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A Study to Compare the Effect of Dual Task Training and Task Oriented Training on Balance, Mobility and Confidence among Geriatric Population with Balance Impairment

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Abstract

As people age, declining mobility and multiple health conditions can make daily activities challenging and reduce independence and quality of life. To help older adults not just live independently but thrive, this study compares the effects of Dual-Task and Task-Oriented Training on balance, mobility, and confidence in older adults with balance impairments. Aim: To compare the effects of dual task training and task oriented training on balance, mobility and confidence among geriatric population with balance impairment. Methodology: Thirty patients, both male and female with age between 60-70 years were divided into 2 groups i.e. group A and group B, 15 subjects in each group. Group A was given dual task training and group B was given task oriented training. The baseline data was recorded on first day [pre intervention] and on last day of fourth week [post intervention]. All the intervention were performed once a day, three days a week for four weeks. Results: Task-Oriented Training significantly boosted confidence in older adults, while both Task-Oriented and Dual-Task Training improved balance and mobility equally. Overall, Task-Oriented Training is more effective for enhancing self-assurance. Conclusion: Both Task-Oriented and Dual-Task Training improved balance and mobility, but only Task-Oriented Training significantly boosted confidence making it more effective for enhancing self-assurance in older adults.

Keywords: Balance, confidence, Mobility.

Introduction

The field of geriatrics is dedicated to the medical treatment of the aged. Greek words geron, which means "old man," and atros, which means "healer," are the sources of the word geriatrics. Three categories exist for the elderly: Individuals aged 65 to 75 are classified as young-old, those between 75 and 85 as middle-old, and those over 85 years of age as old-old.[1,2] Old age is characterised by a time of decline, poor adaptability, health issues, and changes in body cells brought on by depression and the ageing process. Ageing is associated with biological, mental, and social changes that can lead to physical, social, and psychological health issues in those who are susceptible.

According to research, conditions which are chronic illness like arthritis, high blood pressure, diabetes, heart disease, and problems with vision and hearing affect 80% of the elderly. However, 25% of older people with chronic illnesses require special care; the majority are able to go about their everyday lives and take care of themselves. Furthermore, the functional impairments that make it harder for older persons to conduct instrumental daily living activities and other daily routine living activities are more common in this age group.[3] A natural, accumulative, and gradual decline in several physiological processes, including balance, is associated with aging.[4,5] The general term "balance" refers to the dynamics of body posture used to avoid falls. It has to do with inertial forces of the body and its segments inertial properties.[4,6]

Because balance is essential for both functional movement and safety, it warrants special consideration in the elderly people for Maintaining the functional status and is becoming increasingly crucial due to the aging population and longer life expectancies. One of the main risk factors for fall in elderly person is balance discrepancy. The frequency of falls and balance deficits were found to be closely linked.[4,7] For older adults, imbalance is a serious issue. A greater risk of falls and severe injuries is linked to balance issues, which are typically described as the ability to stay upright for a predetermined amount of time.[8] Although balance impairment is regarded as a one of the main predictor of falls, systematic reviews have not recommended specific clinical assessment scales for balance.[9] It is considered that maintaining mobility is essential in maintaining a healthy aging process. The capacity to shift one's posture or location or go from one spot to another while walking and performing basic ambulation is referred to as mobility.

In general, walking difficulties and mobility limitations have negative effects on older person's physical being, cognitive, and social lives. They frequently result in a reduction in self-sufficiency, physical impairment and harm, institutionalization, and a rise in hospitalizations. As a result, as people age, their ability to perform daily tasks, such as using a mobility aid, begins to decline, increasing the risk of despair, loneliness, and even mortality.[10]

In addition to falling, elderly individuals often have excessive anxiety about falling, which can lower their self-confidence and willingness to carry out everyday tasks. This can lead to a decline in balance and muscle strength. Elderly patient's movement and functioning are said to be severely hampered by a lack of confidence in their ability to balance and a fear of falling. For older adults, having the confidence to perform tasks without losing their balance or becoming unsteady is very important since it affects their mobility and increases their risk of falling.[11] Older adult's life experiences are greatly impacted by confidence, which is frequently linked to loss or lack of confidence, which influences concepts like vulnerability and resilience, all of which have an effect on an individual's health and well-being.[12]

