

## Effects of turning and cognitive training in fall prevention with dual task training in elderly with balance impairment

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**Objective:** To compare the effect of turning & cognitive training in fall prevention with dual task training in elderly with balance impairment.

**Methodology:** In this single blind randomized control trial, integrated 40 adults with mean age of  $63.0 \pm 12.0$ , of either gender, able to stand and walk with and without use of assistive devices, having no other neurological impairment were part of study. The intervention protocol was of 6 weeks with 30-45 minutes basic balance training: turning & cognitive training (TCT, n=20) and Dual tasking Training (DTT, n=20). The demographics were recorded and standardized assessment tools included Berg balance scale (BBS), Timed Get up and Go test (TUG), 10 meter walk test and Functional reach test (FRT). The measurements

were obtained at baseline and post-intervention level. SPSS 21 was used for data analysis.

**Results:** Significant improvement was notified in BBS and TUG test ( $p < 0.05$ ). When independent sample T test was used after end of intervention in both groups, no significant difference was noted in FRT and 10MWT with ( $p > 0.05$ ) in both groups.

**Conclusion:** There was remarkable improvement in postural balance and on turning effect after integrating dual task training. For physically inactive elderly individuals, these interventions can enhance mobility, improve balance and lessen risk of fall. (Rawal Med J 201;43:124-128).

**Key words:** Turning single task training, dual tasking, balance, fall, elderly.

### INTRODUCTION

Elderly population is a fast growing age bracket globally. In Pakistan, according to UN reports the proportion of population above 60 will increase 5.8% in the year 2000 to 7.3% in 2025 and it will increase to 12.4 % in 2050. The latest update from population reference bureau confirms 4% of the total population of Pakistan as being 65. Falls are defined as an unintentional change in body position resulting in a person coming to rest or landing on the floor.<sup>1</sup> Fall is categorized as the second cause of involuntary and accidental injuries that leads to death globally.<sup>2</sup>

In elderly population fear of fall is mainly provoked because of age, decrease bone mass density, impaired vision, weak muscle tone, dementia and frail conditions. Use of Poly pharmacy is the leading factor that causes poor balance and leads to fall.<sup>3</sup> Balance depends on vestibular, musculoskeletal, somatosensory and nervous system. Multifactorial interventions are in practice for balance e.g. medicines, vitamin D supplements, modified working and home environment, assistive devices,

specially design foot wears and balance training in rehabilitation.<sup>4,5</sup>

Turning with cognitive training and dual task has been integrated for proper balance in order to avoid fall.<sup>6</sup> Turning is an important element in ambulation, requires high attention and cognitive levels. Geriatric population uses stepping strategy with greater number of steps and risk of fall is higher in forward walking.<sup>7</sup> Cognitive functioning is a domain that includes problem solving issues, concentration and memory planning.<sup>8</sup> Highly practiced task needs motor control and cognitive processing and it varies with postural changes during ambulation.<sup>9</sup> As age progresses, elderly encounters attention deficit problems and can't focus on dual task simultaneously.<sup>10</sup> Dual task is an ability to perform two or more (multitasks) cognitive and motor tasks while maintaining posture within center of gravity and base of support.<sup>11</sup> Usually, multitasking reduces base of support and causes postural instability due to limitation in information processing capacity.<sup>12,13</sup> The aim of this study was to compare the effect of

turning & cognitive training in fall prevention with dual task training in elderly with balance impairment.

