Reference

Miller L, Stubblefield K, Lipschutz R, Lock B, Kuiken T

Neural Engineering Center for Artificial Limbs, Rehabilitation Institute of Chicago, Chicago, Illinois

Improved Myoelectric Prosthesis Control Using Targeted Reinnervation Surgery: A Case Series

IEEE Trans Neural Syst Rehabil Eng. 2008 February; 16(1): 46–50.

Products

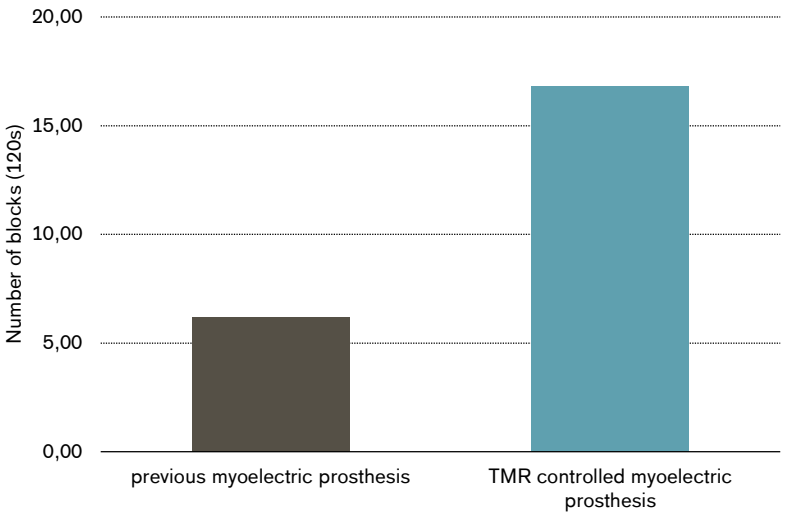
Myoelectric prosthesis in combination with Targeted Muscle Reinnervation

Major Findings

The effect of Targeted Muscle Reinnervation (TMR) on the control of myoelectric upper limb prostheses:

→ **The performance in timed tests (Box and Block and Clothespin Test) has increased by two to six times.**
→ **All subjects reported that the prosthesis was easier to operate.**

Box and Blocks test



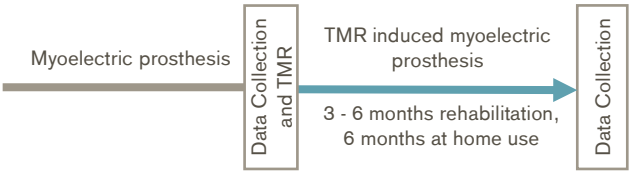
Performance of the pre-surgical myoelectric device and the TMR controlled myoelectric prosthesis was compared with a modified Box and Blocks test (patients were standing instead of sitting while the duration of the test was increased to 120s instead of 60s). With the new prosthesis patients showed marked improvement (on average 177%)

Population

Subjects:	3 shoulder disarticulation and 3 transhumeral amputees
Amputation etiology:	Not reported
Mean age:	Not reported
Mean age at TMR:	Not reported
Previous prosthesis:	myoelectric prostheses (type not reported)
Intervention prosthesis:	TMR in combination with Boston Digital arm, Otto Bock electric wrist rotator and an electric terminal device (hook or hand)

Study Design

Case series:



Manual dexterity was tested before TMR surgery with the previous myoelectric prosthesis. Three to six months of rehabilitation and occupational therapy were needed after the TMR procedure to enable extensive device use. Functional testing with the new myoelectric prosthesis was performed after 6 months of home use.

Results

Body Function		Activity			Participation	Others	
Mechanics	**Pain**	**Grip patterns / force**	**Manual dexterity**	**Activities of daily living (ADL)**	**Satisfaction and Quality of life (QoL)**	**Training**	**Technical aspect**

Category	Outcomes	Results for myoelectric prosthetic use after TMR:	Sig.*
Manual dexterity	Modified Box and Blocks Test (in standing position, duration 120s)	All subjects demonstrated marked improvement with the myoelectric prosthesis and TMR. Number of blocks moved increased on average by 177 % (mean number of 6.17 boxes with pre-surgical fitting vs 16.50 boxes with post-TMR fitting).	n.a.
	Clothespin Relocation Task	All subjects demonstrated improvement ranging from 31% to 55% with an average difference of 45% reduction in time with the TMR controlled myoelectric device compared to previous prosthesis (mean time needed with pre-surgical fitting 85.8s vs mean 57.5 s needed with post-TMR fitting).	n.a.
Activities of daily living (ADL)	Assessment of Motor and Process Skills	80% and 60% of patients had a clinically relevant improvement in motor score and in process score, respectively (mean motor score increased from 0.92 to 1.72 on average, while process score improved from mean 1.02 vs mean 1.60).	n.a.
	Self-reported	Many tasks were easier to perform with the myoelectric prosthesis: cooking, cleaning, housework, yard work, and home maintenance.	n.a.

* no difference (0), positive trend (+), negative trend (–), significant (++/––), not applicable (n.a.)

Author's Conclusion

"The targeted reinnervation technique makes possible the creation of new EMG control signals for the operation of complex prosthetic systems. With relatively little training, TMR patients showed an ability to control a prosthesis using the additional control signals added through the nerve transfers. These advancements have increased the incentive to develop more advanced artificial arms that will allow people with high level amputations, especially bilateral amputees, to improve their functional abilities and independence." (Miller et al., 2008)