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Symmetry of Lower Limbs Kinematics in Children with Hemiparetic Cerebral Palsy performing Sit-to-Stand Movement – Pilot Study

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INTRODUCTION

Asymmetrical behavior during sit-to-stand (STS) movement has been assumed in individuals with impairments¹, such as children with Cerebral Palsy (CP). Therefore, the purpose of this study was to verify symmetry between the affected and non-affected lower limbs of children with hemiparetic CP.

METHODS

Seven children with spastic hemiparetic CP, level I and II according to GMFCS (5 girls and 2 boys, age: 8.0±2.2years), participated in this study.

Sixteen non co-linear retro-reflective passive markers (10mm diameter) were placed at specified anatomical landmarks². In the beginning, both feet were symmetrically positioned with shoulder width apart. Children performed five trials of the STS movement at a self-selected speed.

The software Dvideow was utilized to track the marker coordinates. For data analysis, the 3D coordinates for each marker were submitted to the software Matlab. Moreover, the local coordinate systems were defined according to the International Society of Biomechanics^{3,4}. Ankle, knee and hip angles were evaluated in the beginning and ending of STS movement, in the three planes of motion. Also, maximum and minimum angles, excursion and range were also analyzed.

We considered asymmetry as a statistic significant difference in the kinematic parameter value between both lower limbs. Differences were investigated using a paired t-

test at an alpha level of 0.05. Moreover, a symmetrical index (SI) of kinematic parameters was calculated: $[(Affected - Non-affected) / 0.5(Affected + Non-affected)] \times 100\%$ ¹.

RESULTS AND DISCUSSION

Data analysis showed that the affected limb presented higher knee peak abduction - higher minimum value in frontal plane (p=0.04; SI=45) - and ankle range for inversion-eversion movements - higher range in transverse plane (p<0.01; SI=39) - when compared to the non-affected limb.

Considering that children evaluated in the present study had a mild level of functional impairment; we believe that the asymmetry were found only for variables related with fine motor control characteristics. The motions in frontal and transverse planes during STS movement performance were related with the ability to assist side-to-side centre of mass stability and, therefore, could affect the control of the forward motion of the body; especially in individuals with unilateral impairment such as children with hemiparetic CP⁵. Therefore, we believe that children with hemiparetic CP may present a decreased control of rotations in frontal and transverse planes in the affected limb, which could be compensated with the non-affected limb.

CONCLUSION

Children with CP with mild level of functional impairment presented asymmetry during STS only for variables related with side-to-side center of mass stability.

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REFERENCES

1. Patterson, K.K., et al. Evaluation of gait symmetry after stroke: a comparison of current methods and recommendations for standardization. *Gait and Posture*, 31:241-246, 2010.
2. Kadaba, M.P., et al. Measurement of lower extremity kinematics during level walking. *Journal of Orthopedic Research*, 8:383-392, 1990.

3. Wu, G., et al. ISB recommendation on definitions of joint coordinate system of various joints for the reporting of human joint motion—part I: ankle, hip, and spine. *Journal of Biomechanics*, 35:543–548, 2002.

4. Grood, E.S. and Suntay, W.J. A joint coordinate system for the clinical description of three-dimensional motions: Application to the knee. *Journal of Biomechanics Engineering*, 105:136–144, 1983.

5. Gilleard, W., et al. Rising to stand from a chair: Symmetry, and frontal and transverse plane kinematics and kinetics. *Gait & Posture*, 27:8–15, 2008.

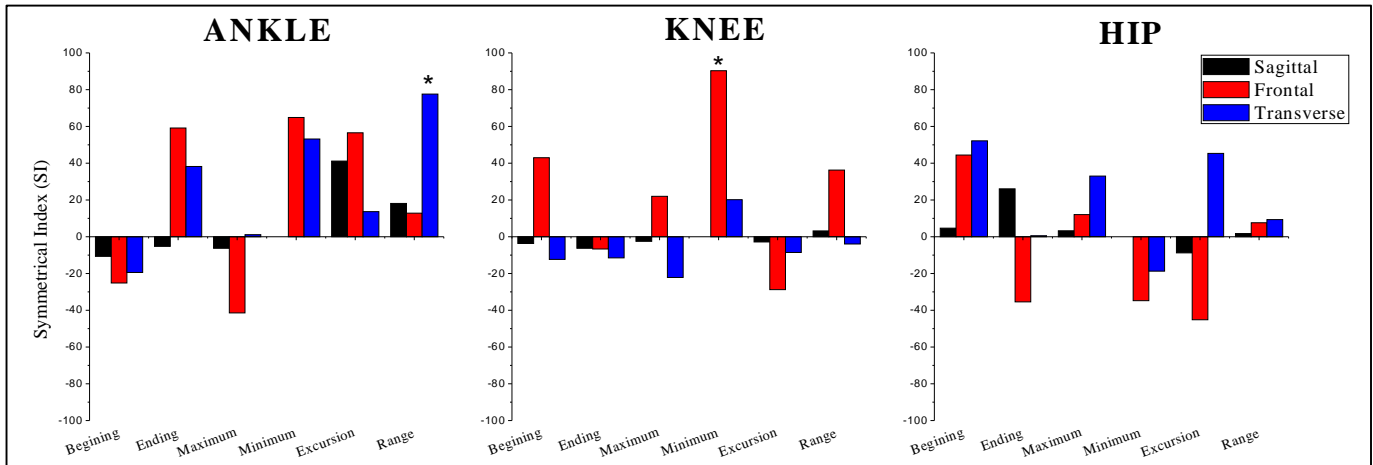


Figure 1 – Symmetrical index between affected and non-affected lower limbs