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The Coherence between Fear of Falling and Dynamic Postural Capability

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Abstract

Objectives: In the context of fear of falling (FoF) and fall-related self-efficacy have a significant impact on the functional performance in gait mobility, postural function and activities of daily living. In this study, we analysed the relation between FoF with the 7-item version Fall Efficacy Scale-International (short FES-I) and biomechanical measurements of balance.

Methods: 25 geriatric patients with increased short FES-I Score (18.5 CI 14.0-24.1; Cut-off ≥ 10/28 points) carried out fourteen different stance and gait tasks to objective the complex postural capability (Sway Star^{TM} System Specific Body Control Index (BCI) compared trunk sway (°, °/s) and time to go with an age and sex matched control group. Correlation between short FES-I and biomechanical parameters were calculated

Results: Increased short FES-I score do not correlate with BCI and major single tasks trunk sway parameters (° and °/s), but correlate significantly positive with time to go tasks.

Discussion: FoF and lower fall self-efficacy does not necessarily lead to a higher postural instability. However, gait was reduced in speed but not necessarily instable (i.e. increased trunk sway amplitudes). Increasing data in diagnostic procedures will cause more complex recommendations in therapeutic strategies.

Introduction

Over 33% of community-dwelling people aged over 65 years fall at least once a year, and of those 50% will have recurrent falls with increasing age, the rate of falls can increase up to 60% [1]. Fear of falling (FoF) in elderly people has been recognized as an important psychological factor associated with falls. A recent systematic review found that the prevalence of FoF in 19 studies of community-dwelling older adults ranged from 21% to 85% [2]. Excessive FoF can lead to needless restriction in participation in physical and social activities resulting in physical deconditioning, poor quality of life, social isolation, depression, and psychological distress [3-5]. A number of risk factors for FoF were identified including old age, female gender, previous falls, the presence of environmental hazards that increase the risk of falls, dizziness, visual problems, poor self-rated health, symptoms of depression and generalized anxiety, poor balance and gait abnormalities, cognitive impairment, functional dependence in activities of daily living, and lower levels of economic resources exercise (planned, structured, repetitive and purposive physical activity aimed at improving physical fitness) may reduce FoF by improving strength, gait, balance and bad mood [6].

However, the complex nature of psychological risk factors for falling and the limited background information on this phenomenon restrict its inclusion in falls prevention programmes [7]. At the moment, there is not enough evidence to determine whether exercise interventions reduce FoF [6].

The purpose of our study was to explore whether a relationship exists among FoF and balance ability.

Methods

Twenty-five community-dwelling participants (fifteen females, nine self-reported fallers over the last 4 months, age: 74.4 (Range 55-82] years, height: 1.65 m ± 0.88 m, mass: 70.1 kg ± 13.2 kg, Mini Mental State Examination score-MMSE: 28.9/30) with FoF were included in this study. Participants were excluded if they had a previous diagnosis of dementia or developmental disability, psychotic symptoms, Parkinson's disease, multiple sclerosis, motor neurone disease or central nervous system inflammation, advanced subcortical arteriosclerotic encephalopathy, which might prevent them from completing assessments.

Using the short falls efficacy scale international (short FES-I), we assessed participants by asking about concern about falling across a wide range of activities of daily living (higher score represents higher concern about falling level). The short FES-I exhibit excellent internal consistency (Cronbach's alpha=0.92) and test-retest reliability (ICC=0.83) to assess FoF in a community-dwelling population [8].

The participants answered to the short FES-I questionnaires and carried through the balance test battery.

For balance analysis, we used the mobile equilibrium analysis system SwayStar^{TM} (Balance International Innovations GmbH, Switzerland). In accordance to the operating manual the measurement device was applied to the lower back with a belt. Two digital angular velocity transducers measured the angular deviation and angular acceleration of the upper body in the anterior/posterior (pitch plane) and medial/lateral (roll plane) direction (level of accuracy of <0.01°/s; sampled at 100 Hz) in freely moving subjects without interfering with

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natural body movements. The trunk movements of the participants were recorded and transferred to a PC via a Bluetooth® wireless link connection.

The test protocol (standard balance screening) included seven tasks in order of increasing difficult: "standing on both legs separated at shoulder width on a normal surface for 20 seconds with closed eyes"; "standing on a foam support for 20 seconds with eyes closed", "standing on one leg", "walking eight tandem (toe-to-heel) steps"; "walking 3 meters with continuously pitching head movements"; "walking 3 meters with eyes closed"; "walking over four barriers (24 cm high) that were 1 meter apart".

