BIOMECHANICS OF POSTURAL CONTROL IN YOUNG ADULT AND ELDERLY

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Introduction

Aging on the neuromotor system conduces to alterations on postural control, which predisposes to falls and injuries. This concern causes an important social and economic problem, especially considering the progressive aging of the population and the increase in the life expectancy of the last decades [1]. Therefore, it is extremely important to understand the functioning of the postural system and its alterations with age. The balance assessment provides a clue of the integrity of the communication between the sensory and motor systems. The most used and reliable method to evaluate postural control is the posturography, through force platform and evaluation of the center of pressure (COP). There are many studies in this area, but still no consensus on which variable calculated from the COP would best represent the functioning of the control of posture, especially if there are modifications caused by age [1]. Hence, the main objective of this work was to investigate the differences in the postural control of young and old adults through the analysis of specific variables calculated from a force platform data.

Methods

The data were obtained from a public repository of data, available at PhysioNet [2, 3]. In this study, the subjects were divided into two groups: 87 young adults (YG) (18 to 59 years) and 76 old adult (OG) (above 60 years). The subjects were evaluated three times while standing on a force platform for 60 s, as still as possible, and looking at a target placed on a wall 3 m ahead [3]. The subjects were instructed to place their feet with an angle of 20º and with heels kept 10 cm. The test was conducted in an AMTI force platform (OPT400600-1000; Watertown, MA, USA) and amplifier (Optima Signal Conditioner; AMTI, Watertown, MA, USA) at a sampling frequency of 100 Hz. The data were filtered with a 10 Hz 4th order zero lag low-pass Butterworth. The following COP variables were calculated: area (STA); total displacement of sway (TDS); total mean velocity (TMV); standard deviation, root mean square, amplitude of the displacement and mean velocity in the anterior-posterior and medial-lateral directions (SDap, SDml, RMSap, RMSml, AMPap, MVap and MVml, respectively) [4]. The variables were compared between the two groups through the Two-sample T test, with a significance level of 0.05.

Results

All variables related to the anterior-posterior direction and velocity of the COP were statistically different between the groups (Table 1).

	YG	OG	p
SDap (cm)	0.38 ± 0.18	0.41 ± 0.23	0.006
RMSap (cm)	0.005 ± 0.002	0.006 ± 0.003	0.006
AMPap (cm)	2.09 ± 0.93	2.43 ± 1.18	0.000
MVap (cm/s)	0.64 ± 0.24	0.92 ± 0.43	0.000
MVml (cm/s)	0.46 ± 0.19	0.53 ± 0.25	0.001
TMV (cm/s)	0.88 ± 0.32	1.16 ± 0.53	0.000

Table 1: Mean and standard deviation of the COP variables of the YG and OG groups, and p value.

The difference of the AMPap between an individual of the YG and of the OG is demonstrated in Figure 1.

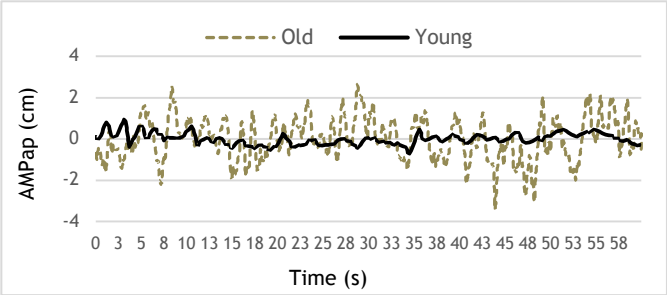

Figure 1: Stabilogram of a young and an old subject.

Discussion

The results demonstrated a significant difference between the postural control system of the young and elderly. Data about medial-lateral COP movements appear not sensitive to discriminate older individuals [5]. According to the literature, the parameters related to velocity were more characteristics of the older population [5]. The results also underline the requirement of intensifying the research in the postural control system of elderly as well as the standardization of the posturography techniques.

References

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