

A novel method to detect differences in start behavioural conditions of anterior reaching activity.

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Introduction: Anticipatory postural adjustments (APA) are unconscious activities that precede voluntary movements and actively contribute to them. Previous studies have underlined the differences in APAs under different start behavioural conditions[1,2]; all these results have been obtained even without a defined method to differentiate between APA and focal movement[3–6]. Our aim is to detect differences in APAs under different behavioural conditions with a novel method to distinguish the onset of voluntary movement.

Methods: We obtained informed consent and evaluated 9 healthy subjects (age 22±2; gender 5 females). Subjects were standing and performed a standing anterior reaching of a cylinder at 117 cm of height from the ground and at the 100% of the arm length. The subjects performed 3 repetitions of the movement for each of the two behavioural conditions: a reaction-time start (external trigger), and a self-placed start (free start). The behavioural conditions were randomly given to the subjects. We used a BTS SMART-DX400 (with 8 cameras, 28 markers[3] and 1 on the cylinder) and a BTS FREEMG 300, with 8 channels measuring bilaterally: tibialis anterior, biceps femori, rectus of the abdomen and lumbar paravertebral muscles. The voluntary movement onset is defined as the moment in which the hand moves for the last time towards the object, according to the evaluation of the displacement of the markers on hand and object. Data analysis was performed in MATLAB environment. For the statistical analysis, we verified the null hypothesis of samples drawn from a normally distributed population, we compared the variance with the Flinger-Killeen test.

Results: The results are shown in table 1.

Table 1 Summary of the main results. Values expressed as pValue for T-test, F for F-test. pValue for Flinger-Killeen.

	T test	F test	Fligner-Killeen
Δt (voluntary movement-hand movement)	0.008	3.739	0.011
sEMG activation area right Erector Spinae	0.000	0.076	0.026
sEMG RMS right Erector Spinae	0.000	0.113	0.034
sEMG maximal activation right Tibialis Anterior	0.000	0.249	0.001
sEMG Maximal activation left Tibialis Anterior	0.000	0.379	0.012
sEMG RMS left Tibialis Anterior	0.000	0.092	0.001

Discussion: Regarding the statistical analysis of the obtained data, the length of APA in markers signals is greater for trials with a self-placed start then for those with external trigger. On the contrary, EMG signals showed shorter muscle activation for the latter, and this is also confirmed by the value of the area subtended by the signals during the activation period. This results are in line with the current literature[1,2,7]. The method used to identify the voluntary onset showed encouraging results. The main advantage of not depending on arbitrary trigger but being a subject-tailored method that has shown an interesting repeatability. The preliminary results should suggest to apply this method in clinical context.

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