Poster # 2255

An app to measure the cost of visual acuity on a walking task

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BACKGROUND

PURPOSE: The purpose of this study was to determine if an app with specific visual acuity requirements can identify changes in walking from a single task condition to a dual task condition.

BACKGROUND/SIGNIFICANCE: It is well known that dual tasking has a negative impact on walking behavior. Gait speed slows down ~15% when talking on a cell phone and ~33% when texting (Lamberg & Muratori, 2012). Performance of the 3 meter get up and go test also results in slower performance under either a manual or cognitive dual task (Shumway-Cook et al., 2000). Individuals with vestibular disease and concussion have reduced gait speed when walking is combined with a secondary cognitive task (Bessot et al., 2012; Catena et al., 2007). Recent evidence demonstrates that frontal lobe activity increases during dual task walking compared to single task or standing dual task activities (Mirelman et al., 2014) suggesting a higher cognitive burden during dual task walking.

Often the secondary cognitive task coupled with walking involves serial subtraction by 2's, 3's, or 7's (Bessot et al., 2012; Yogev-Seligmann et al., 2011; Mirelman et al., 2014). Implicit in this cognitive task is the ability to perform mental subtraction, a task that not everyone can do (i.e. Dyscalcula), which is impaired for individuals with vestibular disease (Risey & Briner, 1990-1991). Individuals post concussion also have difficulty with secondary cognitive tasks while walking (Catena et al., 2007).

Using a visual stimulus identification-response may be a valuable method for evaluating dual task ability that does not depend on mental subtraction ability.

EXPERIMENTAL QUESTION

Here We ask…

1) Does a forced choice object recognition task with high visual acuity demands interfere with walking in a systematic way?
2) Is walking ability altered in the same way for individuals with vestibular disease and healthy individuals?
3) Do individuals respond the same before and after repeated soccer heading?

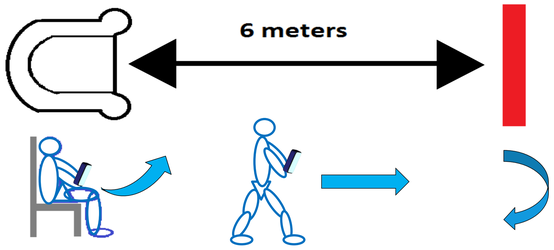
SUBJECTS

Healthy Subjects	Vestibular Disease	Sub-Concussive Heading
n = 57	n = 9	n = 13
Age = 29.1 (15.5)	Age = 54.1(13.6)	Age = 20.2 (1.5)
	# BVH = 6	
	# UVH = 3	

METHODS

VISUAL ACUITY WALKING APP
"EyeWalk"

SINGLE AND DUAL TASKS
Single Task: Walk and carry the tablet
Dual Task: Single Task + Respond to "E" Direction

