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Ylitalo, E.

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Short communication

P 093 - Comparison of three bipedal tasks to quantify contribution of proprioception to postural stability in healthy children and adolescents

E. Ylitalo^{a,*}, H. Mäenpää^b, H. Piitulainen^c^a University of Helsinki and Helsinki University Central Hospital, HUH Children and Adolescents, Helsinki, Finland^b Helsinki University Central Hospital, HUH Children and adolescents, Helsinki, Finland^c Aalto University and Helsinki University Central Hospital, Department on Neuroscience and Biomedical Engineering, Helsinki, Finland

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ABSTRACT

Static postural sway can be quantified as variation in body's center of force (COF) position across time using a plantar pressure plate. We aimed to compare capability of three clinically feasible bipedal tasks to extract the contribution of proprioception to postural stability. We measured the postural sway of 24 healthy volunteers (age range 10.2–17.6 years) with a plantar-pressure plate with three different standing tasks: (1) normal standing, (2) normal standing on soft foam, and (3) feet together standing. Each task was repeated eyes closed to emphasize the contribution of proprioception on maintaining the postural stability. The effect of closing the eyes varied among the tasks, and was greatest in the feet together standing task, possibly due to greater proprioceptive demands in the more difficult tasks. It appears that standing feet together is a potential task for quantifying contribution of proprioception to postural stability.

1. Introduction

Static postural sway can be quantified as variation in body's center of force (COF) position across time using force or plantar pressure plates. Control of posture relies on visual, vestibular and somatosensory afference. In the somatosensory modality, both tactile and proprioceptive (“movement sensors”) afference are involved. Postural stability develops during childhood and adolescence, but is likely not matured at age of 14 years [1]. The role of proprioception for the postural control in developing system is largely unknown. This is a preliminary study to optimize a protocol for our upcoming more extensive study to examine postural stability during development.

2. Research question

We aimed to compare capability of three clinically feasible bipedal tasks to extract the contribution of proprioception to postural stability.

3. Methods

We measured the postural sway of 24 healthy volunteers (age range 10.2–17.6 years, mean 13.7 years) with a plantar-pressure plate (RScan, Belgium) at 33 samples/s. Subjects stood eyes open as still as possible for 30 s (per task) during (1) normal standing, (2) normal standing on soft foam, and (3) feet together standing. Each task was repeated eyes closed to emphasize the contribution of proprioception on maintaining the postural stability. Mean distance of center of force (from sample to sample) was computed for both mediolateral and anteroposterior directions, and for their resultant. The absolute difference in the postural sway between eyes-closed and eyes-open conditions was also extracted (Fig. 1).

4. Results

The normal standing (eyes open and closed) was more stable compared to foam and feet together standing tasks ($p < 0.001$ for both). In the eyes-open condition, postural sway was 48% and 54%

* Corresponding author.

E-mail address: elina.ylitalo@hus.fi (E. Ylitalo).<https://doi.org/10.1016/j.gaitpost.2018.07.027>

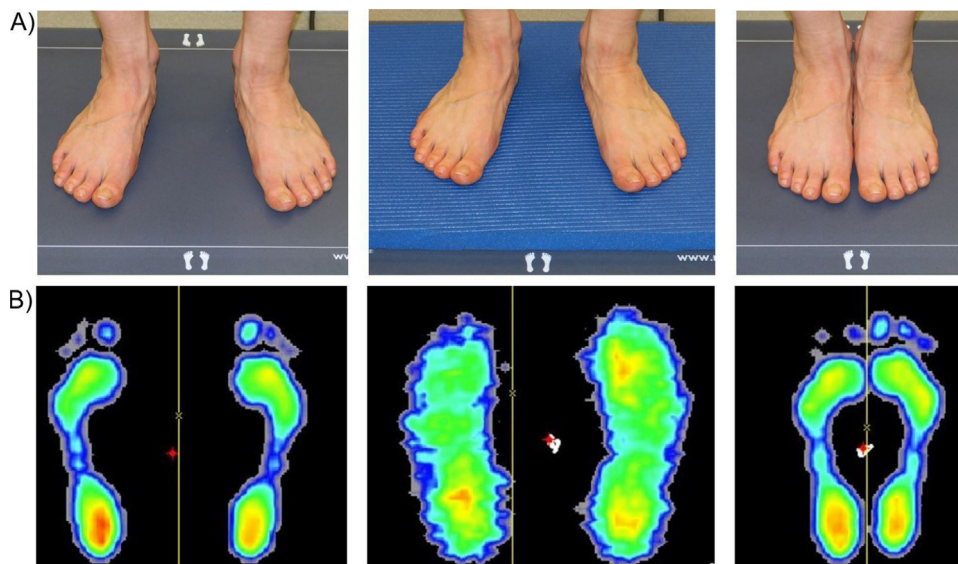


Fig. 1. A) Standing tasks: Normal standing on firm surface, normal standing on soft foam and standing feet together on firm surface. B) Pressure distribution from the above tasks.

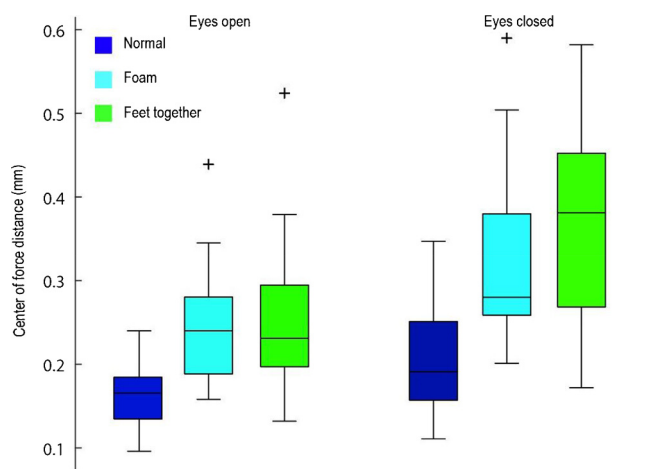


Fig. 2. Postural sway in the standing tasks eyes open and closed.

higher in foam and feet together standing respectively, and in eyes-closed condition, 58% and 81% higher than in normal standing. When the eyes were closed the postural sway increased by 25%, 33% and 47% in normal, foam and feet together standings respectively (t-values 4.98, 5.81 and 5.76 respectively, and $p < 0.001$ for all). The effect of closing eyes was 171% and 40.3% stronger during the feet together

standing compared to normal ($p = 0.004$) or foam ($p = 0.085$) standing (Fig. 2).

5. Discussion

As expected, the postural sway was largest in the feet together standing, and was affected the most by closing the eyes. The effect of closing the eyes varied among the tasks, possibly due to greater proprioceptive demands in the more difficult tasks. Based on absolute amount of change in postural sway and statistical t-values, it appears that standing feet together is a potential task for quantifying contribution of proprioception to postural stability. This task is also feasible for clinical examination, e.g., to follow postural stability during treatment or after surgical operations etc.

Disclosure statement

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References

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