QUIET STANDING BALANCE IN PRE-ADOLESCENT GIRLS AND WOMEN

Verkindt, C[1*]., Dalleau, G. [1], Leroyer, P. [1], and Allard, P. [2]

[1]CURAPS - DIMPS, Université de la Réunion, Le Tampon, France chantal.verkindt@univ-reunion.fr

[2]Laboratoire d'Étude du Mouvement, Research Center, Sainte-Justine Hospital, Montreal, PQ, Canada

INTRODUCTION

Though standing balance is well documented in different able-bodied populations such as in children, young adults and elderly individuals no one has addressed if girls show matured standing balance characteristics as women.

The objectives of this study are to test if able-bodied pre-adolescent girls and women present comparable balance characteristics during quiet upright standing and whether differences are acerbated by the absence of visual information.

METHODS

Twenty-one pre-adolescent girls and 19 young female subjects stood on a force-plate during eyes-opened and eyes–closed conditions. Subjects were tested three times randomly in each condition. The duration of the acquisition was set at 64 s, at a sampling frequency of 64 Hz

The dependent variables were CoP range, CoP velocity, sway area and free moment (T_Z) RMS and range. A large COP range suggests standing instability. The velocities reflect the amount of muscular activity required to maintain stability. Sway area, indicative of the overall standing imbalance, was calculated by the minor and major axes of an ellipse representing the variance in the excursion of the COP and COM reported in square millimetres. The last two upright standing balance parameters are related to the control mechanisms about the vertical axis identified by Dalleau et al. (1).

Multifactor ANCOVAs tested the differences among conditions. Since statistical differences were found in height ($p < 0.001$) and mass ($p < 0.001$) between the pre-adolescent girls and women these factors were used as co-variables in the subsequent analyses.

RESULTS AND DISCUSSION

Pre-adolescent girls have higher instability and postural activity along the ML axis where both COP range and velocity were statistically different (figures 1and 2). This observation is in agreement with the results described by Nolan et al. (2) for girls of 9 to 10 years old.

All the balance parameters including the Tz RMS and range increased in the eyes-closed condition ($p<0.01$). This implies that balance control is affected about all three axes in the absence of vision. Differences between girls and women could be partly explained by the stabilizing part of vision since they were enhanced in the eyes-closed condition about the ML axis.

Since height and mass were included as covariables in the statistical analyses it appears that more than body inertial parameters can explain the differences in balance parameters in pre-adolescent girls and women. We postulate that changes in hormonal impregnation during female development are also partly responsible of static balance improvement.

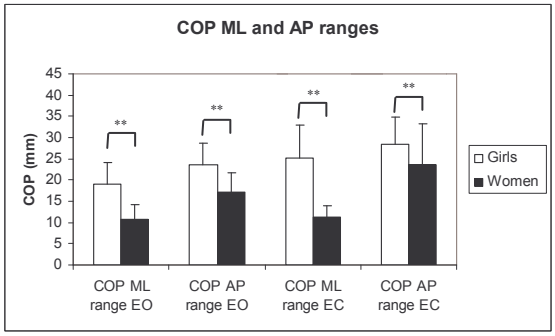

Figure 1: COP ML and AP ranges in girls and women for the eyes-opened (EO) and closed (EC) conditions. T bars represent the standard deviation. (** when the difference is significant with $p < 0,01$)

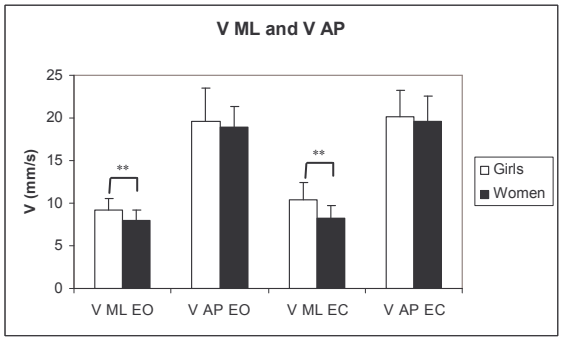

Figure 2 : COP ML and AP velocities and sway area in girls and women for the eyes-opened (EO) and closed (EC) conditions. T bars represent the standard deviation. (** when the difference is significant with $p < 0,01$)

CONCLUSIONS

The results of the present study suggest that balance strategies are different in pre-adolescent girls and women during quiet standing. They support the consideration of subject' age as well as the gender when assessing standing balance. Without visual information, balance is further acerbated and requires strategies about all three axes to maintain upright balance. But a girls' specific strategy remains about the ML axis only. Our results suggest that the greater imbalance in girls could be explained more by physiologic than morphologic characteristics and that the postural control is still in development in 10 year old girls.

REFERENCES

1.Dalleau G, et al. *European Spine Journal* **16**:1593-1599, 2007.

2.Nolan Let al. *Developmental Medicine and Child Neurology* **47**:449-454, 2005.