Title: Investigating normal day-to-day variations in postural control in a healthy young population using Wii balance boards

Johnston W[1], Purcell C[1], Duffy C[1], Casey T[1], Greene BR[2], Singleton D[3], McGrath D[1], Caulfield B[1].

[1]Insight Centre for Data Analytics, University College Dublin, Ireland
[2]Kinesis Health Technologies, University College Dublin, Dublin, Ireland
[3]Applied Research for Connected Health, University College Dublin, Ireland

Background: Objective measurements of postural control are frequently used to examine the causes of, features associated with, and therapeutic interventions for ankle instability. However, researchers have typically used single-session measures to represent postural control at one point in time. Recent studies in a healthy elderly population demonstrate significant variations in day-to-day postural control and suggest that single-session measurement may not truly reflect postural control capabilities. An investigation into patterns of day-to-day variation in postural control in a younger population are warranted.

Objective: To investigate the variations between continuous day-to-day clinical measurements of postural control, and the associations between these continuous daily measurements and once-off measurements.

Design: Observational study.

Setting: University laboratory.

Participants: Twenty-four healthy young adults (9 female, 15 male) aged 18-40 years.

Interventions: Subjects complete two 40 second eyes open and eyes closed static balance trials on Wii Balance Boards.

Main Outcome Measurements: Lifestyle questionnaire and 40 second eyes-open/eyes-closed static Wii Balance Board balance tests, on 20 consecutive weekdays.

Results: Coefficient of variation demonstrated substantial inter-subject differences from 10-131% (eyes-open) and 10-112% (eyes-closed) across variables. Minimal detectable change percentage showed that 22/30 parameters demonstrated acceptable measurement error (<30%). Across mean COP distance, mean sway length, mean sway frequency and sway area, 16/24 (eyes-open) and 11/24 participants (eyes-closed) exhibited statistically significant differences ($p < 0.05$) between the once-off and the daily measures.

Conclusion: Variations in postural control exist in a healthy young population. Depending on testing conditions and specific variables, a once-off measure is not indicative of an individual's true postural control. Therefore, when investigating subtle changes in postural control, long-term monitoring may prove to be a superior assessment tool.