Measuring postural transitions using wearables

Postural transitions i.e. the way which we stand up or sit down are complex motor tasks that can be used to measure physical function. Currently these transitions, which can be classified as sit-to-stand (SiSt) or stand-to-sit (StSi), are mainly assessed by an observer using a stopwatch to calculate the time taken to complete a single or multiple transitions. Even when administered by specialist health professionals such as physiotherapists or physical therapists, this leads to observer discrepancies, limiting the quality of results and the clinical utility of the information.

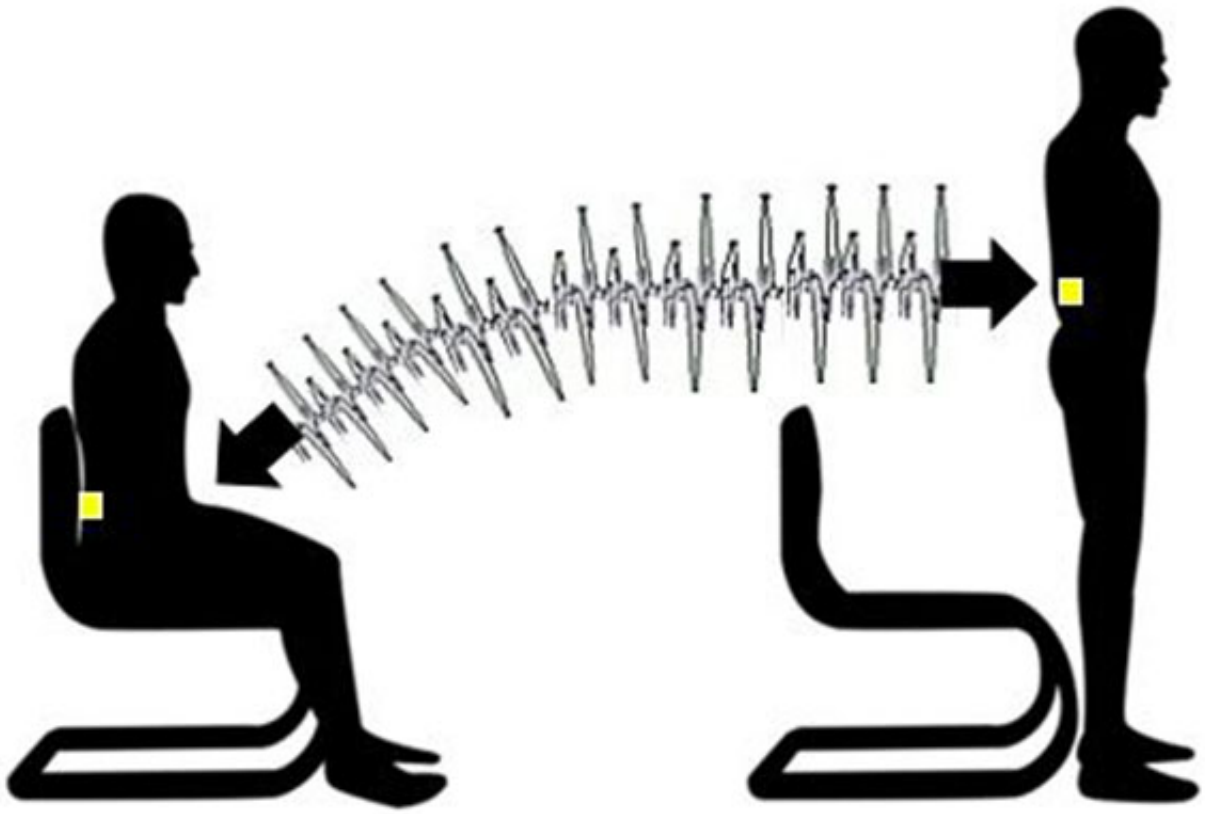

Fig. 1.

Advances in wearable sensing allows unobtrusive devices to provide more objective measures of postural transitions, helping to eliminate human-error. Wearables using multiresolution algorithm techniques (e.g. wavelets) can identify and quantify transitions from accelerometer data. Although preliminary research has demonstrated feasibility of this method, a ‘one size fits all’ approach has been employed. This study aimed to assess a range of algorithm techniques to see if a more optimal combination existed that would improve both detection and quantification of SiSt and StSi

transitions.

Eighty participants (40 younger and 40 older adults) completed three SiSt and three StSi transitions on different chair types in a controlled laboratory environment. A single wearable was worn on their lower back. Video recordings of the transitions were used as a reference measure to validate transition detection and duration.

What results suggested was that detection of transitions was excellent (up to 97%) regardless of multiresolution algorithm used. However, the calculation of transition duration was different between algorithms and must be the subject of further investigation. Interestingly, there was little difference in the performance of the algorithm when comparing groups or chair types, suggesting robustness across different testing conditions. Importantly, it has been shown that the use of a single algorithm type was insufficient to identify both SiSt and StSi transitions. Therefore, the previous ‘one size fits all’ approach can be deemed insufficient.

As research continues to explore the utility of wearables for informing clinical rehabilitative practices, it is important to robustly validate the algorithms that are being employed. This study has sought to identify a more robust method of detecting postural transitions using a single wearable. Future research should also attempt to apply these practices in uncontrolled environments and in pathological groups to truly test its utility.

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