Reference

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Comparison of range-of-motion and variability in upper body movements between transradial prosthesis users and able-bodied controls when executing goal-oriented tasks

Journal of NeuroEngineering and Rehabilitation 2014, 11:132.

Products

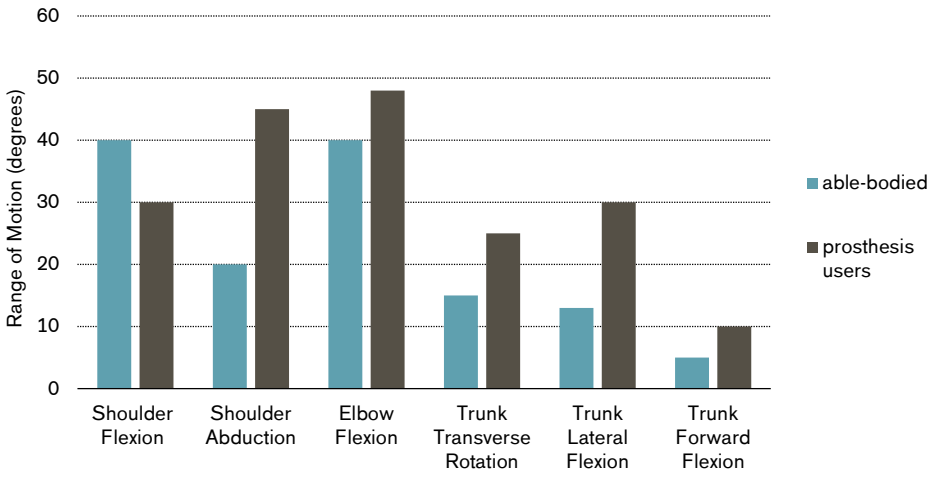
Myoelectric prosthesis

Major Findings

With myoelectric prosthesis users compared to able-bodied controls:

- → **Shoulder and trunk movements are common compensatory motions in prosthesis users.**
- → **Increased variability in movement suggests that prosthesis users do not stick to a defined motor strategy.**
- → **Kinematic repeatability may increase with prosthesis experience.**

Average range of motion for carton poring task



Upper body range of motion (RoM) was analysed on able-bodied controls and myoelectric transradial prosthesis users during execution of carton pouring task (lifting a carton, located at midline of the body, and emptying the liquid contents into a jar on the contralateral side with minimal spilling). Results indicate that prosthesis users demonstrate a significant increase in shoulder abduction, trunk transverse rotation, trunk lateral flexion and trunk forward flexion than able-bodied subjects.

Population

Subjects:	6 able-bodied controls 7 myoelectric transradial prosthesis users
Prosthesis:	System Electric Hand, MyoHand VariPlus Speed Hand, Transcarpal Hand, Motion Control Hand, i-Limb Ultra Revolution, i-Limb Ultra and i-Limb Hand
Amputation causes:	4 traumatic, 3 congenital
Mean age:	able-bodied individuals - 35 ± 11 year prosthetic users - 49 ± 18 years
Mean time since amputation:	9.5 ± 11.0 years

Study Design

Observational study:

Participants were requested to execute five goal-oriented tasks while seated (carton poring, page turning, food cutting, lifting and transferring weighted object, lifting and transferring tray). Able-bodied controls and prosthesis users performed these tasks using their non-dominant and prosthetic limb, respectively.

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 prosthesis users compared to able-bodied controls:	Sig.*
Mechanics	Goal orientated tasks: • carton poring • page turning • food cutting • lifting and transferring weighted object • lifting and transferring tray	The majority of prosthesis users were unable to routinely execute food cutting and page turning tasks.	n.a.
		Prosthesis users demonstrated a significant increase in shoulder abduction, trunk transverse rotation, trunk lateral flexion, and trunk forward flexion RoM when executing carton pouring, lifting and transferring tasks.	--
		No difference in shoulder and elbow flexion/extension RoM was observed.	0
		Kinematic variability was high for prosthetic users.	--
		Kinematic repeatability was low for prosthetic users.	--

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

Author's Conclusion

"Transradial prosthesis users utilize shoulder abduction and trunk movement as compensatory motions to execute goal-oriented tasks, and the majority of these motions are accompanied by increased kinematic variability when compared to able-bodied controls. The average repeatability of upper body kinematics was positively associated with prosthesis experience. As these dynamics may be necessary to compensate for the absence of active distal DoFs (degrees of freedom) in the prosthetic arm, transradial prosthesis users may benefit from dedicated training that: 1) encourages optimization of these dynamics to facilitate execution of ADLs, and 2) fosters adaptable but reliable motor strategies." (Major et al. 2014)