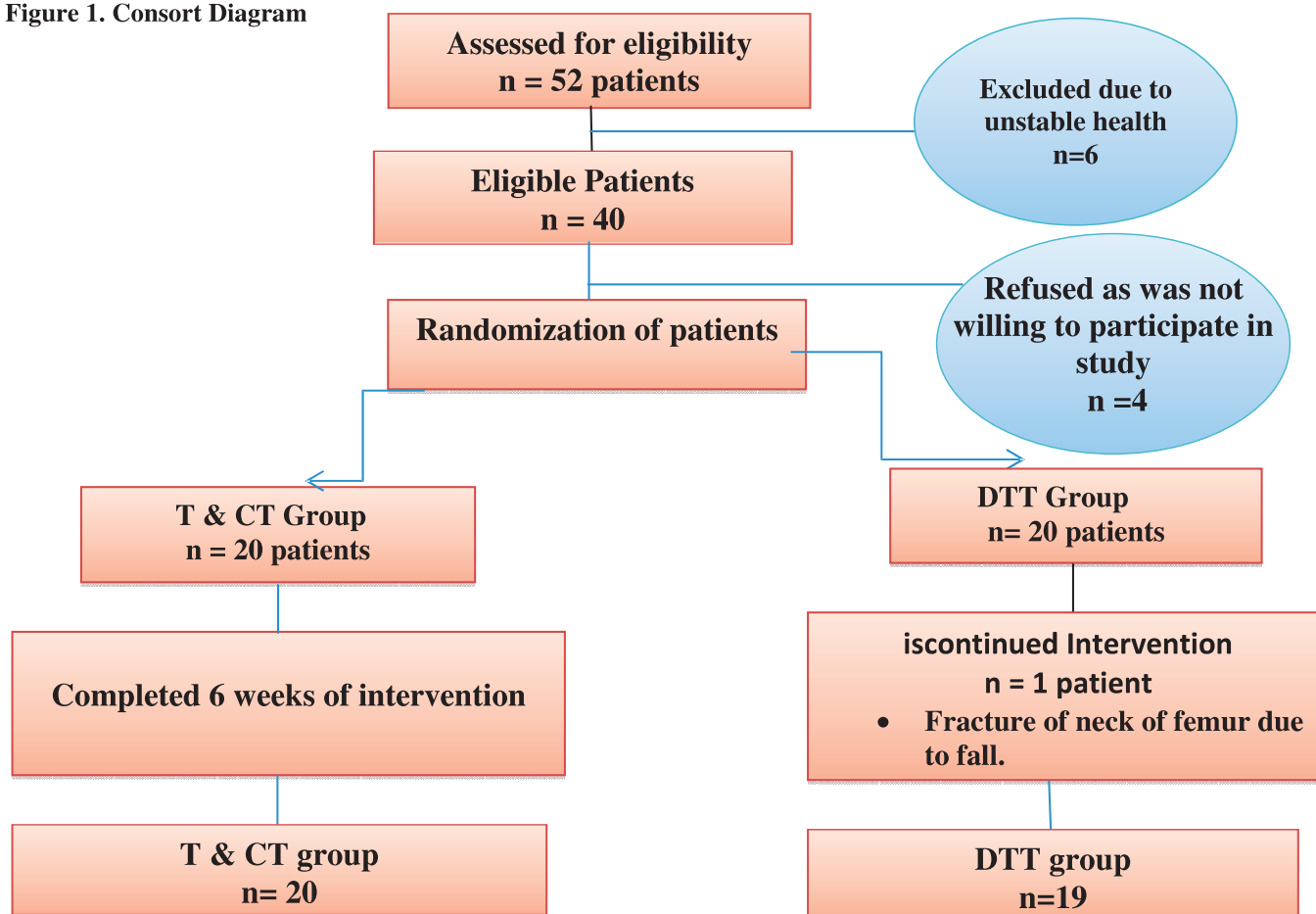
### METHODOLOGY

The study was a randomized control trial conducted in Rohela Clinic, Wah Cantt, Pakistan from July 2016 January 2017. Ethics Committee of Riphah College of Rehabilitation & Sciences approved the study. Sample size was based on availability of participants in specific time frame. Initially, 40 participants were enrolled by purposive non-probability sampling technique. Adults with age 50 above were recruited from a healthy pool of community dwelling population, able to stand and walk with assistive device having no neurological impairment. Those who were unable to ambulate without assistive devices, neurological or musculoskeletal impairment history, unstable medical conditions and medication affecting

cognitive and balance abilities were excluded. All were assessed through Mini mental status examination and those who scored more than 24 were enrolled in study.

The demographics were recorded and standardized assessment tool include Berg balance scale, Time Get up and Go test, 10 m walk test and Functional reach test. Baseline assessment was recorded and then participants were randomly assigned to TCT (n=20) and DTT group (n=20). Treatment was given for 3 days/week for up to 6 weeks; 5 minutes warm up, followed by 10-45 minutes intervention and 5 minutes cool down. Intensity and duration of exercises were increased gradually. Figure 1 shows distribution of participants. After applying test of normality, all tools showed non-significant outcomes, so parametric Independent Sample T Test was selected for analysis of data between two groups. SPSS 20 was used for data analysis.

Figure 1. Consort Diagram



This study integrated 40 adults with mean age of the participants was 63.0±12.0. Out of 40 participants, 30% (n=12) were males while 70% (n=28) were

females. At baseline, there was no significant differences (p>0.05) between two groups.

