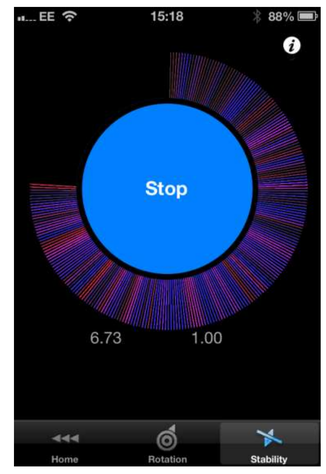
The "D+R Balance" application: a novel method of assessing postural sway



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INTRODUCTION & AIMS

Postural sway may be assessed clinically using a classical Romberg test, or quantified using dynamic posturography. The latter requires specialist equipment and appropriately trained staff. Smartphones and tablets have the capacity to respond to movement and tilt. We assessed the potential use of a novel iPhone application as a possible method of quantifying sway.

MATERIALS & METHODS

We recruited 50 volunteers to this study. Subjects with a history of audiovestibular or significant musculoskeletal pathology were excluded. Each performed the Romberg and tandem Romberg tests on floor and foam in a soundproofed and normal clinic room, with and without ear defenders. Postural sway was recorded using the D+R Balance application with the iPhone attached to the subjects' left arm. The K value, a figure of sway generated by the application, was compared using the paired t-test for both environments and each scenario.

RESULTS

SCENARIO COMPARISON	COMMENT	P <0.05
Eyes open vs closed	↑ sway with eyes closed	When feet in tandem (TAN)
Foam vs floor	↑ sway on foam	SPR, TOG, EO, ED SPR, TOG, EC, ED SPR, TAN, EC +/- ED NR, TOG, EO NR, TOG, EC
Feet together vs in tandem	↑ sway with feet in tandem	SPR, FLOOR, EO +/-ED SPR, FLOOR, EC +/-ED SPR, FOAM, EO, ED SPR, FOAM, EC +/-ED NR, FLOOR, EO, ED NR, FLOOR, EC+/-ED NR, FOAM, EO, ED NR, FOAM, EC, ED
Ear defenders vs without	No difference	
Soundproof room vs normal clinic room	↑ sway in SPR	EC, TAN, EC

Key SPR: soundproof room, TOG: feet together, TAN: feet in tandem, EO: eyes open, EC: eyes closed, NR: normal room, ED: ear defenders

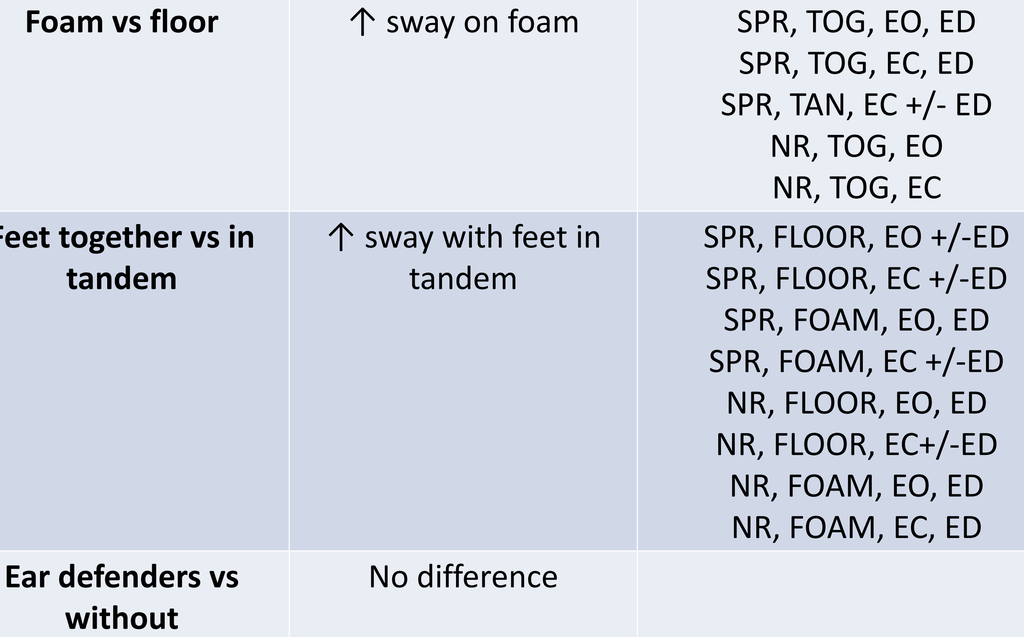

Figure 2: Mean K value in soundproof room with different standing variables.