Balance control summary of those stance and gait tests and associated sway variables discriminate between patients with balance deficits and age- and sex-matched normal subjects. This latter cumulative value is called the Balance Control Index (BCI). The principle underlying the BCI provided is based on a stepwise discriminant analysis of patient data collected with SwayStar™. For all six tests in the balance screening test and the BCI sequence SwayStar^{TM} provides normal reference values from the ages of 16 years to 82 years [9]. Reference values are calculated for an age group ± 5 years either side of the test subject's age.

The protocol was approved by the local ethic committee (Study Nr: K-108-16)

Data Aanalysis

For data analysis, we calculated (1) BCI, (2) total task duration (s) in gait conditions and (3) peak-to-peak excursions (with respect to reset angular positions of zero displacement at the start of each trial) for angular displacement in roll plane (°) in "walking eight tandem (toe-to-heel) steps" and "walking over four barriers" and (4.) angular velocity in pitch plane (°/s) in "standing 2 legs eyes closed", "standing on 2 legs on foam with eyes closed", "walking 3 meters with continuously pitching head movements" and "walking 3 meters with eyes closed".

Pearson's Product-Moment **Correlation** coefficient was used to examine the associations between biomechanical parameters and the FoF defined by the short FES-I. Differences between fallers and non-fallers were calculated with t-test for independent samples and Wilcoxon-Man-Whitney-Test. The significance level was set at p ≤ 0.05. The statistical analysis was performed using PASW Statistics 18.0.

Results

Short FES-I Score was increased with mean 18.5 (CI 14.0-24.1; Cut-off: ≥ 10/28) in all patients and confirmed FoF in the study group.

Interestingly 36% of the tested participants have a normal postural stability score (BCI).

There was no significant correlation between BCI and FoF (short FES-I) (p=0.111; r=0.358).

Regarding the trunk angular displacement in roll plane (°) we found no correlation between following conditions and FoF (short FES-I): "walking eight tandem steps" (r=-0.178; p=0.395), "walking over barriers" (r=0.233; p=0.261) (Figure 1).

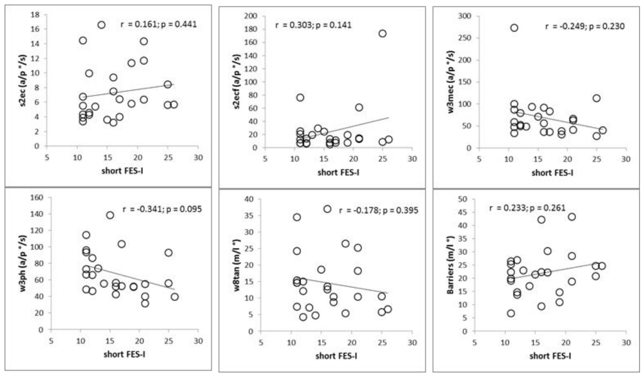

Figure 1: Correlation between short FES-I and trunk sway parameter short FES-I=short falls efficacy scale international; s2ec=standing on 2 legs eyes closed; s2ecf=standing on 2 legs eyes closed on foam; w3mec=walking 3 meters eyes closed; w3ph=walking 3 meters pitching head; w8tan=walking 8 tandem steps; Barriers=walking over barriers; a/p=anterior/posterior direction; m/l=medial/lateral direction; °/s=trunk inclination angular velocity; °=trunk inclination degree; r=coefficient of correlation; p=significance level.

Furthermore, short FES-I did not correlate with angular velocity in pitch plane (°/s) in "standing 2 legs eyes closed" (r=0.303; p=0.141), "standing on 2 legs on foam with eyes closed" (r=0.161; p=0.441), "walking 3 meters with continuously pitching head movements" (r=-0.249; p=0.230) and "walking 3 meters with eyes closed" (r=-0.341; p=0.095) (Figure 2). Even "walking eight tandem steps" time could not reach significant level (r=0.360; p=0.077) (Figure 2).

