

EFFECTS OF NOVEL TOOL USE: CORTICAL AND FUNCTIONAL MEASURES IN CHILDREN USING A PROSTHETIC SIMULATOR

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As of 2005, there were a total of 1.6 million people living with the loss of a limb, with this population projected to double to 3.6 million by 2050 [1]. While prostheses aim to enhance the function of these individuals, it is estimated that 45% of pediatric prosthetic users reject their prosthesis [2]. The literature which describes the neurological control mechanisms of prosthetic use is sparse and often low-powered due to an inadequate number of participants. However, prosthetic simulators may be a solution to chronically low-powered prosthetic-centric studies by serving as functional homologues, though this has yet to be tested. The purpose of this study was to determine if prosthetic simulators can accurately emulate the neurological and muscular response to the use of an actual prosthesis. Children with upper limb deficiencies (ULD) and typically developing (TD) children were tasked with performing the box and blocks test and were asked to move as many blocks from one side of a partitioned box to the other. Functional near-infrared spectroscopy (fNIRS) measured the overall neurological response as well as hemispheric activity differences within the brain during the use of the prosthetic simulator and the actual prosthesis during the task. Electromyography (EMG) measured muscle activity and was used to calculate the coactivation index of the flexor carpi ulnaris and extensor digitorum muscles. This index describes the level of motor control within the upper limb, with higher indexes indicating opposing contractions and a lack of control, often seen in prosthesis users [3].

1. K. Ziegler-Graham, et al. *Arch. Phys. Med. Rehabil.*, **89**, 3, 422–429, 2008
2. E. A. Biddiss *Prosthet. Orthot. Int.*, **31**, 3, 236–257, 2007.
3. J. Zuniga et al. *J NeuroEngineering Rehabil* **15**, 48, 2018