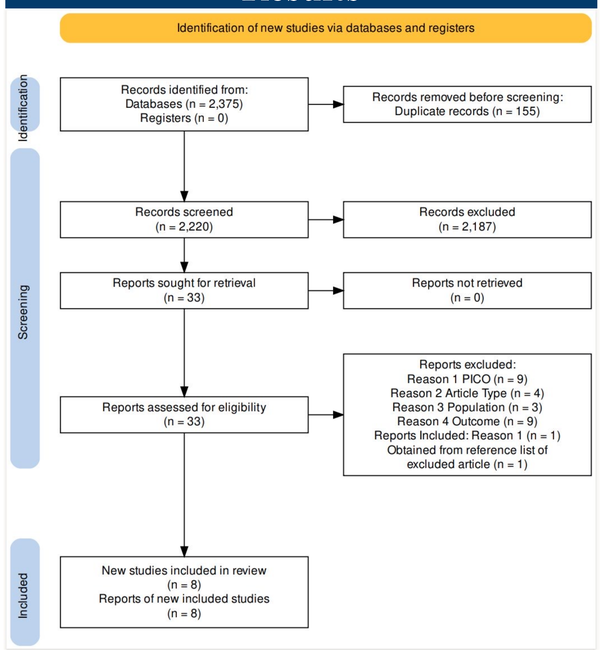
PICO Question

In adults with UEA, what is the effect of externally powered, myoelectric prosthetics on return to work when compared with body powered prosthetics?

Introduction

- Of the two million affected by amputations in the United States, 3% are upper extremity amputations.
- Disability first language utilized to express significance
- Chosen definition of work and trade work
- Body-powered prosthetics (controlled by the individual)
- Myoelectric prosthetics (powered by electric motors)
- OTP's can aid in trauma guidance, assistance with ADL, and determining patients' needs to set the parameters for intervention

Results



Myoelectric Results

Prosthetic Experience:
- Wearability:
  - Rashes/Skin abrasions
  - Don't wear prosthetic during extreme sports, beach, sunburn, etc.
- Durability:
  - Glove placement, issues with grip and electrode functions
  - Constant errors and break downs (power, sensory, etc.)
- Comfortability:
  - Decreased comfortability; user driven adaptation
  - MSC

Adaptive Study Measure:
- Adapted for fine motor tasks

Hand Dexterity and Sensory Feedback:
- Greater dexterity
- Increased sensory feedback due to use of Vibrotactile Feedback (VTF)

Application to Work:
- Training Time:
  - EMG signaling placement

Body Powered Results

Prosthetic Experience:
- Wearability:
  - Sweat and temperature
- Durability:
  - Component wear down
  - Pulley-system
- Comfortability:
  - More reliable, comfortable and less maintained,
    - Better skin state, wear down, sweat and temperature
  - MSC

Adaptive Study Measure:
- Adapted for physical demanding tasks

Hand Dexterity and Sensory Feedback:
- Decreased hand dexterity and internal sensory feedback
- Greater control over body mechanics

Application to Work:
- More training required for body mechanics and manipulation

Strengths

- Results are generalizable to upper extremity amputee populations
- Bridges gaps in literature and opens room for more research
- Systematic Review was guided to completion using PRISMA

Limitations

- The systematic review includes eight studies and 358 participants**.**
- There were four level three articles and four level four articles, all good and fair quality except one being poor.
- Small sample size, controls not being amputees, lack of work-based outcomes, not all participants had the same training with prosthetics, and generalizability was limited.

Relevance

- Occupational therapists can utilize this information to create client-centered interventions designed around return to work with proper prosthetic.
- Prosthetic education and training will help clients return to work at an expediated rate.
- Prosthetic experience
- Musculoskeletal complains
- Adaptive survey measure
- Hand dexterity & sensory feedback
- Application to work
- Training experience

Conclusion

Myoelectric prosthetics are better suited for fine motor and mentally demanding work whereas body-powered prosthetics are preferable for gross motor and physically demanding work.

References