Results.– The dynamic EMG has allowed us to confirm that anticipated contractions of the paravertebral muscles (preceding the deltoid muscles contraction) are for 90% of our population, correlated with a APA: a shift in Y is observed in the stabilometry monitoring. This APA shows a backward shift of the center of gravity, of 3.98 mm in average on the Y-axis due to the requested movement. The remaining 10% of healthy subjects without APA do not have either anticipated paravertebral recruitment, observed by EMG.

Conclusion.– This stabilometry approach of APA which measures the anticipatory movement of paravertebral muscles when extending upper-limbs gives us a sensitive and specific tool. Its systematic usage in the caring of lombalgie patients is under study.

http://dx.doi.org/10.1016/j.rehab.2013.07.356

P003-e

Hip-ankle coordination strategy of stroke patients in dynamic condition

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Keywords: Frontal postural strategy; Hemiplegia; Double inverted pendulum; Hip and ankle relative phase; Anti-phase pattern; Preferential motor coordination

The aim of this Master’s thesis is related to the postural behaviour in quiet standing of stroke patients with hemiplegia in static and dynamic condition. The human quiet stance is often modelled as a single-link inverted pendulum pivoting only around the ankle joints in the sagittal plane. Several recent studies have shown that this single-link inverted pendulum doesn’t take into account simultaneous ankle and hip movements. In order to show specific ankle-hip coordination, we decided to use a tri-pendulum model (quite similar to the double-link inverted pendulum model). This study looked in particular at the frontal plane because hemiplegic standing is more largely disturbed in this plane.

To do so, the measurement protocol used is based on a dual-plate force platform and 3D movement capture system coupling. Twelve stroke patients with hemiplegia and a control group (forty one subjects) participated to this study. In the static evaluation, stroke patients present an increased ankle and hip range of motion, and a preferential hip-ankle angular variation in anti-phase pattern in the two planes is observed for all participants (without excluding the existence of a hip-ankle in-phase pattern). In the dynamic evaluation, during the central ball avoidance test, only stroke patients who can attest a preferential motor pattern produced a hip-ankle anti-phase pattern in the frontal plane contrary to the control group (who also have a behaviour in-phase but to a lesser extent). All this data has enabled us to show the relevance of this model in the frontal plane.

It would be interesting to carry out this study further and include a larger number of subjects and determine the relevance of this variable (relative phase) both in the evaluation and its integration into rehabilitation approaches through biofeedback and virtual environment techniques.

http://dx.doi.org/10.1016/j.rehab.2013.07.357

P004-e

Balance assessment of hemiplegic subjects on a robotic dynamic posturography platform “IsiMove”

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Keywords: Balance; Hemiplegia; Dynamic platform; Robotic

Objectives.– Balance disorders are common in hemiplegia and can be assessed in clinical or instrumental way on force platforms. The aim of this study is to show preliminary results of balance evaluation in hemiplegia patients tested on a new robotic dynamic posturography platform: “IsiMove”.

Patients.– Ten healthy subjects (age: 51(26), 5 females and 5 males) and ten hemiplegia patients (age: 57(30), 6 females and 4 males) were selected. Six of them have right-sided hemiparesis and all of them can stand without assistance.

Methods.– The study was done in the Neuro-orthopedic rehabilitation service of Rothschild hospital (APHP). The “IsiMove” platform is a robotic dynamic platform designed by the Institut des Systèmes Intelligent et de Robotique (ISIR-UPMC) and developed by AssistMov society. The experimental protocol performed on the IsiMove consists of five exercises. Each exercise consists of a sequence of movements: rotation around X axis and Y axis, translation around Y axis, rotation around Z axis and translation around X axis. Each movement was performed in 10 s. But performed at various frequencies: 0.1 Hz, 0.2 Hz, 0.3 Hz, 0.4 Hz and 0.5 Hz, in which the subjects must stand still, eyes open, without leaning on the side bars.

Results.– For analysis results we used the main dynamic parameters. The Equilibrium Score (ES), a modified Postural Instability Index (PSI) and the Right-left forces ratio on feet. The results of the first two parameters were not relevant, probably because the movement of the platform during the protocol was not disturbing enough. However, the right-left force ratio has allowed us to characterize the support asymmetry among patients, and the behaviour difference between healthy subjects and subjects with hemiplegia.

Discussion.– This is the first experience using a robotic dynamic posturography platform. New protocols more disturbing with random velocity are necessary for equilibrium analysis. In addition, these protocols could be applied to the evaluation of other pathologies as well as to their rehabilitation.

http://dx.doi.org/10.1016/j.rehab.2013.07.358

P005-e

Influence of two modes of visual deprivation on postural stability and gait in healthy subjects

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Introduction.– Three main systems are involved in postural stability: vestibular, visual, proprioceptive. It is known that “visual dependence” concerns many healthy subjects (excessive reliance on the visual afference, even when it is not available or provides inaccurate information). Balance rehabilitation without visual information can be conducted either with eyes closed or open in the dark. These conditions do not have the same impact on posture when recorded on platform [1]. There are no studies about the impact of these conditions on gait.

Objectives.– Observe any differences in the gait when subject’s eyes are closed (EC) or open in darkening glasses (EODG).

Materials and methods.– 1-Recruitment: 18 healthy subjects (20-40 years). 2 - Procedure: Gait analysis on GAITRite walkway. The analysis focuses on the speed, stride length, the double stance time, the deviation from the axis of walking, FAP score (average of three recording).

Results.– There was a significant difference (Wilcoxon test) between the two conditions, walking under EODG condition being more difficult than under EC condition: increase of the double stance time (30 vs 28%: P = 0.002), decrease of the speed (99 cm/s vs 107, P = 0.002, increase of the deviation (5.13 vs 4.76), P = 0.03).