



COMPARATIVE STUDY TO EVALUATE THE EFFECTIVENESS OF VESTIBULAR REHABILITATION VERSUS DUAL TASK TRAINING ON BALANCE & GAIT IN OLDER ADULTS.

Sana Saleem¹, Dr. Bharti Arora², Dr. Priya Chauhan²

¹MPT Student SGT University, Gurugram

²Assistant professor, SGT University, Gurugram, Haryana

Conflicts of Interest: Nil

Abstract:

Objective: The study was done to evaluate the effectiveness Of Vestibular Rehabilitation Versus Dual Task Training on Balance & Gait in older adults. **Methods:** A total of 60 subjects were randomly assigned into 2 groups, Group-A Vestibular Rehabilitation (VRT) (n=30) and Group- B Dual-task Training (n=30). Both received intervention for 45 minutes in a day 3 times in a week for 4 weeks. Participants were assisted with The Functional Gait Assessment (FGA) and Time up and Go (TUG) after 4 weeks of intervention. **Result:** Vestibular Rehabilitation significantly improved ($p = 0.01$) with elderly participants. The FGA significantly improved with a large effect size, ($p = 0.02$). Specifically, component tasks such as walking with horizontal head turns ($p = 0.03$), gait with a narrow base of support ($p = 0.02$), ambulating backward ($p = 0.04$) significantly improved. The TUG component task gait initiation significantly improved ($p = 0.02$). However, there were no significant differences in Dual-task Training group analysis for post intervention outcome when measured for FGA ($p = 0.6$) and TUG ($p = 0.4$). **Conclusion:** The present study shows there was a significant improvement in the Vestibular Rehabilitation therapy over Dual-task Training in elderly people on balance and gait performance. Our results are encouraging to use VRT as a part of rehabilitation protocol by improving their balance and gait and gaining confidence of walking by reducing the risk of falls on these elderly individuals without vestibular disorders.

Keywords: Gait, Vestibular Rehabilitation, elderly people

Introduction

Balance becomes more precarious in elderly people and can lead to serious health consequences. The physiological decline in balance and gait disturbance that occurs with age is a factor that also favors falls. A variety of diseases can cause gait disturbances in elderly, like Parkinson's disease, cerebrovascular gait disturbance etc. Even without pathological disorders, due to aging of different body systems i.e. visual, vestibular and proprioceptive, is a factor that also leads to impaired balance and gait disturbance.[1] In a population-based study, 35% prevalence of gait

disorders among person of 70 years above. 85% of 60-year old still walk normally, but only 20% of 85-year-olds do. About 30% over the age of 65 years living at home fall at least once per year.[2]

Accidental falls especially in older patients are a very serious issues in public health problem from both an economic and a clinical perspective.[3] Falls also have significant psychological and social consequences, as patients limit their physical activity and lose their self-confidence due to the fear of falling.[4] Nearly a third of all people who fall multiple times a year are hospitalized or

sometimes die in the following year.[5]Therefore, repeated falls are a prognostic factor for greater morbidity–mortality, generates isolation and interferes greatly in their activities of daily life, significantly minimize their quality of life.[6]

Walking is frequently performed sensorimotor tasks in everyday life. It relies on a complex, simultaneous interaction of the sensory control, motor system, and cognitive functions. Walking speed normally decreases by about 1% per year from age 60 onwards. Gait disturbances in old age should be recorded as deviations of the main quantitative parameters of gait—speed, step size, and breadth of stance.[7]

Vestibular Rehabilitation Therapy (VRT) is an exercise-based program designed to promote vestibular adaptation and substitution that enhance gaze stability, postural stability, to improve activities of daily living, reduces vertigo and dizziness [8]. This protocol has been shown to be effective in improving impaired balance affected by different neurological and vestibular disorders. In addition, vestibular rehabilitation exercises also benefits people with non-vestibular imbalance and vertigo.[9]Vestibular rehabilitation focuses on the facilitation of the maximal use of any remaining vestibular function, improvement of postural stability and gaze by the use of visual and somatosensory cues and improvement of home and workplace safety. One of the important goals of VRT is the improvement of gait, especially during head movements as a measure to prevent falls in individuals.[10].

Dual Task methods or paradigms have been used to examine the relative attention demands associated with different types of postural task .changes in secondary task are used to infer task dependent changes in attentional demands ,so attentional demands vary as the functional of task complicity ,age, and balance abilities. Dual Task Training allows the practice of multitask coordination under the various sets of instructions ,attention has been switch between the tasks .The efficacy of these different tasks training strategy are for the acquisition ,retention and transfer of tasks coordination skills in Stroke[11].The aim of the study was to

find the comparative effect of Vestibular Rehabilitation therapy or dual task improves more on balance and gait in elderly individuals.

