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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 						
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	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 pros- thesis 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 \pm 0 8no pain), whereas the NMP group reported an intensity of 2.33 \pm 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		Activity	Participation Others		Others	
Mechanics	Pain	Grip patterns / Manual force dexterity	Activities of daily living (ADL)	Satisfaction and Quality of life (QoL)	Training Te as	echnical spect
Category		Outcomes	Results for a phantom pai	mputees with n	and without	Sig.*
Pain		functional Magnetic Res- onance Imaging (fMRI) of brain	In amputees with phantom limb pain, corti- cal 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 movement w of extensive prosthesis us in the group their prosthe metic prosthe used <8 h/da	of activation as more symn prosthetic use sed >8 h/day - of amputees t ses (no prost esis or myoele y – NMP grou	during lip netrical in group ers (myoelectric MP group) than hat poorly used nesis or a cos- ectric prosthese p)	++) 1
		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 was significa extensive my	phantom limb antly positively oelectric pros	o pain over time / correlated with thesis use.	++
Satisfaction		Satisfaction with the prosthesis	Reasons giver the first month ence for the ir of the prosthe stump pain.	n for discontinu is after amputa itact arm and/o sis, but never p	ation (typically in tion) were prefer- r impracticability shantom limb or	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)

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