INSTANT EFFECTS OF RANDOM WHOLE-BODY VIBRATION ON POSTURAL CONTROL PERFORMANCE IN YOUNG ADULTS

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INTRODUCTION

Whole body vibration (WBV) training using an oscillation platform to stimulate human body has became a popular exercise intervention for improving health fitness in young adults, such as muscle strength performance and balancing ability in young, healthy adults. (Torvienen, et al., 2002). And common commercial WBV apparatus were classified into 2 types, vertical vibrating and seesaw oscillation. Both they could generate vibration to activate sensory receptors in body, that in turn provoke muscle contraction in leg muscle resulting better balance performance. Therefore, in most previous studies, vibration platforms with a vertical mode of oscillation were used including Power Plate (Torvienen, et al., 2002, Verschueren et al., 2004, Azar Moezy et al., 2008) and the other studies (Jun Iwamoto, 2004) which is of a side-alternating vibration mode, Galileo. Although no study has compared the effects or functions before, the 2 vibration modes differ in terms of the mechanism and stimulated muscles, which need further investigations to illustrate their differences. Accordingly, trying to exam 2 manner affecting on human body, we use Duplicate-plates WBV device (Magtonic,Taiwan) offering 2 frequencies choice for each plate at the same time to imitate vertical and tilting vibration in one WBV machine. The purpose of this study is to compare acute effects of random whole-body vibration with a dual plate on postural and dynamic balance control in young adults.

METHODS

Twenty healthy young adults aged from 22 to 30 year-old were randomly divided into whole-body vibration (WBV) group I (n=10, 25.2± 1.5y) and group II (n=10, 24.8± 1.6y). At each program, subjects stood on a vibration machine (Duplicate-plates WBV, Magtonic,Taiwan) for 6 bouts of 30 seconds of vibration alternating with 30 seconds of rest, so the total vibration duration was 3 min. Vibration was set at 35Hz/35Hz in group I and 20Hz/50Hz (or 50Hz/20Hz) in group II. Outcome measures were practiced before and instantly after training. Balance performance on the center of pressure (COP) measuring system (AMTI force plate, USA) was tested under 3 conditions: static stance with and without vision, and stance on sway board with vision for 30 seconds each. Postural stability was measured by overall COP displacement, anterior–posterior (A-P), and medial–lateral (M-L) stability indices, which indicated the higher score, the poorer balance. Statistical analysis was conducted by a pair student's t-test to compare pre-test and post-test value of 3 balance performance parameters. α was set 0.05.

RESULT

Postural stability in pretest between groups as well as between 3 conditions was no significant difference. And then after WBV treatment, the total COP displacement among 2 groups had a little regression, but with no significance. Moreover, there was no difference on balance performance of M-L max range by standing on firm base as well as unsteady support after vibration intervention. However, adjustment in A-P oscillation was significantly improved by almost 20% only following vibrated with 2 frequencies simultaneously, except opening eye to stand on ground.

DISCUSSION

Whole body vibration is a new kind of somatosensory stimulus for proprioception that could initiate protective and stabilizing muscular reflexs and hence improve synchronization of firing of motor units and enhance co contraction of synergist muscle to better the postural control (Geurts ACH, et al, 2005, Jordan MJ et al., 2005). Adults always use the ankle strategy, coordinating plantar or dorsi flexors to resist unbalance situations. Those could explain the positive effect on M-L adaptation under no vision and unstable surface conditions after WBV with distinct frequencies produced much multi-direction perturbation for lower extremity caused the increase of muscular and cutaneous sensor sensitivity in current study. However, contrast to previous investigation

(Torvinen et. al., 2003), there was no obvious change on COP displacement and M-L max range under standing on static floor with or without vision after 3-min WBV, probably because the vibration stimulation in our study was more intense than Torvinen's protocol (35Hz v.s. 26Hz) that could slightly worsen COP displacement performance among 3 statuses without significance.

Table 1: Raw results of measurement (cm)

		COP displacement		M-L max range		A-P max range	
Condition	Group	Pre	Post	Pre	Post	Pre	Post
Static base with vision	I	942.7 ± 159.8	968.2 ± 142.8	1.29 ± 0.53	1.14 ± 0.46	2.08 ± 0.62	2.09 ± 0.64
	II	944.5 ± 127.9	968.1 ± 145.4	1.25 ± 0.41	1.07 ± 0.50	2.35 ± 0.74	2.01 ± 0.63
Static base without vision	I	936.5 ± 172.2	953.9 ± 127.3	1.21 ± 0.55	1.15 ± 0.66	2.32 ± 0.66	2.34 ± 0.59
	II	947.8 ± 110.1	964.1 ± 134.6	1.31 ± 0.51	1.24 ± 0.42	2.95 ± 0.62	2.11 ± 0.71*
Standing on sway board	I	795.7 ± 120.9	816.1 ± 134.4	7.62 ± 1.67	6.67 ± 1.36	5.10 ± 1.85	4.77 ± 1.58
	II	846.9 ± 138.7	844.8 ± 133.9	7.24 ± 0.94	7.10 ± 2.26	5.19 ± 1.12	4.18 ± 1.66*

*: Significant difference between pre and post ($p<.05$)

CONCLUSIONS

The current result indicates using uplicate-plates WBV with different frequencies can enhance dynamic balance ability immediately in young adults.

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