Methodology:

It is a comparative experiment type design conducted in physiotherapy rehabilitation center. Inclusion criteria (1)The age of the study subjects was 65 years or more (2)They presented balance impairment without a vestibular disease. (3) Have fallen at least once in the last 12 months (4) Taking more than 15 s, or needing support, in the modified timed up-and-go (TUG) test. Exclusion criteria (1) Cognitive decline that prevents the patient from understanding the assessment (2) balance disorders caused by conditions other than age like neurologic, vestibular, etc. (3) Conditions that prevent standing on two feet, which is necessary for a complete postural assessment and performance of vestibular rehabilitation exercises. (4) Unstable and unexplained medical condition (5) Could not provide informed consent for study participation.[12]

Study protocol:

A total of 60 subjects were randomly assigned into two groups, Group A -Vestibular Rehabilitation Therapy (n=30) and Group B-Dual Task Training (n=30). Each one received treatment for 45 minutes 3 times in a week for 4 weeks. Patients who fulfilled all criteria were assigned randomly to the two groups by simple randomization comprises of computer-generated random number system. This study was approved by the institute ethics committee and review board of SGT University, Gurugram, India. Each participant provided their written informed consent.

The vestibular rehabilitation program consisted of vestibular adaptation exercises consist of vestibular ocular reflex i.e. Gaze stabilization, Head and eye in same directions, Head and eye in opposite directions. Ocular motor exercises consist of Smooth pursuit (visual tracking) and Saccade latency (target in both hands)[13] ,balance and gait exercises include - Stand with feet shoulder-width apart , arms across the chest and ask the patient to bring the feet closer together with closed eyes on cushion sofa or

foam, practice ankle sways ,medial- lateral and anterior-posterior later on with circle sways with closed eyes, attempt to walk with heel touching toe on firm surface and later on carpet, Practice walking five steps and turning 180(left and right)Walk and move the head side to side ,up and down , Touching the wall, Take a ball in hand ,lift it up, transfer to other hand follow arch visually, Circle with ball, Walking on straight line, Walking with head in motion, Walking with head turns, Sit to stand, Standing with one foot, Standing on cushion ,Standing and throwing, Standing with heel together, standing on one feet. The exercise difficulty progressively increased throughout the rehabilitation sessions by increasing duration of session and support surface difficulty, initially hard surface to on foam surface.[14]

Dual task training consisted of stance activities - Semi tandem, eyes open ,arm alterations -Spell words forward, Semi tandem, eyes open ,arm alterations -Spell words backward, Draw letter with right foot- Name any word starts with A-K, Perturbed standing, holding the ball- Remember prices, and gait activities -Walk narrow base of support- Count forward by 3, Walk narrow base of support step sideways backwards avoiding obstacles- Remember words, Walk and kick a ball to hit the cans- Tell the opposite direction of ball.[15]

Outcome measurements

The Functional Gait Assessment (FGA)

It is a 10-item clinical gait test during which participants are asked to perform the following gait activities: walk at normal speeds, at fast and slow speeds, with vertical and horizontal head turns, with eyes closed, in tandem, over

obstacles, backward, and while ascending and descending stairs. FGA is scored on a 4-level (0–3) ordinal scale, scores range from 0 to 30, with lower scores indicating greater impairment. for adults from ages 60 to 80 years, the normal score on the FGA would be considered 24/30 and for adults over the age of 80 years, the normal score would be considered 19/30. Reliability of the FGA to be $r = .93$ (ICC [2,1]) in community-dwelling adults. [9,12]

Time Up and Go

To determine the fall risk and to measure the progress of balance, sit to stand, stand and walking. It is Highly reliable and valid tool. The patient starts in a seated position, stands up upon command, walks 3 meters, turning around, walks back and sits down on chair. The time stops after the patient is seated. Intertester reliability (ICC) reported as high, in elderly people, from .92-.99. Construct validity shown by correlating TUG scores with gait speed (Pearson $r = .75$), step length (Pearson $r = -.74$), postural sway, (Pearson $r = -.48$) and step frequency (Pearson $r = -.59$).[16]

Result

In the experimental group, The Functional Gait Assessment (FGA) increased significantly ($p=0.001$) after 4 weeks compared with the baseline evaluation and also Time Up and Go increased significantly after 4 weeks ($p=0.002$), as shown in table no.2 and also in figure 1. There were no significant differences in the Dual task training group in any of the main outcome measures i.e. in the Functional Gait Assessment (FGA ($p=0.60$) and in Time Up and Go ($p=0.40$), as shown in table no.3 and also illustrated in figure 2.

Table 1: Participants characteristics at baseline

Variables	Mean ± SD(VRT)	Mean ± SD(DTT)	p
Age (years)	70.6±6.5	74.6±8.5	0.75
Gender	1.66 ± 0.49	1.78 ± 0.42	0.15
Falls in previous years	6.25±0.45	5.2 ± 0.45	0.45
No. of comorbidities	3.2±1.7	3.5±1.7	0.52
Geriatric depression scale score	3.5±2.7	3.4±2.7	0.89
Anxiety inventory scores			
State	38.6±10.7	35.6±9.7	0.7
Trait	34.3±10.3	35.6±10.7	0.8

Geriatric depression scale score, higher scores shows more feeling of depression; State, Trait Anxiety inventory scores higher score show more feeling of anxiety. VRT- Vestibular Rehabilitation Therapy, DTT-Dual Task Training.