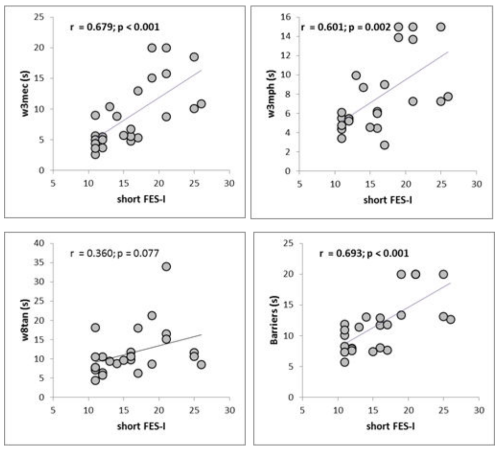

Figure 2: Correlation between short FES-I and gait time short FES-I=short falls efficacy scale international; w3mec=walking 3 meters' eyes closed; w3ph=walking 3 meters pitching head; w8tan=walking 8 tandem steps; Barriers=walking over barriers; s=seconds; r=coefficient of correlation; p=significance level.

On the contrary gait time (s) correlated significantly with short FES-I in "walking 3 meters with continuously pitching head movements" (r=0.679; p ≤ 0.001), "walking 3 meters with eyes closed" (r=0.601; p=0.002) and "walking over barriers" (r=0.693; p ≤ 0.001).

In all observed parameters, there were no significant differences between fallers and non-fallers (Table 1).

Discussion

FoF is associated with a range of negative health consequences, including an increased risk of falls. Delbaere et al. suggested that FoF can lead to falls independent of any objective balance impairment [7]. Exercise interventions have been proposed as a promising tool for the prevention of falls and are recommended in evidence based guidelines for fall prevention across the world, but few have specifically focused on exercise and its potential effect on FoF.

Low quality evidence (Chochrane review) suggests that exercise interventions are associated with a small to moderate reduction in FoF amongst community-dwelling older adults immediately at the end of the intervention period [6].

	short FES-I	BCI	s2ec (a/p °/s)	s2ecf (a/p °/s)	w3mec (a/p °/s)	w3mec (s)	w3mph (a/p °/s)	w3mph (s)	w8tan (m/l °)	w8tan (s)	Barriers (m/l °)	Barriers (s)
faller (n=9)	16.1 ± 5.0	419.4 ± 122.8	7.9 ± 4.4	25.1 ± 25.3	85.5 ± 72.8	8.2 ± 6.0	61.7 ± 25.6	7.4 ± 4.1	17.6 ± 9.4	12.4 ± 8.5	26.8 ± 9.9	12.2 ± 5.0
non-faller (n=16)	16.0 ± 4.8	409.2 ± 116.1	7.0 ± 3.5	23.7 ± 40.6	59.8 ± 24.2	9.0 ± 3.0	70.7 ± 27.2	7.8 ± 3.9	12.8 ± 8.4	11.1 ± 4.9	22.2 ± 6.6	11.9 ± 4.6
p	0.997	0.838	0.586	0.928	0.213	0.636	0.427	0.791	0.206	0.649	0.231	0.871

Table 1: Differences between faller and non-faller in all evaluated parameter short FES-I=short falls efficacy scale international; BCI=Balance Control Index; s2ec=standing on 2 legs eyes closed; s2ecf=standing on 2 legs eyes closed on foam; w3mec=walking 3 meters eyes closed; w3ph=walking 3 meters pitching head; w8tan=walking 8 tandem steps; Barriers=walking over barriers; a/p=anterior/posterior direction; m/l=medial/lateral direction; °/s=trunk inclination angular velocity; °=trunk inclination degree; s=seconds; p=significance level.

Unexpected FoF increased significantly in community-dwelling older adults after an exercise program over a period of two years [10].

On the other side exercises intervention in Parkinson disease [11] and post stroke inpatient [12] with pronounced postural instability and gait disturbance reduced FoF.

An additional study have found decreased balance abilities and postural control reflected in increased postural sway in groups with FoF or an increased postural stiffness because of this fear [13]. However, this study evaluated static balance and not balances during walking, and most studies were not performed in older people.

The results in our study show that patients with FoF might have not all dramatically increased postural instability in stance and different gait tasks, objectified by biomechanical measurement. 36% of patients have a normal postural stability (BCI) in different gait and stance tasks, whereas 72% of patients reduced their gait velocity without significant increased trunk sway parameter (e.g. postural instability). Some older people with FoF adapt their gait, often described as “cautious gait” or “fearful gait”. In contrast to static balance, however, little is known about the dynamic balance in older people with FoF. Since most falls occur during movement, dynamic balance may be more important and directly related to falls and FoF. It is possible that the decrease in the gait velocity in the FoF study group is an adaptation to stabilize postural sway.

It seems that FoF does not strongly influence trunk sway in stance and different gait conditions, although gait velocity in different tasks.

