at more advanced phases. Whereas, locomotor tasks which imply the transition from a condition to another were able to evidence significant abnormalities. The quantitative analysis of these transient locomotor tasks might therefore potentially provide markers for a precox differential diagnosis respect other neurodegenerative diseases characterized by parkinsonisms.

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Parkinsonian patients walking on treadmill: A comparative surface EMG study

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1. Introduction

Treadmill training is ever more utilized in neurological rehabilitation because it may offer a unique intervention modality to complement conventional therapy. In Parkinson's disease (PD), only a few investigations have examined the potential utility of treadmill training [1,2]. These studies have demonstrated an improvement of gait speed, cadence, stride length, swing time and stride variability. The theoretical basis of a treadmill training efficacy on PD gait represents an interesting and rarely pursued goal for knowledge [3]. We have performed the following study by aiming to observe and compare over-time modifications of lower limb muscle activation during a treadmill 30-min walk with respect to over-ground gait in PD subjects.

2. Methods

Fifteen subjects suffering from idiopathic PD (mean age: 63.4 ± 4.3 yy) have been tested in the walking ability at their own comfortable speed over-ground and at the same velocity on treadmill, in ''ON-medication'' condition. Surface EMG muscle activity has been monitored after 5, 15, 20, 25 and 30 min of treadmill walking. A series of over-ground walks at comfortable speed has been recorded immediately after the treadmill training. Seven PD subjects were in early-moderate stage (=I–II Hoehn and Yahr stage) and the remaining eight were in advanced stages group (=III–IV Hoehn and Yahr stage). We have been using the TELEMG (BTS-Italy) system for motion analysis and have been monitoring activity of vastus lateralis (VL), biceps femoris caput longus (BF), tibialis anterior (TA) and gastrocnemius medialis (GCm). Ten control subjects underwent the same protocol thus providing comparison values. The main outcome measures were over-ground walking speed, gait cycle (GC) duration, swing duration (% of GC), time at the muscles activation peak (% of GC). A multivariate analysis of variance for repeated measures has been exploited for data analysis.

3. Results

Parkinsonian patients in the advanced stage of disease walking on treadmill decreased significantly gait cadence with respect to over-ground gait, controls and patients in early-moderate stages. Moreover, advanced PD patients showed a delay in BF and VAS peak timing during treadmill walking with respect to over-ground gait and with respect to the other groups. GCm activity ending and TA peak delayed with respect to over-ground peak timing significantly in both the PD groups with respect to over-ground gait and healthy subjects. No changes in GCm starting and peak timing have been found. These changes persisted over-ground acutely after the treadmill training. No changes have been found in the control group.

4. Discussion

Advanced parkinsonian patients showed, on treadmill, different gait temporal parameters from those presented over-ground: cadence is lower than that performed over-ground, although subjects walked at the same velocity. We argue, consequently, that parkinsonian stride length increased. Under L-DOPA effect, earlier PD patients acted as controls, showing minimal and non-persisting changes on treadmill with respect to over-ground walking. The treadmill seems to act specifically on parkinsonian patients in advanced stage. Advanced PD patients present specific L-DOPA resistant axial symptoms which have been sensible to treadmill as it may work as an external cue. Consequently, treadmill training may be a feasible and efficacious therapeutic option in advanced PD rehabilitation.

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