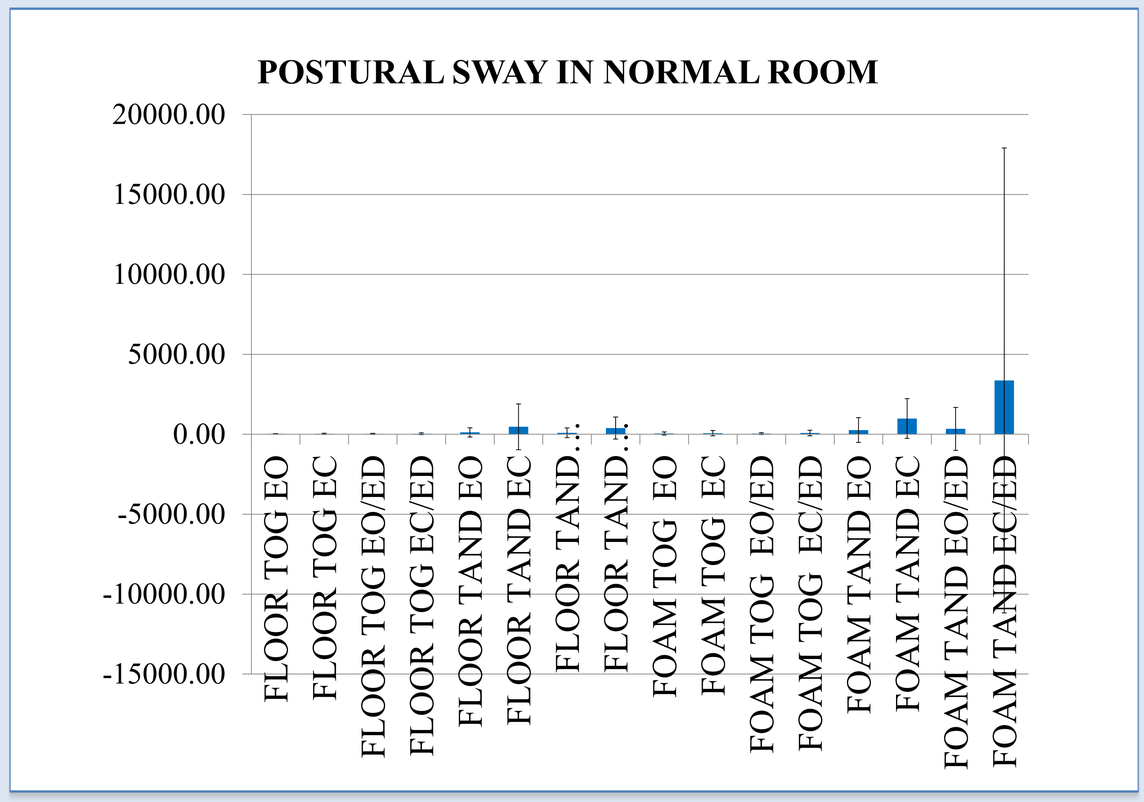

Figure 3: Mean K value in normal clinic room with different standing variables.

DISCUSSION

Visual input, this and numerous studies have shown that postural sway increases when eyes are closed [1-6]. Vision can compensate for the loss or disruption of proprioception or vestibular system and plays a key role in adjusting posture [5, 7].

Proprioception, body sway increased significantly when standing on foam surfaces compared with the solid surface; which is in agreement with the literature [8-10]. In effect, pressor information from the feet challenges ankle proprioceptors to rapidly adjust to small changes in position [10] and it is essential in compensating for vestibular disturbance [11].

Auditory, our results also suggest that auditory signals are crucial in maintaining postural control, as sway was shown to be greater in the soundproof room. This is in accordance with other studies [12, 13]. No difference was noted with or without ear defenders. This could be due to the fact that some low-level ambient sound could still be heard through the ear defenders. Palm et al. have shown that non-specific auditory information does not influence postural control [14].

CONCLUSION

The results of this feasibility study suggest that this method of assessing postural sway deserves further investigation and may provide an alternative to current dynamic posturography systems. The novel application has obvious advantages such as low cost, availability and ease of use.

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