ISEK Abstract: Submission Jan 18th 2017

Title

Auditory rhythmic cueing changes muscle synergies during walking in people with Parkinson's disease: A pilot study

Submission format:

BACKGROUND AND AIM: PD is characterised by motor dysfunction such as gait impairment, which increases the risk of falls and disability [1]. Atrophy of dopaminergic neurones in the substantia nigra leads to loss of automaticity during walking [2]. Functional benefits of automaticity include improved dual task performance. Auditory rhythmic cueing (ARC), a rehabilitation technique, may normalise stepping through auditory feedback [3] and promote motor learning to improve gait function. However motor control strategies associated with ARC are unknown. This study aims to analyse lower-limb muscle synergies during walking with ARC which may reveal motor control strategies employed by people with PD. **METHODS:** Data analysis was performed on a subsample of 16 participants (8 healthy older adults (HOA) (74 ± 7 years, 47% female) and 8 with PD (70 ± 4 years, 37% female) drawn from a larger study. Wireless surface electrodes (Cometa, Bareggio (MI) Italy) measured lower limb muscle activity bilaterally from two groups: dorsiflexors (tibialis anterior) and plantarflexors (medial gastrocnemius, lateral gastrocnemius and soleus). Participants walked overground for 300 seconds in alternating 30 second bouts of usual walking (UW) and ARC walking. Muscle synergies were determined using non-negative matrix factorisation and the number (NVAF) calculated that accounted for 90% of overall variance [4]. **RESULTS:** Non-parametric tests showed no significant differences ($p>0.05$) in NVAF between the PD group (3-6 NVAF) and HOA (3-5 NVAF) during UW. NVAF increased in 3 participants with PD, who had greater fear of falling scores, when ARC was applied during walking whilst no increase was observed in HOA. The plantarflexors had greatest weighting on synergies 1 and 2, whilst the dorsiflexors contributed most to synergies 3 and 4 in both groups and walking activities. A change in muscle weighting on the first 2 synergies was observed in the PD group, with right plantarflexors dominating during UW changing to left plantarflexors during ARC walking. **CONCLUSIONS:** Given that 4 muscle groups were analysed, 4 synergies were expected to account for 90% variance. Increased NVAF following ARC suggests ARC promotes more complex motor strategies to normalise stepping in people with PD. Results suggest that individuals with higher fear of falling scores benefit most from ARC. The change in composition of the first 2 synergies in the PD group during ARC walking suggests asymmetry is targeted, which is commonly present in PD. Analysis of the remaining experimental cohort will provide higher power for more robust statistical testing.**REFERENCES:**1.Bloem et al.(2004).Mov Disord,**19**(8),871-884.2.Redgrave et al.(2010).Nat Rev Neurosci,**11**(11),760-772.3.Mak & Hui-Chan.(2008).Mov Disord,**23**(4),501-9.4.Chvatal& Ting.(2013).Front Comput Neurosci,**7**,48.