Age Related Differences in Kinematic Responses While Walking Over a Compliant Surface

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Introduction

- Maintaining dynamic stability can be challenging when walking over compliant surfaces such as sand or soft, muddy ground
- Anticipatory (APAs) and compensatory (CPAs) postural adjustments are important factors contributing to stability during a self- or externally-induced balance perturbation
- These postural adjustments are altered with age, often resulting in exaggerated responses and greater role for upper limbs in the balance response
- Over repeated exposures, balance responses can habituate through feedforward- and feedback-based adaptations

Objective: To examine differences between young and older adults in limb and trunk kinematic responses during first and repeated trials of walking over a compliant surface (foam)

Hypotheses:
1. Compared to young adults, older adults would demonstrate impaired APAs and CPAs, as well as greater exaggeration of limb and trunk responses while walking over foam
2. Compared to young adults, the rate of habituation in older adults would be slower

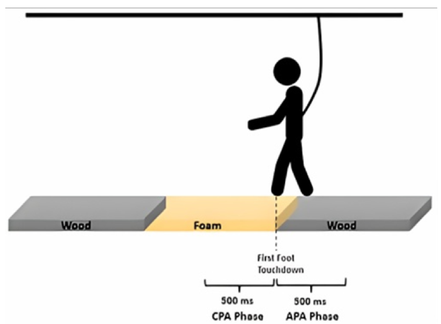
Methods

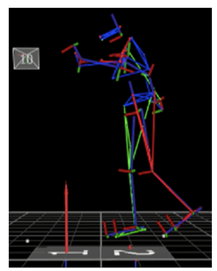
- Young (22 – 29yrs) and older adults (68 – 84yrs) completed 4 trials of walking over a high-density foam mat
- Participants were instructed to walk over the foam mat starting with their preferred leg and at their normal speed
- A Vicon motion tracking system was used to measure limb and trunk kinematics

Primary Outcome:
Group differences and habituation in mediolateral center of mass (COM_{ML}) displacement during APA and CPA phases

Secondary Outcome:
Group differences and habituation in upper limb and trunk angles at FFTD

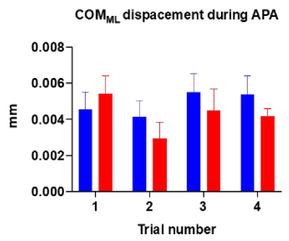
Methods

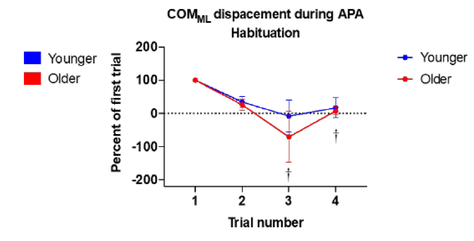


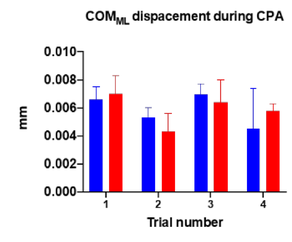


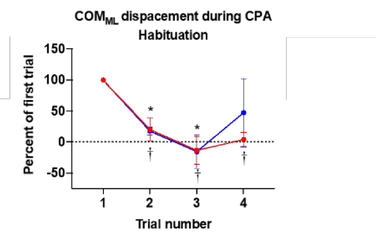
Ipsilateral: the side of the leading limb during gait initiation onto the foam
Contralateral: the side of the trailing limb during gait initiation onto the foam

Results



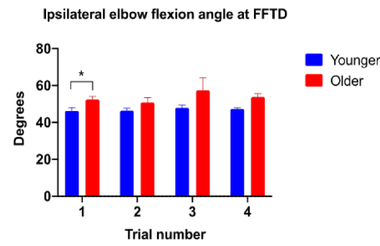


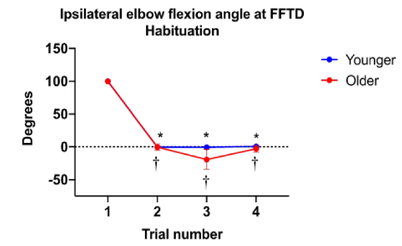


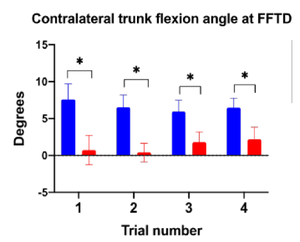


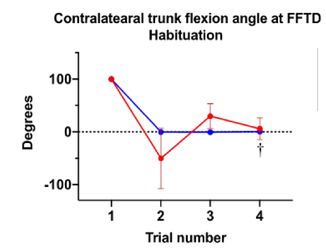
* Significantly different from first trial – young adults
† Significantly different from first trial – older adults

Results









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Discussion & Conclusions

- There are age-related differences in kinematic responses at FFTD, indicating age-related differences in stability strategies while walking over a compliant surface
- There was significant habituation in COM displacement during APA and CPA as early as trial 2 in older adults, indicating improvements in ML stability over repeated trials
- Older adults showed habituation in elbow flexion angles ipsilateral to the leading limb and trunk flexion angles contralateral to the leading limb during gait initiation onto the foam over the four trials
- Further research is needed to determine the importance of upper limb responses to stability while walking on uneven surfaces

References

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