Gait perturbations to discriminate between older adults with and without history of falls

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BACKGROUND AND AIM: While falls among older adults are considered a major health problem, the sensitivity of conventional fall risk assessments to identify individuals is poor [1]. Among the main risk factors for falls are balance and gait impairments [2]. The ability to resist or recover from gait perturbations requires fast and accurate responses and might discriminate between fallers and non-fallers. We therefore investigated the ability to discriminate between older adults with and without history of falls using perturbationbased gait assessment.

METHODS: Twenty-five older adults (14 females; 74.0±11.1 years of age) walked at a fixed speed (1.03±0.20 m/s) on the GRAIL (Motekforce Link BV, Amsterdam, The Netherlands). Trunk and lower limb kinematics were collected (Vicon, Oxford, UK) during steady state walking and in response to four types of perturbations: ipsi-lateral and contra-lateral platform sway and unilateral belt acceleration and deceleration. Maximum pelvic velocity per step in the medio-lateral and anterior-posterior direction was calculated during baseline walking and the first step after each perturbation. Additionally, self-reported fall history over the past 12 months, falls efficacy score, physical activity questionnaire, one-legged stance test and the timed up and go test were assessed. Participants were categorized as fallers or non-fallers based on their self-reported fall history. Differences between fallers and non-fallers were analysed using one-way ANOVAs.

RESULTS: Seven participants (28%) reported at least one fall in the past 12 months and were categorized as fallers. Fallers showed significantly (F=5.651; p=0.026) lower maximum pelvic velocity in response to the deceleration perturbation compared to non-fallers. No significant differences in maximum pelvic velocity were found during baseline walking and for the other perturbation types (Figure 1). Moreover, fallers could not be discriminated from non-fallers based on the conventional measures.

CONCLUSIONS: We successfully discriminated fallers from non-fallers based on the recovery from deceleration perturbations. Fallers had more difficulties in maintaining walking speed as indicated by the lower maximum pelvic velocity. On average, their maximum pelvic velocity was negative, meaning that their position on the treadmill became more rearward after the deceleration perturbation. Therefore assessing the ability to recover from deceleration perturbations may be used to identify fall risk in older adults. The added value of other perturbation outcomes and strategies to recover from perturbations will be discussed.

[1] Gates S. et al. (2008). J Rehabil Res Dev, 45(8): 1105-16.

[2] Ambrose, AF et al. (2013). Maturitas, 75(1): 51–61.