ANALYSIS OF THE DIFFERENCES IN POSTURAL CONTROL BETWEEN CHILDREN AND ADULTS WITH VISUAL IMPAIRMENTS

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ABSTRACT

In the absence of vision, postural control requires compensatory mechanisms to be maintained effectively. The objective of this study was to identify the differences in postural control between visually impaired children and adults. Blind individuals participated in the study, divided into two groups: DV children group (8 children; both sexes; average age 8.8±2); DV adults group (6 adults; both sexes; average age 37.5±6). To evaluate postural control, the SMART-D 140® System with two Kistler model 9286BA force platforms was used, allowing the analysis of center of pressure (CoP) oscillations. The participants were instructed to stand in an orthostatic position, with their arms close to their bodies for 30 seconds, with their eyes open and closed, with and without proprioceptive perturbation. For proprioceptive alteration, a 5cm high foam was used on the force platform. According to the median values of the group's COP parameters. According to Mann-Whitney, the main differences were found in the M/L COP and COP velocity, where we observed that regardless of the condition, blind adults sway more than blind children with a large effect size ($r = 0.82$). Interestingly, even when challenging the sensory system, we did not find a significant difference in either group ($p > 0.05$). Our findings corroborate those described by other authors who state that the process of balance control in children does not involve vision due to insufficiently developed visuomotor coordination.

Keywords: Static balance; Proprioceptive disturbance; Low vision.

INTRODUCTION

Human vision is composed of various structures responsible for the sensory, cognitive, and executive functions involved in motor behavior. A change in these structures can lead to partial or total blindness, hindering the patient's motor development. Visual impairment, regardless of the level of deficit, is already detrimental to sensory information, which translates into changes in postural control that, even with the functional neuroplasticity that occurs in the brains of the blind, does not result in the suppression of the loss of this sensory information. Blind children exhibit greater balance problems during walking when compared to subjects of the same age with normal vision and even when compared to deaf children.

Visually impaired individuals adapt to try to capture more sensory information from the environment and to orient themselves in space. Thus, the central nervous system simulates the dynamic behavior of the planning motor system, where control and learning occur, thereby integrating afferent and efferent sensory inputs during a proprioceptive activity in the absence of vision.

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According to reports, when we compare the balance control process between children and adults with DV, children may not involve vision because the developed coordination of visual movement is insufficient. 3.6. In adults, it is suggested that the automatic postural response system is not affected by birth vision. In order to clarify such results, this study aimed to identify the differences in postural control between visually impaired children and adults.

METHODOLOGY

This is a cross-sectional study conducted at the Evangelical University of Goiás. –UniEVANGÉLICA, with the sample composed of adults and children with visual impairments.

To evaluate static balance with and without somatosensory perturbation, the SMART-D 140® System (BTS Engineering) was used, containing two Kistler Platform model 9286BA force platforms, which allow the analysis of stabilometry based on the oscillations of the center of pressure (CoP). The acquisition frequency of the platform was 10 Hz, captured by four piezoelectric sensors positioned at the ends of the force platform measuring 400/600 mm. The data were recorded and interpreted by software (SWAY; BTS 161 Engineering), integrated and synchronized with the SMART-D 140® system (Figure 1).

For the assessment of static balance, the participating children were instructed to stand as still as possible, with their arms hanging along their bodies and their heads kept in an upright position. The acquisition conditions consist of 4 sensory conditions which were performed in the following order: condition 01: stable surface with eyes open; condition 02: stable surface with eyes closed; condition 03: unstable surface with eyes open; condition 04: unstable surface with eyes closed. The acquisition time was 30 seconds for each condition. In the conditions with eyes open, the individuals were instructed to maintain visual fixation on a point placed at a distance with and without the perturbation, that is, a stable surface and an unstable somatosensory surface configured as a soft surface on a D33 foam 7cm thick and 1x50cm. The CoP variables analyzed in this study were: total CoP displacement (mm), average velocity (mm/s), medio-lateral sway (X) (mm), and anteroposterior sway (Y) (mm).

Figure 1. Demonstration of static balance assessment with and without somatosensory perturbation using the force platform.

Legend: A) Evaluation of static balance without somatosensory disturbance; B) Evaluation of static balance with somatosensory disturbance.
Source: Authors.

RESULTS

The present sample was composed of 8 children and pre-adolescents with an average age of 8.8±2 years and an adult group consisting of 6 individuals of both sexes; with an average age of 37.5±6 years. Table 1 presents the median values of the COP parameters for the group. According to Mann-Whitney, the main differences were found

in the M/L COP and COP velocity, where we observed that regardless of the condition, blind adults sway more than blind children with a large effect size (r = 0.82). Interestingly, even when challenging the sensory system, we did not find a significant difference in either group (p > 0.05).

Table 1. COP Parameters of the Force Platform

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Parameters	Condition	Groups		
		Children DV	Adults DV	P Value
COP M/L	AO with foam	3,37	11,68	**0,01**
	AO without foam	4,36	7,03	n.s.
	OF with foam	3,37	10,05	**0,002**
	OF without foam	5,25	8,66	n.s.
COP A/P	AO with foam	6,54	6,09	n.s.
	AO without foam	3,32	5,72	n.s.
	OF with foam	4,72	4,35	n.s.
	OF without foam	4,72	6,13	n.s.
COP SPEED	AO with foam	2,1	5	**0,03**
	AO without foam	2,33	4,82	**< 0.001**
	OF with foam	1,99	4,58	**0,01**
	OF without foam	1,99	4,58	**0,01**

Leyenda: A/P = anteroposterior; COP = oscilación del centro de presión; OA = ojos abiertos; OF = ojos cerrados; M/L = medio-lateral; n.s. = no significativo.

CONCLUSION

Our findings corroborate those described by other authors, who state that the process of balance control in children does not involve vision due to insufficiently developed visuomotor coordination. When we observed the behavior of the groups with proprioceptive alterations, the postural behavior was the same for all the analyzed conditions.

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