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Efficacy of Square Stepping Exercises versus Conventional Balance Training on Balance, Gait Speed and Fear of Fall among Frail Individuals: A Pilot Study

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ABSTRACT

Introduction: Frailty is a state of increased vulnerability due to age-related decline across multiple systems, often leading to walking difficulties and higher fall risk. Square Stepping Exercise (SSE) is a cognitively engaging, low-cost intervention performed on a grid-patterned mat, challenging visuomotor coordination, dynamic balance, and anticipatory adjustments, potentially enhancing neuroplasticity and sensorimotor integration.

Aim: As the growing burden of frailty and its associated healthcare costs, the findings of this study could have significant implications for improving functional independence and quality of life among frail individuals and provide evidence-based recommendations for clinicians to optimise fall prevention strategies.

Materials and Methods: Thirty-six participants (both male and female, aged 60-85 years) were randomly assigned into two groups using the chit method: Group A {SSE + Conventional Balance Training (CBT)} and Group B (CBT). Inclusion criteria were Fried Frailty Scale ≥3, Hindi Mini-Mental State Examination ≥21, and Tinetti POMA >19. Exclusion criteria included regular exercise participation in the past 3 months or presence of any severe musculoskeletal, neurological, or cardiovascular disorders interfering with safe participation. Both groups underwent supervised training for 4 consecutive weeks (3 sessions/week, 40-45 min/session). The following outcome measures were assessed at baseline and post-intervention: Mini-BESTest (balance), 6-Metre Gait Speed Test (gait speed), and Hindi-Version Fall Efficacy Scale (fear of fall).

Results: Both groups demonstrated significant improvements for within-group analysis on Mini-BESTest (p=0.012), 6m-GS (p=0.002) and H-FES (p=0.024) from baseline and post-intervention. However, between-group comparisons showed that participants in the SSE+ CBT group showed significant improvements on MiniBESTest (p=0.046) and 6m-GS (p=0.0014), whereas non-significant results were observed in H-FES (p=0.57), compared to the CBT group.

Conclusion: Square Stepping Exercises combined with CBT were more effective than CBT alone in improving balance, enhancing gait speed, and reducing fear of fall among frail individuals. This pilot study suggests that SSE may be a valuable, low-cost, and clinically feasible adjunct to traditional balance training programs for fall prevention and functional independence among frail individuals.

Keywords: Frailty, Sensorimotor integration, Visuomotor coordination

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