A NOVEL APPROACH TO VISUALISING UPPER LIMB ACTIVITY IN MYOELECTRIC PROSTHESIS USERS

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ABSTRACT

There are reports in the literature suggesting that around 30% of people prescribed myoelectric prostheses reject their device. Further, there is limited and often rather ill-defined data on usage in people who do not reject their prosthesis. To date, the only method of determining real-world prosthesis usage has been through self-report. Self-report is subject to inaccurate and potentially biased recall and provides, at best, average usage data. The lack of high quality data on real world use of prostheses is very surprising, given one of the core purposes of providing a prosthesis is to restore upper limb function in everyday life.

Activity monitoring offers a method to objectively characterise upper limb activity outside of the clinic. Wrist-worn activity monitors, comprising of tri-axial accelerometers, have been used successfully on numerous occasions to assess the upper limb activity of healthy anatomically intact people and, for example, people recovering from a stroke. Despite the obvious potential to quantify upper limb movements, the use of activity monitors for the assessment of people with upper limb absence has been surprisingly underexplored.

Recently we published the first data using activity monitors to quantify myoelectric prosthesis use [1]; however, the data visualisation method was limited in scope. Arbitrary values were introduced for unilateral activity, a natural log of the usage ratio was taken making interpretation difficult, and temporal patterns of prosthesis usage were not considered. Based on methods which have previously been used for the time series visualisation of whole body activity data, we have developed a new method for displaying upper limb activity. This method uses spiral plots with graduated colours to display the percentage contribution of each upper limb to activity over a week long period. Using this method it is possible to quickly identify the level of symmetry in a person's arm activity, and distinguish patterns of activity between users.

Here we present data recorded from trans-radial myoelectric prosthesis users who report to be both satisfied and dissatisfied users of their prostheses. Participants wore Actigraph GT3X+ monitors on both wrists (anatomical and prosthesis) for a seven day period.

Spiral plots allow for quick identification of patterns in prosthesis use throughout the week; this could be beneficial to both clinicians and researchers. Furthermore, there is the future potential with this method to overlay additional data, such as self-reported wear, or activations of the hand.

[1] Chadwell et al. (2016); Frontiers in Neurorobotics; 10:7