The findings of our study are subject to limitations. However, the sample size was relatively small and the results cannot be generalized. Age-related white matter changes (WMC) are prevalent findings among the elderly. WMC are considered to be etiologically related to cerebral small vessel disease and are important substrates for cognitive impairment and functional loss in the elderly. They are almost endemic in community elderly with prevalence ranging from 50% to 98% and were associated with gait disturbance and falls.

Furthermore, 10 study subjects were diagnosed with depressive symptomatic. Therefore, slowing of gait in clinical depression is well established [14]. In this study, we cannot found statistically differences between depressive versus non-depressive study persons in all gait parameters (t-test independent samples).

In conclusion FoF should not be interpreted as a sign of decreased balance control on stance and gait. Slower gait velocity may reflect a useful mechanism optimising balance but psychological factors could influence balance confidence. Further research is required in this field. For multifactorial therapy program, we recommend a well-balanced combination of psychological (e.g. behavioural therapy) and physical intervention [15] based on objective postural analysis. Further studies with more extensive data are necessary to verify this possibility.

References

1. Rubenstein LZ (2006) Falls in older people: Epidemiology, risk factors and strategies for prevention. Age Ageing 35: ii37-ii41.
2. Scheffer AC, Schuurmans MJ, van Dijk N, van der Hooft T, de Rooij SE (2008) Fear of falling: Measurement strategy, prevalence, risk factors and consequences among older persons. Age Ageing 37: 19-24.
3. Delbaere K, Crombez G, Vanderstraeten G, Willems T, Cambier D (2004) Fear-related avoidance of activities, falls and physical frailty. A prospective community-based cohort study. Age Ageing 33: 368-373.
4. Li F, Fisher KJ, Harmer P, McAuley E, Wilson NL (2003) Fear of falling in elderly persons: Association with falls, functional ability, and quality of life. J Gerontol B Psychol Sci Soc Sci 58: 283-290.
5. Van Haastregt JC, Zijlstra GA, van Rossum E, van Eijk JT, Kempen GI (2008) Feelings of anxiety and symptoms of depression in community-living older persons who avoid activity for fear of falling. Am J Geriatr Psychiatry 16: 186-193.

6. Kendrick D, Kumar A, Carpenter H, Zijlstra GA, Skelton DA, et al. (2014) Exercise for reducing fear of falling in older people living in the community. Cochrane Database Syst Rev. 2014 Nov

7. Delbaere K, Close J, Brodaty H, Sachdev P, Lord S (2010) Determinants of disparities between perceived and physiological risk of falling among elderly people: cohort study. BMJ 341: c4165.

8. Kempen GI, Yardley L, van Haastregt JC, Zijlstra GA, Beyer N, et al. (2008) The Short FES-I: A shortened version of the falls efficacy scale-international to assess fear of falling. Age Ageing 37:45-50.

9. Faraldo-Garcı´A, Santos-Pe´rez S, Labella-Caballero T, Crujeiras R, Soto-Varela A (2013)Age-adjusted normality patterns for post-urography by Sway Star system. Eur Arch Otorhinolaryngol 270: 3169-3175.

10. El-Khoury F, Cassou B, Latouche A, Aegerter P, Charles MA, et al. (2015) Effectiveness of two year balance training programme on prevention of fall induced injuries in at risk women aged 75-85 living in community: Ossébo randomised controlled trial. BMJ 351: h3830.

11. Canning CG, Sherrington C, Lord SR, Close JC, Heritier S, et al. (2015) Exercise for falls prevention in Parkinson disease: A randomized controlled trial. Neurology 84: 304-312.

12. Adkin AL, Frank JS, CarpenterMG, Peysar GW (2002) Fear of falling modifies anticipatory postural control. Exp Brain Res 143: 160-170.

13. Jung Y, Lee K, Shin S, Lee W (2015) Effects of a multifactorial fall prevention program on balance, gait, and fear of falling in post-stroke inpatients. J Phys Ther Sci 27: 1865-1868.

14. Brandler TC, Wang C, Oh-Park M, Holtzer R, Verghese J (2012) Depressive symptoms and gait dysfunction in the elderly. Am J Geriatr Psychiatry 20: 425-432.

15. Svantesson U, Babagbemi B, Foster l, Alricsson M (2014) influences on modern multifactorial falls prevention interventions and fear of falling in non-frail older adults: A literature review. J Clin Med Res 6: 314-320.