Turning & Cognitive Training Group (T&CTG)		Dual Task training Group (DTTG)	
Treatment	Dura-tion	Treatment	Dura-tion
<b>Week 1-3</b> <ul style="list-style-type: none"> <li>Warm up</li> <li><b>Balance Training:</b> Dynamic weight shifting, Sitting with eyes open/close, Transfer, Standing static/dynamic Internal/external perturbations with timing and speed, Reaching and Walking forward, backward, sideways and Tandem, Stepping right/left, up/down on stairs.</li> </ul>	5 min	<b>Week 1-3</b> <ul style="list-style-type: none"> <li>Warm up</li> <li><b>Balance Training:</b> Dynamic weight shifting, Sitting with eyes open/close, Transfer, Standing static/dynamic Internal/external perturbations with timing and speed, Reaching and Walking forward, backward, sideways and Tandem, Stepping right/left, up/down on stairs</li> </ul>	5 min
<ul style="list-style-type: none"> <li><b>Week 4-6</b></li> <li>Further Challenged by: Plain or foam surface, Obstacles, Different Gait speed, Reaction time,</li> <li><b>Turning and Cognition training:</b> Pivot turn on a designed track (180-360 degree), Across obstacles</li> <li>Verbal fluency,</li> <li>Sentence completion,</li> <li>Forward and backward counting from 1-10 , Information processing task e.g. 3 serial subtraction, auditory choice reaction task, and visuospatial task.</li> </ul>	30-40 min	<ul style="list-style-type: none"> <li><b>Week 4-6</b></li> <li>Further Challenged by: Plain or foam surface, Obstacles, Different Gait speed, Reaction time,</li> <li><b>Dual Tasking</b></li> <li>Placing pencils in holes of covered cup, cardboard. Pin plugging / pegging a board in 2 different containers. Walking with fully filled glass of water. Transferring objects at different heights. Throwing or catching a ball during walking.</li> </ul>	30-40 min
<b>Note:</b>	5minutes for warm up and cool down in each session, 3 sessions/week for 6 weeks.		

**Table 2. Mean±SD with p values at baseline and 6 week of intervention of both groups.**

Variables	T&CT group Mean ±SD	DTT group Mean ±SD	P-value
Pre TUG	18.10 ± 3.25	20.15 ± 4.04	0.08
Post TUG	12.50 ± 2.54	19.80 ± 6.93	0.001
Pre BBS	32.50 ± 3.90	28.30 ± 5.27	0.06
Post BBS	38.05 ± 3.73	34.30 ± 4.69	0.001
Pre FRT	18.00 ± 2.51	16.55 ± 3.33	0.12
Post FRT	22.10 ± 1.65	22.00 ± 2.67	0.88
Pre 10MWT	25.50 ± 3.12	24.35 ± 4.40	0.34
Post 10MWT	19.45 ± 1.95	17.55 ± 4.35	0.08

TUG: Time up & Go test. BBS: Berg balance scale. FRT: Functional Reach Test 10 MWT: 10 meter walk test. T&CT: Turning & cognitive training. DTT: Dual task training

Significant improvement was found in BBS and TUG test (p<0.05) (Table 2). When independent sample T test was used after end of intervention in both groups, no significant difference was noted in FRT and 10MWT with (p>0.05) in both groups.

## DISCUSSION

Balance requires both cognitive and physical components. Balance impairment leads to fall in geriatric population and the literature confirms the significance of cognitive factors, both intrinsic and extrinsic as the major cause.<sup>14</sup> Most elderly sustain fall on turning due to marked reduction in the ability

to execute a cognitive and postural task simultaneously. We found that major postural instability was in turning and during obstacle avoidance in gait. Motor cognitive training is effective in improving walking and reaction time.<sup>15</sup> Higher center functioning for motor task can lower fall counts and minimize balance impairment.<sup>16</sup> When elderly are engaged in multiple tasks simultaneously, their processing capability decreases and they perform tasks poorly thus leading to high risk fall. There is a need to integrate dual task training with cognitive training in research.<sup>17,18</sup>

Furthermore, physical inactivity and decline has led to poor postural balance; reduce ambulation capacity and increased fall injuries for numerous elders in the community.<sup>19,20</sup> The participants in this study showed significant improvement in all measures. Timed get up and go test is a clinically generalized tool to assess lower limb mobility and fall risk. Variation in patients were observed during TUG at baseline i.e. decrease step length, more time taken during sit-stand, double support in gait, turning and use of hand, but after training participants in dual task group improved significantly. Fatigue factor of this test was not implemented on patients.<sup>21</sup>

Participants of DTT group after six weeks of intervention showed significant improvement in balance both static and dynamic on BBS. In addition, there was improvement in gait speed and the risk of fall was reduced among individuals of both groups. The overall increased in scores of BBS is a novel finding of this study. The results of functional reach test and 10MWT result could not be considered significant due to poor performance as a consequence of aging.<sup>22</sup>

## CONCLUSION

Both Turning and cognitive training and dual task training were equally effective at improving balance, walking performance and reduction in fall risk.

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### Author Contributions:

Conception and design: Komal Khan, Arshad Nawaz Malik  
Collection and assembly of data: Komal Khan  
Analysis and interpretation of the data: Komal Khan, Misbah Ghous  
Drafting of the article: Misbah Ghous  
Critical revision of the article for important intellectual content: Komal Khan, Arshad Nawaz Malik  
Statistical expertise: Komal Khan, Misbah Ghous, Arshad Nawaz Malik  
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