

# Targeted Muscle Reinnervation: A Tour de Force

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## Introduction

Targeted muscle reinnervation (TMR, Figure 1) is a peripheral nerve procedure first performed in 2002 that reroutes the amputated axons to motor endplates and sensory organelles in nearby muscles. It was initially performed to provide new myoelectric sites for intuitive control of advanced robotic prostheses. It has since contributed to a paradigm shift in the treatment of phantom limb pain and residual limb pain in major limb amputees. Here, we review the most recent clinical studies out of Northwestern regarding the impact of TMR on phantom limb pain and neuroma related pain in amputees and expanding applications for the non-amputee patient population.



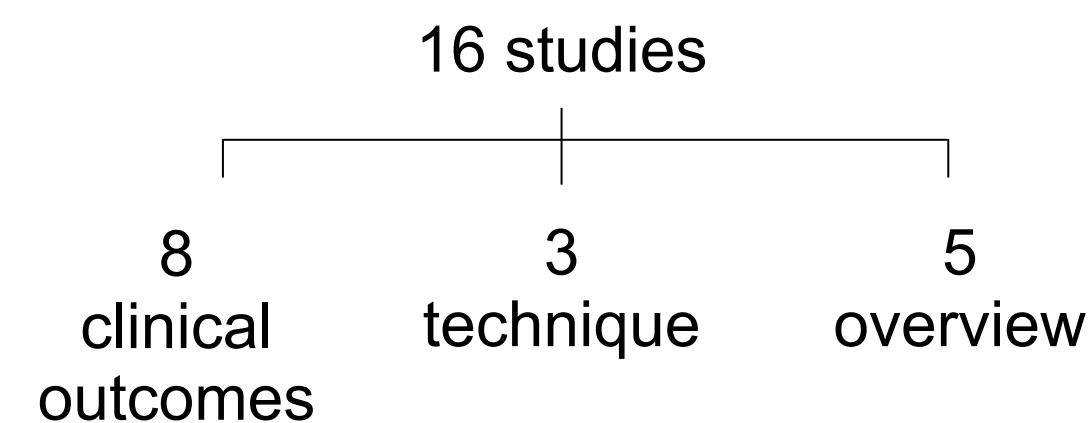
Figure 1.

## Methods

- We conducted a PubMed literature review of Northwestern associated studies on TMR published from 2016-2021
- Primary endpoints of interested were patient reported outcomes regarding pain via numerical rating scale (NRS) and Patient Reported Outcomes Measurement Information System (PROMIS) values
- Technique based articles were included to highlight expanded applications of TMR

## Results

A total of 19 publications focused on TMR and associated with Northwestern University were published between 2016 and 2021. Three were excluded as they were abstracts only, leaving a total of 16 publications for review



## Results

### Clinical Outcomes:

#### Prospective randomized clinical trial

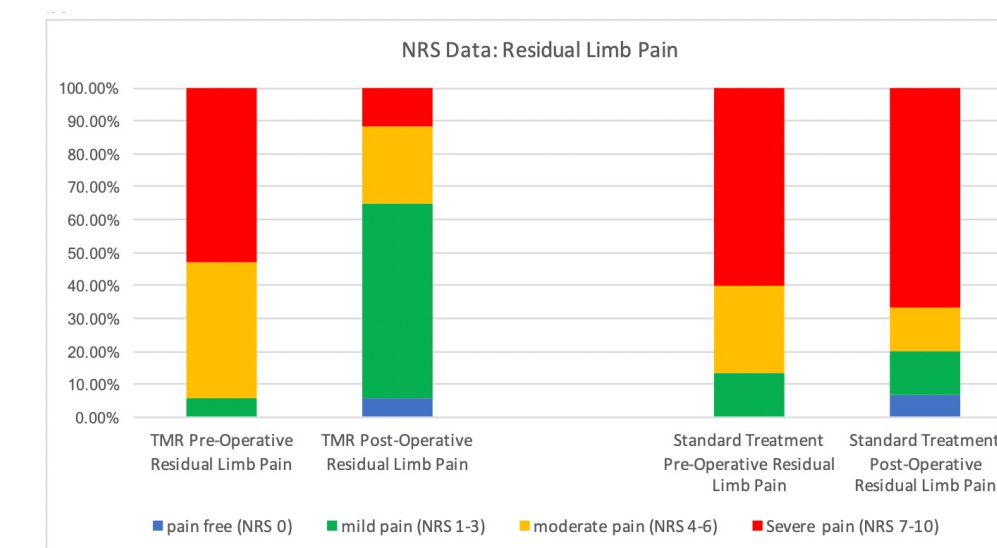


Figure 2a.

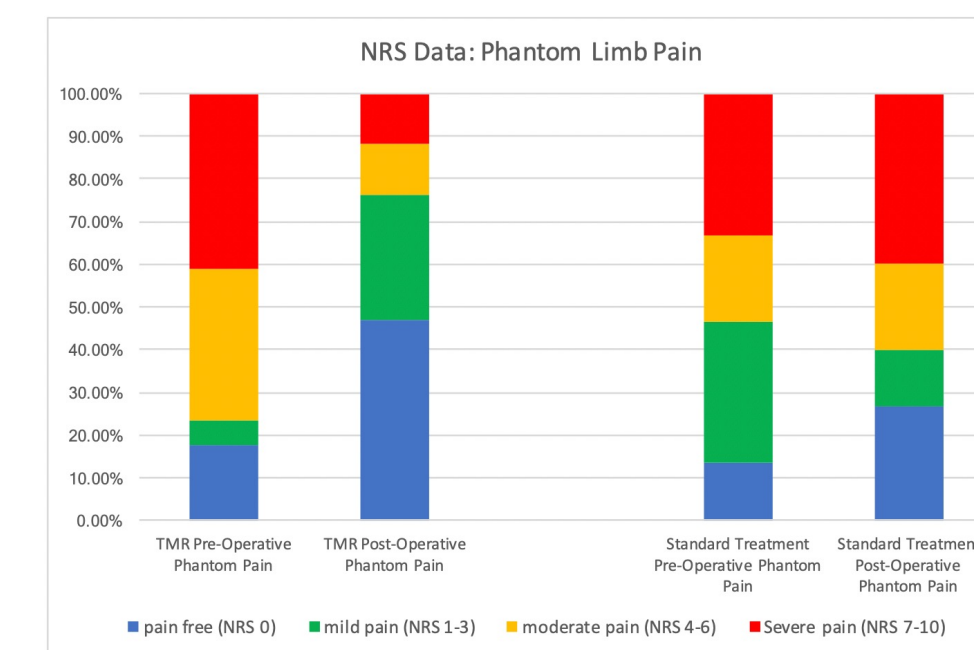


Figure 2b.

### Expanded applications:

Acute amputations  
Sural neuroma in continuity  
Saphenous neuroma in continuity  
Abdominal Wall Neuroma  
Complex regional pain syndrome

## Conclusions

TMR leads to improvements in phantom limb pain, residual limb pain and functional status for chronic major limb amputees. It also leads to a significant reduction in phantom limb and residual limb pain values when done in the acute setting for major limb amputations. Moreover, TMR can be a treatment of choice for non-amputee patients suffering from pain related to neuromas in continuity or end-neuromas.

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