

***Preemptive Treatment of Phantom and Residual Limb Pain with Targeted Muscle Reinnervation at the Time of Major Limb Amputation.***

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**Abstract**

BACKGROUND: A majority of the nearly 2 million Americans living with limb loss suffer from chronic pain in the form of neuroma-related residual limb and phantom limb pain (PLP). Targeted muscle reinnervation (TMR) surgically transfers amputated nerves to nearby motor nerves for prevention of neuroma. The objective of this study was to determine whether TMR at the time of major limb amputation decreases the incidence and severity of PLP and residual limb pain.

STUDY DESIGN: A multi-institutional cohort study was conducted between 2012 and 2018. Fifty-one patients undergoing major limb amputation with immediate TMR were compared with 438 unselected major limb amputees. Primary outcomes included an 11-point Numerical Rating Scale (NRS) and Patient-Reported Outcomes Measurement Information System (PROMIS) pain intensity, behavior, and interference.

RESULTS: Patients who underwent TMR had less PLP and residual limb pain compared with untreated amputee controls, across all subgroups and by all measures. Median "worst pain in the past 24 hours" for the TMR cohort was 1 out of 10 compared to 5 (PLP) and 4 (residual) out of 10 in the control population ( $p = 0.003$  and  $p < 0.001$ , respectively). Median PROMIS t-scores were lower in TMR patients for both PLP (pain intensity [36.3 vs 48.3], pain behavior [50.1 vs 56.6], and pain interference [40.7 vs 55.8]) and residual limb pain (pain intensity [30.7 vs 46.8], pain behavior [36.7 vs 57.3], and pain interference [40.7 vs 57.3]). Targeted muscle reinnervation was associated with 3.03 (PLP) and 3.92 (residual) times higher odds of decreasing pain severity compared with general amputee participants.

CONCLUSIONS: Preemptive surgical intervention of amputated nerves with TMR at the time of limb loss should be strongly considered to reduce pathologic phantom limb pain and symptomatic neuroma-related residual limb pain.