Wee-Wii-validation?

Investigating the validity and reliability of the Nintendo Wii Balance Board for assessment of standing balance in young children

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Overview

Why use a Wii balance board (WBB)?

Is it valid and reliable?

Is it still valid and reliable for use with children?

Clinical take-home messages
Gold standard measures of postural control

The WiiBB - A potential tool to examine standing balance

(Goble, Cone, & Fling, 2014)
WBB: An alternative measure of postural control?

- Cheaper
- Portable
- Easy to use
- Similar design
  - 22x48 cm platform
  - Force transducers at each corner

Research to date:
- Adults: Clark et al., 2010
- Older individuals: Scaglioni-Solano & Aragón-Vargas, 2014
- Children >10 years: Larsen et al., 2014
- Measuring sway: Flatters et al., 2014
How do young children differ & what difference does this make?

Sensory control of balance changes during childhood

- Comprehension, body structure & distribution of mass alters
- A reduction in reliance on visual and vestibular information
- An increase in the reliance of proprioceptive information

*Ages of 4 and 10 years

(Godoi & Barela, 2008)

(Shumway-Cook & Woollacott, 1985)

Higher noise levels than a laboratory grade force platform

Noise levels increase with lower weight

(Flatters et al., 2014; Huurnink et al., 2013)
Research aim

To compare the feasibility of measuring the balance abilities of typically developing children (tdc) aged 4-10 using a Wii balance board (WiiBB)

• To undertake measurement in a non-gait-laboratory environment in order to explore barriers and constraints to measurement

• To compare the accuracy and reliability of measurements to that of the gold standard force plate (Kistler)
Methods

54 tdc: 28f : 26m
(school partnership in Plymouth)

40 second collections, "standing still, facing forwards"

4 sensory conditions: Feet together/apart, eyes open/closed (randomised)

Equipment:

Kistler mobile force plate with amplifier (sample rate of 200Hz)

1401 Data Acquisition hardware

Laptop (OS) with Spike2 software

WiiBB + Hama Nano Bluetooth USB Adapter

Windows XP Laptop running Matlab v7 (sync signal)
## Results: Feasibility

<table>
<thead>
<tr>
<th>Invited to participate n=128</th>
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<td>Parental consent n=54</td>
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<td>Non-return n=74</td>
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**Assent gained on day**

- n=54
- (n=8 non-returns-not tested)

**Data collection**

- Analysed: n=31
- Data loss: n=27 (technical)

- ✓ WiiBB were familiar & friendly
- ✓ Children were motivated—even those without parental consent!
- ✓ All ages followed instructions!
- ✓ 4 simple conditions feasible

- × Parent reply slips…
- × Setup time
- × Technical delays
- × Data loss!!!
- × Transducer failure… 3 WiiBB
- × Analysis not clinician friendly (Matlab, wavelet filtering…)
**Results: Validity & reliability**

- **Force plate**
  - CoP path length (mm)
  - EO - FA
  - EC - FA
  - EO - FT
  - EC - FT

- **Force plate with WiiBB**
  - CoP path length (mm)
  - EO - FA
  - EC - FA
  - EO - FT
  - EC - FT

- **WiiBB**
  - CoP path length (mm)
  - EO - FA
  - EC - FA
  - EO - FT
  - EC - FT

- **Main effect of condition (ANOVA) p<0.01**
- **ICCs good to excellent (>0.7)**
- **WiiBB less sensitive to smaller fluctuations in stability (inaccuracy)**
- **Disproportionate responses to sensory conditions (may produce inaccurate Rhomberg's quotients)**
Take home clinical messages

*Suitability of use in a clinical setting is limited*

- Centre of pressure path length is underestimated (less sensitive – appears associated with low body mass)
- Force transducer drop out presents an unknown bias for clinicians
- Significant training would be needed for clinicians to analyse data and to detect anomalies (such as force transducer drop-out, a sneeze, spikes in electrical noise)

✓ Children were keen to have their balance measured, weren’t phased & were able to manage sensory tasks
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