Changes in Standing Stability with Balance-Based Torso-Weighting in People with Cerebellar Ataxia: A Pilot Study

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INTRODUCTION AND BACKGROUND

- Ataxia means that movements are uncoordinated with increased variability.[1] Disordered gait and balance put people with ataxia at greater risk of falling and sustaining injuries.
- Balance-based torso-weighting (BBTW)[2] involves assessment of directional instability using systematic perturbations and resisted rotations to inform strategic placement of light weights that counter imbalance.
- BBTW has resulted in increased gait velocity[3] and fewer falls[4] in MS but has not yet been tested in a population with ataxia as the primary impairment.
- **Purpose**: To determine if BBTW affects standing stability and functional movement during a single session for people with ataxia and age and sex-matched healthy controls.
- **Hypotheses**: 1) People with ataxia will show improvement in standing stability and functional movement with torso weighting compared to a non-weighted condition.
  2) Healthy controls will show better standing stability and functional movement compared to people with ataxia.

METHODS

Procedures:

- Complete Activity-Specific Balance Confidence (ABC) scale and medical questionnaire.
- Have height, weight, blood pressure recorded.
- Complete Scale for the Assessment and Rating of Ataxia (SARA) for individuals with ataxia.
- Have six accelerometers attached to the torso and extremities. [5,6]
- Perform functional tests without weights:
  1) Stand on firm surface 30s eyes open, 30s eyes closed
  2) Stand on foam 30s eyes open, 30s eyes closed
  3) Timed Up and Go (TUG)
- Undergo BBTW Assessment and Weighting (0.25-2 pounds)
- Repeat functional tests 1-3 with weights

Table 1. Demographics

	Male	Female	Age	ABC	SARA
Participants with Ataxia	4	6	47.2 (6.6)	54.6 (16.8)	13.33 (3.83)
Healthy Controls	4	6	47.8 (8.8)	97.5 (1.54)	N/A

Figure 1. BBTW™ Garment and Weights

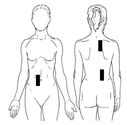


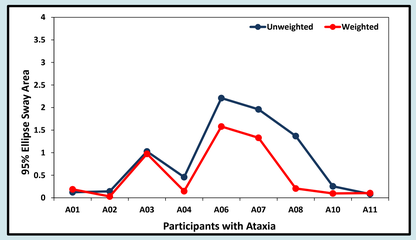
Figure 2. Sample Weight Placement on Garment

(3 half-pound weights)

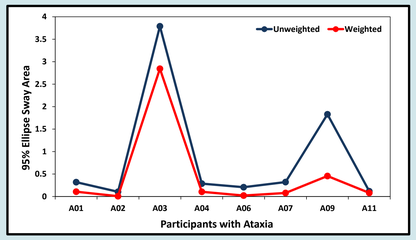
RESULTS

Standing Stability: Sway and Duration

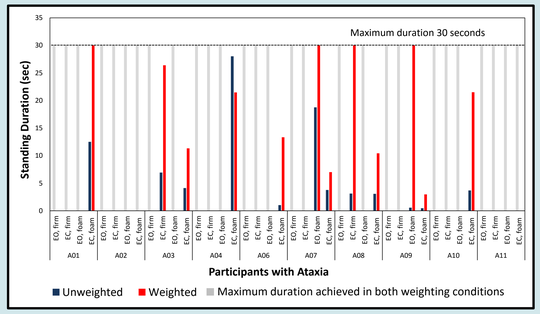
Sway: Eyes Open on Foam (p=0.02)



Sway: Eyes Closed on Firm (p=0.02)



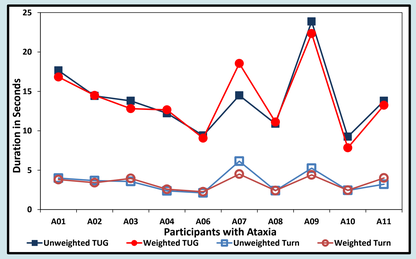
No difference in sway between weighting conditions in individuals with ataxia for eyes open on firm surface (ceiling effect) and eyes closed on foam. Healthy controls showed ceiling effect in all standing tasks.

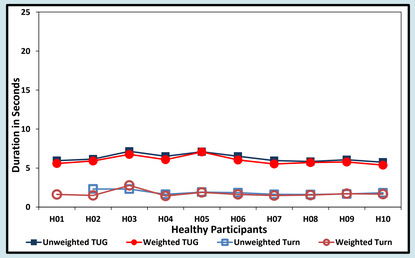


Participants with ataxia stood significantly longer in the weighted versus the no weight condition (p = 0.004). Stand time for people with ataxia was significantly lower than for healthy controls (p<0.001).

All healthy controls stood without stepping or requiring assist for the full 30 seconds under all activities and conditions.

TUG and TUG Turn Duration





- TUG duration: No significant difference in participants with ataxia (p=0.43); significant difference in healthy controls (p<0.001)
- Turn duration during TUG: No significant difference in either group (participants with ataxia p=0.27; health controls p=0.18)

DISCUSSION

Standing stability (95% ellipse sway area and standing duration) improved with BBTW in participants with ataxia, particularly when standing with eyes open on foam or eyes closed on firm surface. Sensory augmentation with BBTW may help compensate when a single sensory modality is constrained, but is insufficient in this single session design to fully compensate when two modalities are constrained. TUG times improved with BBWT in healthy controls but not participants with ataxia. However, one individual took longer for the TUG with BBTW but subjectively reported that sit to stand was easier. Velocity of movement may not be the best measure of immediate improvement for this population.

CONCLUSION

BBTW may have potential for improving standing stability in individuals with ataxia. Further research is needed to determine if long-term use of torso-weighting might provide sufficient practice to improve accuracy as well as velocity of gait.

CLINICAL RELEVANCE

Very light weights, when applied strategically, can improve stability. Outcome measures in this population should include accuracy of movement in addition to speed, especially in the short term. This intervention may provide a needed impetus for increased exercise or physical activity in people with ataxia, and thus increase quality of life.

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