

The effects of a step training program on the stepping, physical, and cognitive performance of community-dwelling older adults with mild dementia: a pilot investigation

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Introduction:

Falls are common in older adults with dementia. Reduced stepping performance is a common risk factor for falls. Step training has been shown to be effective in reducing the risk of falls in healthy older adults. However, the effects of step training have not been investigated in older adults with dementia.

This study aimed to investigate the potential effects of a step training program on a pilot sample of community-dwelling older adults with mild dementia.

Methodology:

Nineteen older adults who were diagnosed with mild dementia and able to walk 10 meters independently without a walking aid were recruited. The participants were randomized to either a step training group ($n = 10$) or a waitlist control group ($n = 9$). The step training group performed step training for 30 minutes, twice per week, for 12 weeks. The waitlist control group received usual care for 12 weeks. We evaluated the feasibility (adherence to the step training program), safety (number of adverse events), and clinical outcomes, including (1) stepping performance (Choice Stepping Reaction Time Test and Maximum Step Length Test), (2) attention and executive function (Color Trails Test), (3) balance (Berg Balance Scale), (4) mobility (Timed Up and Go Test), (5) dual task ability (Timed Up and Go test – dual task), (6) lower limb muscle strength (30-second sit-to-stand test), (7) fear of falling (Iconographical Falls Efficacy Scale), and (8) depressive symptoms (Geriatric Depression Scale).

Results:

The adherence of the step training group and the waitlist control group to the step training program was 86% and 90%, respectively. No adverse event has been reported. The step training group had a significant improvement in the Maximum Step Length Test (backward directions, $p = .03$; lateral directions, $p = .04$) at 12 weeks compared to the baseline (see Table 1). In contrast, no significant change was found in the waitlist control group. Additionally, the time for the Choice Stepping Reaction Time Test and the score of the 15-item Geriatric Depression Scale were reduced by 38% and 35%, respectively, compared to the baseline in the step training group.

Conclusions:

The step training program is feasible and safe for older adults with mild dementia to perform. The program also has the potential to improve stepping performance and various clinical outcomes in this population. This pilot investigation suggests that future studies with a bigger sample to evaluate the effects of the step program are warranted.

Table 1. Within-group changes in stepping, physical, and cognitive performances.

Outcomes	Step training group (n = 10)		p-value	Waitlist control group (n = 9)		p-value
	Baseline	12 weeks		Baseline	12 weeks	
CTT1, s (SD)	230.8 (123.3)	187.2 (71.9)	0.12	167.4 (56.5)	164.0 (19.2)	0.87
CTT2, s (SD)	289.4 (116.4)	287.5 (83.5)	0.33	265.5 (146.4)	297.5 (192.3)	0.70
CTT-DTC, % (SD)	0.94 (0.86)	0.88 (0.27)	0.07	0.52 (0.31)	1.0 (0.94)	0.18
BBS, score (SD)	47.1 (4.2)	48.9 (5.2)	0.22	45.3 (6.5)	49.5 (3.54)	0.13
CSRTT, s (SD)	76.72 (45.9)	47.9 (10.82)	0.24	50.78 (18.7)	45.4 (9.48)	0.46
MSLT, cm (SD)						
Forward	57.3 (11.35)	56.5 (12.89)	0.63	63.38 (22.03)	68.0 (17.17)	0.63
Backward	46.89 (11.8)	54.05 (16.39)	0.03	55.94 (17.17)	48.0 (26.87)	0.47
Lateral	48.07 (13.77)	53.2 (12.37)	0.04	57.0 (34.0)	58.25 (28.4)	0.94
TUG, s (SD)	16.77 (6.56)	16.48 (7.61)	0.40	14.01 (5.11)	15.42 (10.84)	0.74
TUG-DT, s (SD)	29.57 (12.88)	27.76 (15.17)	0.16	21.1 (11.15)	21.35 (8.2)	0.96
TUG-DTC, % (SD)	0.84 (0.53)	0.71 (0.63)	0.75	0.45 (0.24)	0.59 (0.58)	0.52
STS30, repetitions (SD)	9.7 (2.1)	10.6 (2.4)	0.17	9.3 (8.1)	11.0 (7.1)	0.65
Icon-FES, score (SD)	19.4 (7.76)	18.4 (6.0)	0.77	16.3 (6.5)	19.0 (12.73)	0.58
GDS-15, score (SD)	5.7 (4.3)	3.7 (2.8)	0.24	3.6 (3.2)	4.0 (4.24)	0.82

Paired t-test was used for within-group comparison.

CTT1, Color Trials Test-1; CTT2, Color Trials Test-2; DTC, dual-task cost; BBS, Berg Balance Scale; CSRTT, choice stepping reaction time test; MSLT, maximum step length test; TUG, Time Up and Go test; TUG-DT, Time Up and Go dual-task test; STS30, 30 seconds Sit-to-Stand test; Icon-FES, Iconographical Falls Efficacy Scale; GDS-15, 15-item Geriatric Depression Scale.