The Effects of Different Cueing Devices on Gait Initiation in Healthy Elders

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Introduction
A previous study has been conducted which investigated the effectiveness of 3 different, commercially available cueing devices, providing four modes of cueing (dual function on metronome), on the gait initiation of 20 participants with Parkinson’s disease (McCandless et al., 2010). There is little published data on gait initiation in the elderly and on Parkinson’s disease (PD) participants or the effectiveness of such devices.

Both ageing and disease cause changes to the nervous, muscular, skeletal systems, and every other system in the body. These changes affect the control of balance. The initiation of gait is a task that challenges the balance control system as it moves from stable static balance to continuously unstable gait (Halliday et al., 1998). Researchers and clinicians have designed cueing devices that aim to improve the movement of people that have gait difficulties. From this, some studies (Dibble et al., 2004, Donovan et al., 2010; Jiang and Norman, 2006) have tested the efficacy of such devices and mixed results have been found in both the elderly and Parkinson’s patients.

The aims of the study were to establish the different effects, each of the commercially available cueing devices had on the gait initiation of elderly participants. The differences in the path of centre of mass (COM), shown by the yellow trajectory in Fig.3, and medial-lateral velocity of the centre of mass (COMvel) were used to distinguish any biomechanical differences between the 5 conditions.

Methodology
9 elderly participants were recruited for the study with a mean age of 68.9. Participants came into the lab and a full body CAST marker set (Capozzo et al. 1997) was attached to the participant in order for the 10 camera motion capture system to track their movements. From a seated position on a chair participants were required to stand, walk 3m down the lab, turn and walk back to the chair. Participants completed several trials under each of the 5 conditions; no cue, laser cane, normal cane, sound, metronome and vibrating metronome. In order to generate the COM data the participants walked across force platforms, these were covered by non-patterned carpet to minimise any external cueing.

Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean Max ML</th>
<th>COMvel (m.s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cue</td>
<td></td>
<td>0.193</td>
</tr>
<tr>
<td>Laser Stick</td>
<td></td>
<td>0.149</td>
</tr>
<tr>
<td>Stick</td>
<td></td>
<td>0.176</td>
</tr>
<tr>
<td>Sound</td>
<td></td>
<td>0.167</td>
</tr>
<tr>
<td>Vibration</td>
<td></td>
<td>0.159</td>
</tr>
</tbody>
</table>

Figure 3: Typical COM paths of participants under the five separate conditions. Table 1: Mean maximum medial-lateral COM velocities under the five separate conditions for all participants. A significant difference was found between no cue and laser stick, stick and vibration, and was trending towards a difference with sound.

Conclusions
A significant difference was found in the medial-lateral COMvel between no cue and 3 of the 4 cueing devices suggesting that postural stability is limited when normal elderly are given cueing devices. The COM paths support this and show that in relation to the ‘no cue’ condition, which shows the natural, automatic gait of the participant, the four cueing devices distort their typical movements. This could signify that cueing devices interrupt the automatic motor systems of the body and increase cognitive activity during gait initiation for normal elderly.

References