PIII.65 Dexterous Prosthesis and Structured Training Can Reduce Compensatory Movements in Upper-Limb Amputees

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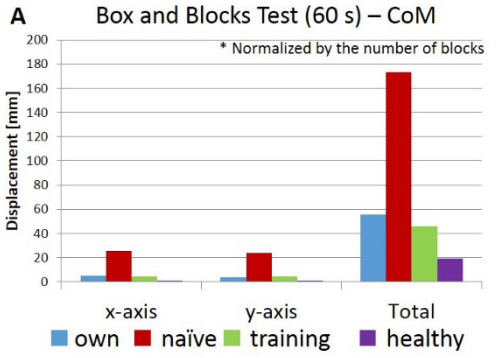
Following the loss of a limb, new myoelectric prosthetic users tend to develop a set of compensatory strategies in order to accommodate for missing degrees of freedom (DoFs) while performing daily activities. In time, these can lead to overuse of supporting anatomical structures and consequently result in chronic pain. Here, we investigated the full body compensations expressed by an experienced transradial myoelectric prosthesis user. We observed the displacement of the centre of mass (CoM) during the execution of two standard clinical assessment tests. The subject was asked to complete the clothes pin relocation test (CPRT) and box and blocks test (BBT) using a commercial single DoF myoelectric prosthesis that she had been using for over 20 years. In addition, we have provided the subject with an advanced prosthetic hand with active rotation and flexion/extension units, and two grip types. Using this new device, in two separate sessions, the patient completed the same clinical tests as with the commercial prosthetic system, immediately after receiving the new system and following a period of targeted structure rehabilitation prosthetic training. The patient was able to transfer 21 blocks using her own prosthesis, and only 3 when fitted for the first time with the advanced system. However, following training, the patient transferred 15 blocks with the advanced system. Similarly, the patient could relocate 3 clothes pins in 26.75 s using her prosthesis and did the same task in 62.06 s before and in 31.69 s after training with the advanced system.

RESULTS: shown in the panel A of the figure indicate an increased body compensation in the naïve advanced prosthetic session during the BBT, followed by a substantial decrease after the training. The CoM trace spread during the CPRT decreased with the introduction of the advanced prosthesis, particularly following training (panel C). At this stage, the observed CoM trace was similar to that observed in an able-bodied control subject. These preliminary results indicate that given the multi-articulated prosthesis, patients require training in order to match the performance of their own long-term devices. However, the effects of additionally available DoFs have an immediate impact on the reduction in unwanted full body compensatory movements.



B

Clinical Scores

	own	naïve	follow up
BBT [blocks]	21	3	15
CPRT [s]	26.75	62.06	31.69

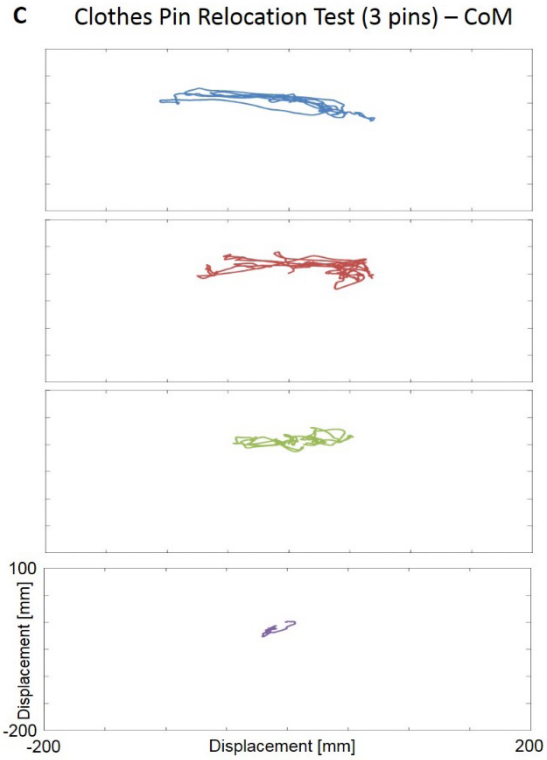


Figure – Results of Box and Blocks (BBT) and Clothes Pin Relocation Tests (CPRT) observed in a transradial myoelectric prosthesis user and a healthy control. **(A)** Normalized center of mass (CoM) displacements during BBT while using own commercial prosthetic (blue), first time upon receiving the advanced system (red) and following the structured training protocol (green). Healthy control (purple) is used as a reference. **(B)** Clinical scores for both CPRT and BBT. **(C)** Spatial displacements of CoM during CPRT in the all four aforementioned cases