POSTURAL CONTROL AND POSTURAL MECHANISMS IN OBESE AND CONTROL CHILDREN.

[1,2]Julie Nantel, [1,2]Hugo Centomo and [1,2,3]François Prince

[1] Department of Kinesiology, University of Montreal, Canada
[2] Gait and Posture Laboratory, Marie Enfant Rehabilitation Center, Montreal, Canada
[3] Department of Surgery, Faculty of Medicine, University of Montreal, Canada
email: francois.prince@umontreal.ca

INTRODUCTION

The obesity is in constant increase since the last two decades and the problem is taking epidemic proportion in children [1]. Only few investigators looked at the possible effects of the obesity on the postural control in children. The two principal variables generally assessed in postural balance control are the center of pressure (COP) and the center of mass (COM). To control the equilibrium of the body during quiet standing, the COP must oscillate either side of the COM [2]. Furthermore, Winter et al. [2] demonstrate that postural equilibrium, for healthy adults, was regulated by two different mechanisms according to the observed direction of oscillation. In the anterior-posterior (A/P) direction, the COP_{net} is mostly controlled by an ankle strategy called COP_c. In the medio-lateral (M/L) direction, COP_{net} is controlled by the hip abductor and adductor muscles and it is called hip strategy (COP_v) and more specifically a load/unload strategy. The purpose of the present study is to compare the postural control between obese and non obese children during quiet standing and to assess degree of maturation compare to adult population.

METHODS

Nine non obese children (mass: 32.5; SD: 8.9kg) and nine obese children (mass: 54.1; SDd: 16.6kg) aged between 8 and 13 years participated in the study. The criterion for obesity was a BMI above 95e percentile for the age. Subjects were instructed to stay as still as possible in upright position with a comfortable width between the feet. Two trials of 120 seconds were collected at 60 Hz on two dynamometric force platforms (AMTI). The root-mean-square (RMS) of the centre of pressure velocity (V_{COP}) and RMS amplitude of load/unload mechanism (COP_v), the COP mechanism (COP_c) and the COP_{net} in the A/P and M/L directions were calculated. Finally, the contribution (in %) of the COP_v and COP_c to the COP_{net} was also estimated. Data were also compared to adults[2]. Statistical analysis was realized with a one-way ANOVA. The statistical significant level was set at $p < 0.05$.

RESULTS AND DISCUSSION

Figure 1 shows that the RMS amplitude of the COP_v in the M/L direction was significantly superior in the obese group (X: 4.7; SD: 1.8mm) compared to control (X: 2.4; SD: 1.1mm). The RMS amplitude of the COP_{net} in the M/L direction was also larger in obese children (X: 4.8; SD: 1.7mm) than in control (X: 3.1; SD: 1.4mm) indicating that obese children could have problem with there postural balance. The contribution of the COP_v on the COP_{net} in the M/L direction was significantly different (X: 96.8; SD: 4.5%) for obese children compare to (X: 78.7; SD: 24.5%) the non obese children. Finally, the V_{COP} in the M/L direction was statistically smaller in the obese group (X: 5.8; SD: 0.9mm/s) when compared to the control group (X: 9.85; SD: 4.7mm/s). No difference was found in any of the parameters in the A/P direction. In regards to the COP_v contribution to the COP_{net} (96.8%) and to the V_{COP} in the M/L direction (5.8 mm/s), obese children demonstrated a more mature postural control, much like the adults population [2], than the non obese children. However, because of there larger COP_{net} amplitude in M/L direction (Figure 1), obese children could be more at risk of falls than normal-weight children.

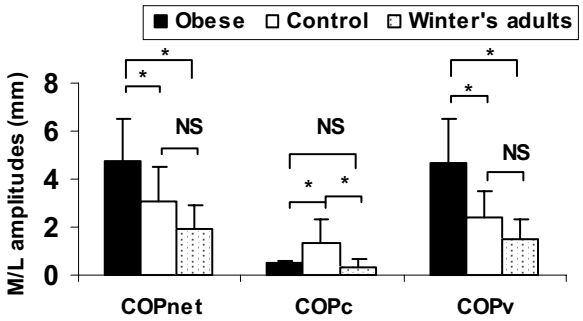

Figure 1: RMS amplitudes of COP_{net}, COP_c and COP_v in M/L direction for the obese and control children. * $p < 0.05$, NS = not significant.

CONCLUSIONS

Results showed a difference in the postural control of the obese children compare to non obese in the M/L direction. Indeed, the contribution of the COP_v to the COP_{net} was more pronounced in the obese group, indicating an increased involvement of the abductor/adductor muscles to achieve postural stability. Notwithstanding, because of their higher body inertia obese children have difficulty to control there equilibrium.

REFERENCES

1. Weiss R et al. Obesity and the metabolic syndrome in children and adolescents. N Engl J Med 35, 2362-74, 2004.
2. Winter DA et al. Medial-lateral and anterior-posterior motor responses associated with centre of pressure changes in quiet standing. Neurosci Res Commun 12, 141-8, 1993.