Learning to Control Opening and Closing a Myoelectric Hand

American Congress of Rehabilitation Medicine 2010; 91:1442-6

Virtual hand – PAULA; Myoelectric simulator; Table-top hand (acts like Sensor Hand Speed)

Prosthetic users differ in learning capacity which determines time needed to learn how to use myoelectric prosthesis.

Acquired control of a myoelectric hand is irrespective of the type of device used for training (PAULA/ simulator/ table-top hand).

PAULA software is as effective as tabletop hand and prosthetic simulator.

Graph shows peak velocities of opening and closing the hand reached in the post-test (after the training period) for the high capacity learners (HCL) and low capacity learners (LCL) plotted for each of the velocity conditions – slow, comfortable and fast. High-capacity learners could make a good distinction between the 3 different velocity conditions, whereas low-capacity learners could not make this distinction.

Subjects: 34 able-bodied participants
Previous: none
Amputation causes: none
Mean age: 21 years
Mean time since amputation: none

A randomized study:

After entering into the study, the subjects were randomized into three groups based on type of the training they will receive. On the first day a pretest was conducted. Afterwards, the subject’s control of the hand was trained on 3 consecutive days either by using virtual hand, tabletop hand or prosthetic simulator. After the last training session on the 3rd day, a posttest was administered to determine the level of
skill after the training. The pretest and the posttest test were the same and consisted of 2 parts: the participant was asked to first provide a maximum myoelectric signal for at least 2 seconds (this was repeated 5 times) and, second, to open and close the hand to the maximal aperture on 3 different velocities at command. Participants were asked to control hand opening and closing at the slowest speed possible, at a comfortable speed, and at the highest speed possible. All velocities were executed 3 times in a random order. When the hand was not fully opened or closed, the participants were corrected and instructed again.

<table>
<thead>
<tr>
<th>Category</th>
<th>Outcomes</th>
<th>Results for training with PAULA vs simulator vs table-top hand:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanics</td>
<td>Peak and mean velocity</td>
<td>Both peak velocity and mean velocity showed the same main effects.</td>
</tr>
<tr>
<td>Mechanics</td>
<td>Number of peaks</td>
<td>A large effect of the velocity conditions showed that in the slow condition the most peaks occurred, whereas in the fast condition the fewest number of peaks were shown.</td>
</tr>
</tbody>
</table>

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

**Author's Conclusion**

“In conclusion, learned control of a myoelectric hand does not depend on the type of training (with a virtual hand, an isolated hand, or a prosthetic simulator). Prosthetic users may differ in learning capacity, and this should be taken into account when choosing the appropriate type of control for each patient.” (Bouwsema et al. 2010)