

Functional Measures of Dexterous Fingertip Prosthesis

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BACKGROUND

Pointdexter, a dexterous fingertip terminal device, was designed to optimally combine the functions of prosthetic hands and hooks in a single upper-limb terminal device. Pointdexter adds an additional, selectable, dexterous grasp option focused on manipulating small objects. The current design is a two-tongued add-on to existing multi-articulating hands. The pointer finger on the hand is replaced with dexterous tongued end-effector in the fingertip and is driven with standard control signals.

AIM

Pointdexter adds dexterous function within the form and aesthetics of multi-articulating hands, where appearance is just as important as function in adoption of the prosthesis by the user (Billock 1986).

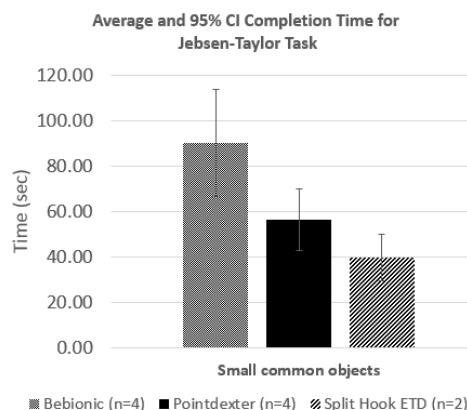
METHOD

LTI conducted an initial clinical evaluation of functional outcome measures to compare Pointdexter, a Bebionic hand, and a powered split-hook ETD. IRB approval and participant informed consent was obtained. Four persons (2 male, 2 female) participated in the study. Two with transradial limb absence and two using a prosthesis simulator. Subjects were trained users of myoelectrically controlled anthropomorphic hands. Subjects conducted functional measures consisting of the Jebsen-Taylor Hand Function tasks. The order of the three conditions (Bebionic hand, Pointdexter, ETD) were randomized for each subject.

RESULTS

Timed trials of the functional outcome measures were conducted with: Bebionic hand (Otto Bock), Hand with Pointdexter (LTI), and split-hook ETD (Motion Control). Participants practiced with each device accommodate learning effects associated with the administered tests. Subjects conducted multiple timed trials of each of the sub-tasks. The data (Figure 1) summarizes completion times for subjects manipulating small common objects. In these tasks, the hand was generally the slowest and the ETD the fastest, with the Pointdexter being faster than the hand.

The ETD performed best across all tasks and users; it is generally considered the most functional device tested. Pointdexter was able to emulate the precision of the ETD in manipulating small objects and improved the performance when compared to the standard hand. Variability was high and sample size too small for statistical analysis, so further testing will be required.



DISCUSSION AND CONCLUSION

Initial functional tests with the device are encouraging. Anecdotal feedback from users highlighted a desire for more precise, secure, and strong grip patterns in the multi-articulating hand. More design work is needed to improve strength and security of grasp in order to gain more split-hook functionality while still retaining the form-factor of a hand.

REFERENCES Billock J, Clinical Prosthetics and Orthotics 10(2):57-65,1986

ACKNOWLEDGEMENTS Supported by the NIH NICHD award R43HD090800. The content is solely the responsibility of the authors.