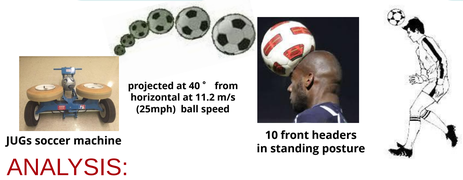


SUB-CONCUSSIVE:
SOCCER-HEADING MODEL

Pre
- Single & Dual Task Walking App Test

Soccer heading

0 hr Post
- Single & Dual Task Walking App Test



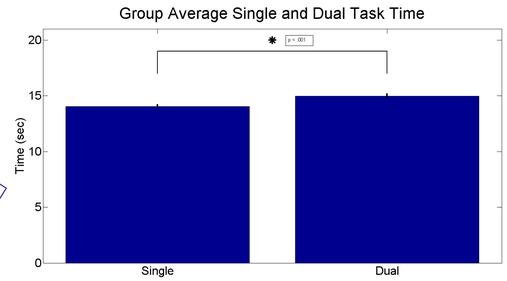
✓ *Measured head impacts 11 - 24 g.*

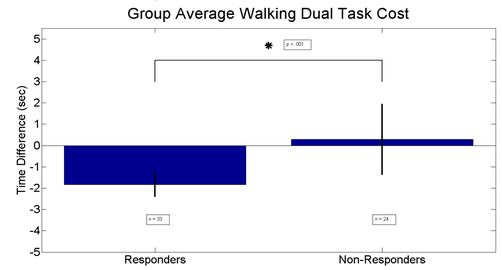
ANALYSIS:
Outcome Variables: Time, Visual Acuity Accuracy
DT_cost = 100-[(ST-DT)*100]/ST
DT_cost > 105% = "Responder"
Paired t-tests (ST vs. DT)
ANOVA (Difference scores)
Repeated Measures ANOVA (Difference scores)

RESULTS

Healthy Subjects

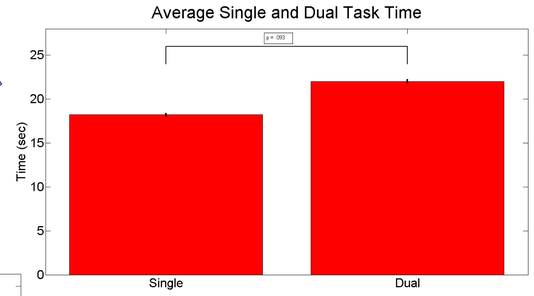
1. **On average, healthy individuals slow down when a visual stimulus identification-response task is combined with walking, compared to walking in isolation.**
2. **However, not all healthy individuals "responded" as anticipated and "responders" were significantly slower than "non-responders."**
3. **No difference in visual acuity accuracy (not shown).**

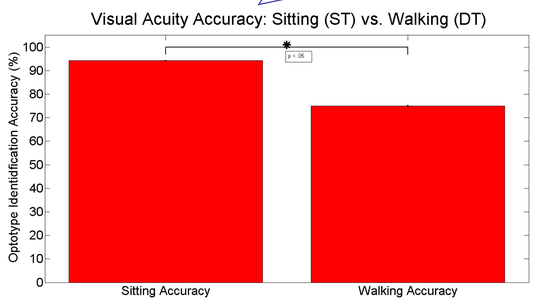




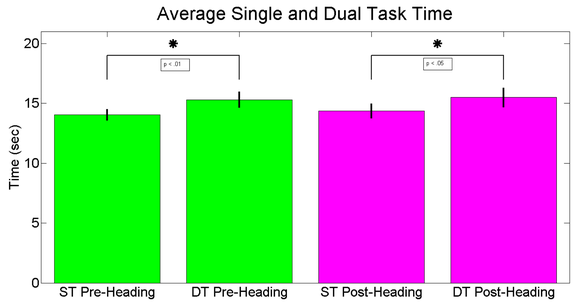
Vestibular Subjects

1. **Individuals with vestibular disease walk slower in the visual acuity dual task condition.**
2. **Individuals with vestibular disease are less accurate reading when walking compared to reading when sitting.**





Sub-Concussive Heading Subjects



1. **Sub-concussive soccer heading did not influence time to complete the single or dual task. There was a significant increase in time to perform the walking task under the dual task condition before and after heading. "Responders" performed more slowly than non-responders (not shown).**
2. **Accuracy at identifying the direction of the optotype was not different.**

CONCLUSIONS

1) Healthy individuals slow down during a walking task combined with a secondary visual object identification task with a high visual acuity requirement.
2) Not all healthy individuals respond the same: "Responders" significantly slow down compared to "Non-Responders," suggesting that some individuals are more susceptible to walking task interference when coupled with a secondary visual object identification task with high visual acuity requirements.
3) Individuals with peripheral vestibular disease (UVH/BVH) slow down (although not significantly) and also demonstrate a significant reduction in accurate visual object identification when a walking task is coupled with a high visual acuity object identification task.
4) Repeated sub-concussive head impacts does not change walking performance or accuracy during dual task conditions. "Responders" were significantly slower at both time points compared to "Non-Responders."

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