Table 2 : Vestibular Rehabilitation Therapy Intervention			
Outcome measure	Pre intervention (Mean ± SD)	Post intervention (Mean ± SD)	p value
FGA	32.5± 8.3	25.4±8.2	.001**
TUG	31.8 ± 4.4	22.2 ± 3.5	.002**
**highly significant *TUG: Time Up And Go Scale *FGA: The Functional Gait Assessment Scale			

Table 3 : Dual task training Intervention			
Outcome measure	Pre intervention (Mean ± SD)	Post intervention (Mean ± SD)	p value
FGA	32.5± 7.3	29.4±5.2	.06 ^{NS}
TUG	31.3 ± 4.0	27.2 ± 3.5	.04 ^{NS}
*NS : Non- significant *TUG: Time Up And Go Scale *FGA: The Functional Gait Assessment Scale			

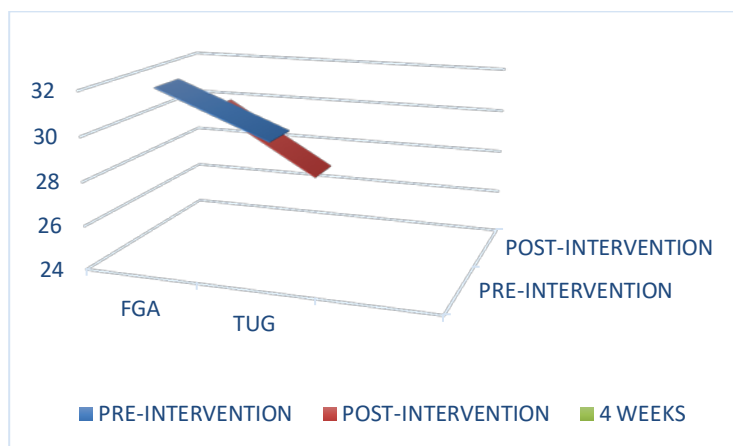


Figure 1: Shows significantly improvement in Vestibular Rehabilitation Therapy group.

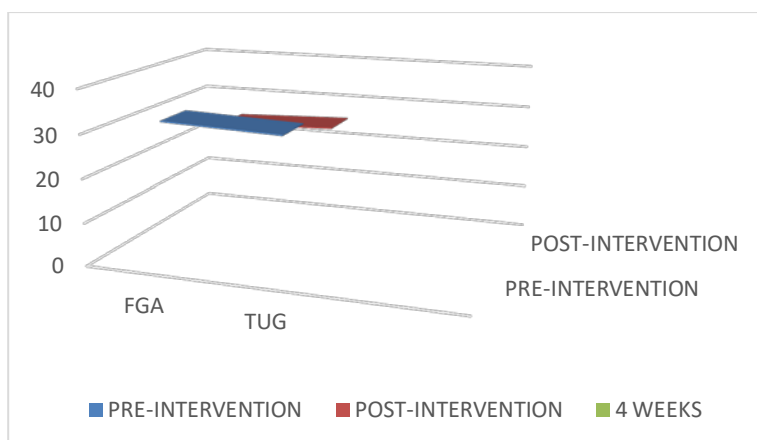


Figure 2: Shows Non-significant improvement in Dual task training group.

Discussion

The present findings of this study indicate that VRT group showed a significant improvement on balance and gait with elderly people. [17] Whiteny et al (2010) suggested that VRT is important to coordinate learning strategies order to maximize adaptation, motor learning and avoid over stimulation. Therefore, it is critical for clinician to play more attention to not only common vestibular symptom but also gait stabilization to avoid fall and further to improve balance. Eye and head movements exercises are performed to improve the gaze stability, whereas exercises performed while sitting, standing on firm or cushion or on narrow base to improve postural stability. [18]. Gait impairments including reduced foot clearance, decreased speed and minimal heel strike causing a hazard. Exercises containing stepping forward and backward over obstacles further increase stride length, heel strike and foot clearance.[19]The elderly people in this study showed a significant improvement in FGA performance (Walker et al., 2007). The total score and the tasks “horizontal head turns”, “walking narrow base,” and “ambulating backward” have improved significantly. Other than the improvements seen in the FGA, the participants also showed a significant improvement in gait initiation confirming previously observed improvements in elderly people with this type of intervention.[20] Gait initiation is a highly challenging task requiring a combination of sensory information sources e.g. from the vestibular, visual systems and somatosensory[21]and had been identified as affected in people with vestibular impairments .(Sasaki et al., 2001; Henriksson et al., 2011).

Strength and limitation:

Our results are encouraging to use VRT as a part of rehabilitation protocol over Dual task training by improving their gait patterns and gaining confidence of walking by reducing the risk of falls on these elderly patients without vestibular disorders. Although it was on smaller sample size, therefore there is need for further future studies for larger sample size.

Conclusion:

Our results are encouraging to use VRT as a part of rehabilitation protocol by alleviating their gait disturbances, improving balance and gaining confidence of walking by reducing the risk of falls on these elderly patients without vestibular disorders.

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