Reference

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Determining skill level in myoelectric prosthesis use with multiple outcome measures

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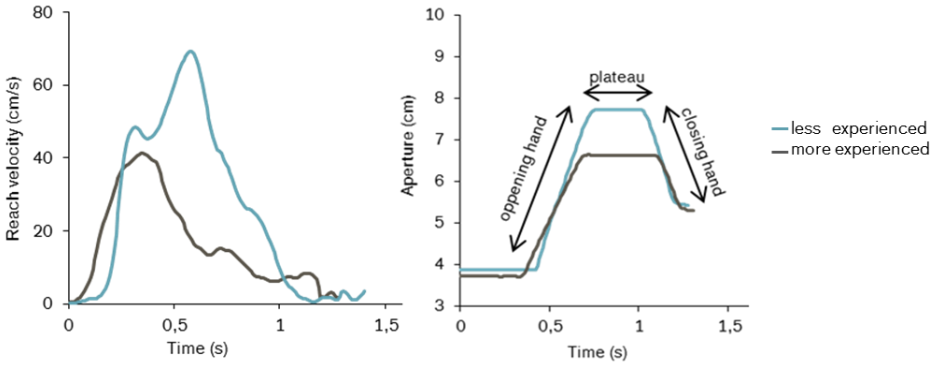
Products

Dynamic Mode Control hand, Digital hand, Motion control

Major Findings

→ Time is a key parameter when using an upper extremity prosthesis
→ Minimizing the time needed to reach and grasp an object should be a major goal of rehabilitation
→ More experienced prosthetic users are faster, have better grip force control and need less visual attention when using the hand

Reaching and grasping an object



In the figure the reach (left) and the grasp (right) of an object performed by experienced (grey) and less experienced (blue) prosthetic users are shown. Grasp time and plateau phase were shorter for the forearm prostheses.

Population

Subjects:	6 unilateral transradial patients
Previous:	3 Dynamic Mode Control hands, 2 Digital hands, 1 Motion control
Amputation causes:	2 congenital deformities, 3 traumas, 1 illness
Mean age:	36 ± 18 years (range 19-59 years)
Mean time since amputation:	10 ± 8 years (range 1-19 years)

Study Design

Observational (non-interventional) study:

To obtain more insight into how the skill level of an upper-limb myoelectric prosthesis user was composed, the study aimed to portray prosthetic handling at different levels of description, relate results of the clinical level to kinematic measures, and identify specific parameters in these measures that characterize the skill level of a prosthesis user. Six experienced transradial myoelectric prosthesis users performed a clinical test (Southampton Hand Assessment Procedure [SHAP]) and two grasping tasks. Kinematic measures were end point kinematics, joint angles, grasp force control, and gaze behaviour.

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 more and less experienced prosthetic users	Sig.*
Grip patterns /force	Southampton Hand Assessment Procedure (SHAP)	The highest scores were obtained in the spherical grip, whereas the participants scored the lowest on the tip grip. Patients who had better scores on SHAP showed overall better performance on kinematic measurements.	+
Mechanics	End point kinematics	More experienced prosthetics users are reaching the object faster with shorter plateau phase between reaching and grasping an object and they need less time to execute the task.	+
	Joint angles	The movement patterns were rather similar for all participants, except for the variation in the amount of shoulder abduction (more shoulder abduction was used to compensate for the lack of wrist movement in the prosthesis).	0
	Gaze behaviour	More experienced prosthetic users focus on the object most of the time during task execution. The less experienced ones focus on the object of interest only at the beginning of a task and on the prosthesis during the task execution.	+

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

Author's Conclusion

"In this study, we measured prosthesis use on different levels of description using clinical and kinematic measures. This study followed and extended the suggestion to combine several outcome measures, by not only measuring on a clinical, functional level, but also on more kinematic levels. The results provided a wide range of information. The clinical test (SHAP) was a good measure of skill level of the prosthesis user, whereas the fundamental measures provided deeper insight into the performance and skill level of the prosthesis users. Participants who scored higher on the SHAP showed less deviation in end point kinematic profiles from nondisabled movement patterns, with, among other factors, shorter movement times, higher peak velocities, and shorter plateau times in the aperture. Moreover, they showed better grip force control and less visual attention to the hand. The results show that time is a key parameter in prosthesis use and should be one of the main aspects of focus in rehabilitation. The insights provided by this study are useful in rehabilitation, because they allow therapists to specifically focus on certain parameters such as plateau time or visual control, which will hopefully result in the highest level of skill that can be achieved for that prosthesis user." (Bouwsema et al. 2012)