VISUAL VS AUDIO BIOFEEDBACK FOR THE CONTROL OF UPRIGHT POSTURE

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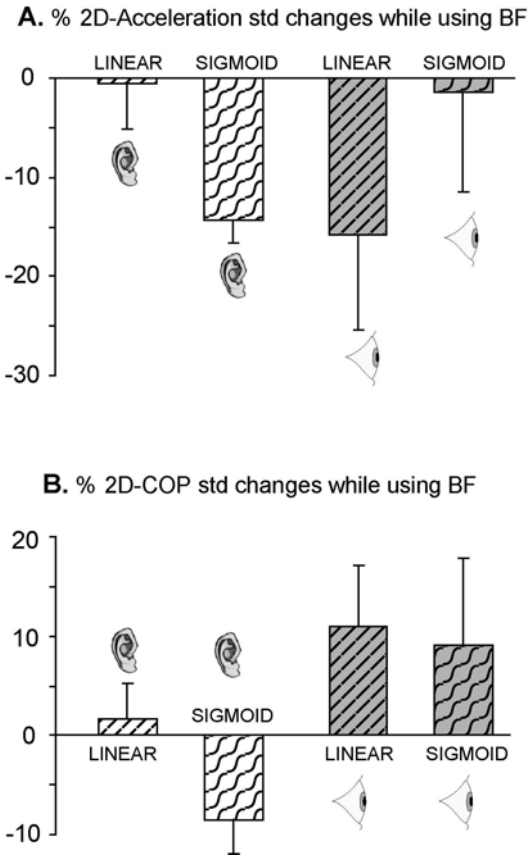
INTRODUCTION

Visual biofeedback (BF) for postural control has been studied since the 1970's [1] and, traditionally, provided a representation of center-of-pressure information on a monitor placed in front of the subject. Nowadays, a few systems for balance assessment offer visual BF as a rehabilitation treatment or sports training [2]. Up to now, audio BF did not raise as much interest as visual BF even if it has potential advantages in terms of costs and portability compared to visual BF (i.e. a pair of headphone could substitute for a monitor). The purpose of this study is to compare visual and audio BF and to show how both reduce sway even though they may achieve this same result inducing different postural strategies.

MATERIALS AND METHODS

Eight healthy young adults (average age 23±3 years) participated in this study. Each subject stood on foam (4'' Temper™) while using audio or visual BF of anterior-posterior and medial-lateral accelerations sensed at trunk level (L5) [3]. Two different codings of the acceleration (one based on a linear function and the other on a sigmoid function) were implemented both for the audio and the visual BF. Also, two reference conditions were tested. The reference condition for audio BF consisted of a trial in which no sound was provided to the subject. The reference condition for visual BF consisted of a presentation of a random sway on the monitor. Each subject performed 5, 1-minute repetitions of each of the 6 conditions (30 trials total). The order of the trials was randomized. For each trial, the standard deviation of the center-of-pressure displacement and the standard deviation of the acceleration were calculated. Statistical significance of the results was evaluated with a 2-way ANOVA: first factor visual or audio BF, and second factor linear or sigmoid coding function.



RESULTS AND DISCUSSION

Basically, BF reduced the standard deviation of the accelerations which were fed back. Sigmoid coding of audio BF information was more effective than linear coding in reducing sway. Linear coding of visual BF information was more effective than sigmoid coding in reducing sway (Figure A). This result suggests that both the different sensory channel (audio and visual) and different coding function (linear and sigmoid) chosen to represent the BF information, may influence the effectiveness of BF.

Only sigmoid audio BF reduced the standard deviation of the center-of-pressure displacement (Figure B). An inverted pendulum model can explain the reduction of both acceleration and center-of-pressure standard deviation found using sigmoid audio BF. However, in order to explain the opposite behavior of acceleration and center-of-pressure standard deviations found with visual BF, it is necessary to use a multi-segmental model. Consequently, the subjects may have preferred an ankle strategy in response to sigmoid audio BF and a hip strategy in response to visual BF.

In conclusion, both the effectiveness and the strategy chosen by the subjects to control the BF signal may be depend on the BF coding function and presentation.

REFERENCES

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