

## EVALUATION OF POSTURAL STABILITY AND ITS RELATION TO ISOKINETIC PERFORMANCE IN PERSONS WITH CEREBRAL PALSY

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**KEY WORDS:** postural control, cerebral palsy, isokinetics

**INTRODUCTION:** There are several studies targeting to the functional evaluation of lower extremities in Cerebral Palsy (CP). However there is lack of information concerning the relationship of lower-limb weakness and certain limitations in functional abilities like postural stability (Mauishi et al. 2001; Engsborg et al. 2000; Nardone, 2001; Wiley and Damiano, 1998; Damiano and Kelly, 1995). The main purpose of this study is to determine the level of neuromuscular potential, assessed by isokinetic tests and its relation to postural stability in persons affected by different types of CP.

**METHODS:** A sample of twenty three subjects ( $21.3 \pm 8.9$  years) with different symptoms of CP (tetraparesis with ataxia, tetraparesis with athetosis, tetraparesis with spasticity, diplegia with spasticity, right and left hemiplegia, right and left hemiparesis) performed a bilateral knee flexion/extension concentric test on an isokinetic device (BIODEX System 3 Pro) at the levels of angular speed 60°/s, 210°/s and 360°/s at a frequency of 100 Hz. Their performance was assessed by means of the Peak Torque (PT) and their Bilateral (BD) and Reciprocal Deficit (RD). On the other hand their Postural Stability has been evaluated by means of the Romberg's Neuromuscular Test (eyes open) during 40 sec using a strain-gauge force plate (DINASCAN 600M) at a sampling rate of 100 Hz. The estimated error of the anterior/posterior and medial/lateral coordinates of the Center of Pressure (CoP) was 1mm. Position-time data concerning CoP were treated using the package "Generalized Cross/Validatory Spline" (Woltring, 1986) according to the true predicted mean-squared error developed in MATLAB 5.3. Postural stability was parameterized in terms of RMS of CoP displacements, range of CoP displacements, length of CoP path and mean velocity.

**RESULTS AND DISCUSSION:** The obtained results confirmed high level of (BD) and moderate level of (RD) in the low extremities. Besides, the results exemplified statistically significant correlations between postural stability, expressed in terms of the CoP path length and mean velocity, and, bilateral concentric knee flexion/extension. More concrete, the CoP path length and mean velocity are correlated with (PT) at the three levels of angular velocity for both right (R) and left (L) knee flexors (FL) and extensors (EX) according to the next:

$$\begin{aligned} &L_{360^\circ/s}^{EX} (p < .007; r = -.573), L_{210^\circ/s}^{EX} (p < .007; r = -.568), L_{60^\circ/s}^{EX} (p < .001; r = -.665) \\ &R_{360^\circ/s}^{EX} (p < .005; r = -.584), R_{210^\circ/s}^{EX} (p < .007; r = -.572), R_{60^\circ/s}^{EX} (p < .001; r = -.674) \\ &L_{360^\circ/s}^{FL} (p < .031; r = -.471), L_{210^\circ/s}^{FL} (p < .034; r = -.464^*), L_{60^\circ/s}^{FL} (p < .006; r = -.583) \\ &R_{360^\circ/s}^{FL} (p < .016; r = -.520), R_{210^\circ/s}^{FL} (p < .014; r = -.527), R_{60^\circ/s}^{FL} (p < .004; r = -.604) \end{aligned}$$

It is obvious that the greater the (PT) corresponding to the knee flexors and extensors concentric contraction the better the postural stability for the subjects. These results corroborate the findings of a previous study which confirmed better postural stability in better performance in vertical countermovement jump (Gianikellis et al. 2002) in (CP). Finally, the results suggest the use of isokinetics to improve postural stability in persons with CP, however more studies should be elaborate to establish specific training programs.

### REFERENCES:

Gianikellis, K., Bote, A., Pérez, A., Pulido, J.M<sup>a</sup>. (2002). Postural stability in persons with cerebral palsy and its relationship with the performance in vertical jumping. In *Proceedings of the XX<sup>th</sup> International Symposium on Biomechanics in Sports*. Edited by K.E. Gianikellis. Universidad de Extremadura. 543 - 546.