Reference

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Does use of a myoelectric prosthesis prevent cortical reorganization and phantom limb pain?

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Products

Myoelectric prosthesis, cosmetic prosthesis

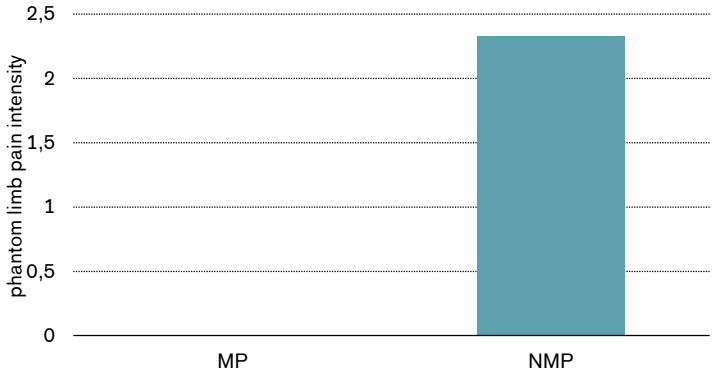
Major Findings

Prosthetic use and phantom limb pain in upper limb amputees:

→ **Enhanced use of a myoelectric prosthesis was associated with reduced phantom limb pain and reduced cortical reorganization.**

→ **Phantom limb or stump pain was never given as a reason for discontinuation of prosthetic use.**

Average phantom limb pain intensity



First group (MP) had patients with a myoelectric prosthesis who reported extensive wearing time (>8 h/day) and usage (>50 on a visual analogue scale (VAS) ranging from 0–100). The second group (NMP) had either no prosthesis or a cosmetic prosthesis or myoelectric prostheses was poorly used (<8 h/day and/or < 50 VAS). Phantom limb pain intensity measurement was based on the MPI Pain Intensity Scale (range, 0–6). The MP group showed an average phantom limb pain intensity of 0 ± 0 8no pain), whereas the NMP group reported an intensity of 2.33 ± 1.53.

Population

Subjects:	9 upper limb amputees; 10 control, healthy participants
Previous:	2 myoelectric prosthesis, 3 cosmetic prosthesis, 4 no prosthesis
Amputation causes:	not listed
Mean age:	49 ± 18 years
Mean time since amputation:	22 ± 19 years

Study Design

Observational study

Nine unilateral upper-limb amputees and 10 control participants were examined with functional magnetic resonance imaging (fMRI) of the brain while they moved the lip. Location and amount of cortex devoted to each part of the body is known and described. Cortical reorganization was assessed by comparing the location and the extent of the cortical representation during the lip movements in comparison to hand location in healthy and upper limb amputated participants.

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 amputees with and without phantom pain	Sig.*
Pain	functional Magnetic Resonance Imaging (fMRI) of brain	**In amputees with phantom limb pain, cortical area of activation during lip movement was displaced towards the hand area (by 10.67 ± 7.33 mm in somatosensory cortex and 5.84 ± 3.57 mm in motor cortex). In pain free amputees, area of activation during lip movement was symmetrical.**	++
		Cortical area of activation during lip movement was more symmetrical in group of extensive prosthetic users (myoelectric prosthesis used >8 h/day - MP group) than in the group of amputees that poorly used their prostheses (no prosthesis or a cosmetic prosthesis or myoelectric prostheses used <8 h/day – NMP group)	++
	Pain Intensity Scale (range, 0–6)	**The MP group showed an average phantom limb pain intensity of 0 ± 0, whereas the NMP group reported an intensity of 2.33 ± 1.53.**	++
		Reduction in phantom limb pain over time was significantly positively correlated with extensive myoelectric prosthesis use.	++
Satisfaction	Satisfaction with the prosthesis	Reasons given for discontinuation (typically in the first months after amputation) were preference for the intact arm and/or impracticability of the prosthesis, but never phantom limb or stump pain.	n.a.

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

Author's Conclusion

"This study showed that frequent and extensive use of a myoelectric prosthesis is correlated negatively with cortical reorganization and phantom limb pain and positively with the reduction in phantom limb pain over time. This suggests that the ongoing stimulation, muscular training of the stump and visual feedback from the prosthesis might have a beneficial effect on both cortical reorganization and phantom limb pain. The converse that increased phantom limb pain might have motivated patients to decrease prosthesis use, is unlikely because no patient reported increased phantom limb pain with prosthesis use or gave stump or phantom limb pain as reason for discontinuing prosthesis use. Our data are in accordance with animal experiments suggesting that behaviourally relevant tactile stimulation expands the cortical representation of the stimulated body region. Our data strongly suggest that extended use of a myoelectric prosthesis might reduce both cortical reorganization and phantom limb pain, a still relatively treatment-resistant disorder." (Lotzke et al. 1999)