Task-related training [TRT], is a rehabilitation approach that helps patients find the best control mechanisms to relieve their movement problems. It entails practicing functional, goal-directed motions in a natural setting. The patient is expected to engage in a task-specific, self-driven, or goal-driven activity as part of a task-oriented training programme. Task-related training uses a functional method to practise gait and gait-related tasks. Task-oriented training encompasses a broad spectrum of therapies, including sit-to-stand exercises, ground walking training, cycling programmes, endurance training, circuit training, and reaching tasks to enhance balance. According to the task-oriented approach, movement is arranged around a goal and subject to environmental constraints. It arises as an interaction between multiple brain systems.[13] Task-oriented training includes a range of

strategies to assist individuals in determining the best control methods for resolving motor problems. Many movement patterns are used during task-oriented training in order to reduce compensatory movements and boost adaptive movements. Task-oriented training being a training approach that focuses on particular functional activities related to the neuromuscular and musculoskeletal systems.[14]

When a secondary task is undertaken simultaneously, balance is usually disrupted. When their attention is split between multiple things, older adults find it challenging to maintain balance during activities. Elderly people with balance impairments are not the only ones who experience it; healthy older persons often exhibit decreased physical performance during the attention-demanding tasks, which raises the risk of falls even more. Situations such as completing a secondary activity at the same time occur more frequently in everyday situations. Therefore, to increase one's capacity to carry out a secondary work simultaneous without losing balance, specialized exercise training protocol is required. Research indicates that elderly people who are prefer sensorimotor functions such as walking and balancing over cognitive functions like memory encoding and response selection.[15]

Dual-task demands have typically included manual motor activity (e.g., carrying a glass of water on a tray with one hand), verbal fluency (e.g., recognizing animal species aloud), and mental tracking (serial subtractions). Dual-task training may help older adults better share their attention between motor and cognitive tasks or other motor tasks like walking while holding a glass of water in one hand on a tray, even though the ability to prioritize and allocate attention between two or more tasks gradually declines with age.[16] DT performance is necessary for many everyday tasks, including as carrying goods while walking. DT performance is negatively impacted by structural alterations in the prefrontal regions of older individuals' brains that are linked to attention and executive function.[17]

Methodology

Procedure

After explaining the need and procedure of the study to the patient, a written informed consent was obtained from the subjects meeting the inclusion and exclusion criteria. A minimum of 30 subjects were enrolled in the study and were divided into 2 groups-Group A and Group B. Each selected patient was assessed for balance, mobility and confidence. Group-A was given dual task training and Group-B was given task oriented training.

Group A: The session conducted for 45 minutes, 3 times a week. Each task performed for 3 minutes with resting time 2 minutes after each task. Dual task training included semi tandem standing with eyes open and arm alterations with spelling words forwards, semi tandem standing with eyes closed, arm alterations with spelling words backwards, subjects has to draw letter with left and right foot and will be naming any word start with letter A-K, perturbed standing holding a ball and remembering price. eg: groceries, subjects will be asked to perform tandem/ semi tandem walking while counting backward from 100, obstacle crossing while counting backward from 100, semi tandem/ tandem walking with doing arithmetic eg: 2+5, 9-7, obstacle crossing with recount daily activities.

Figure. 1: Dual task training

Group B : The session conducted for 45 minutes, 3 times a week. Each task performed for 3 minutes with resting time 2 minutes after each task. Task oriented training included performing Step-ups, Kicking a ball, standing up and walking, walking through obstacle course, tandem stance, single leg stance, walking and carrying object, speed walking, walking backwards, walking sideway.

Figure. 2: Task oriented training

Result

The data was analyzed by calculating the score in terms of frequency, percentage, mean, standard deviation, unpaired T- test, and paired T- test.

Table 1. Demographic characteristics of the patients

	GA(n-15)	GB(n-15)	p value
Gender(M/F)	8/7	9/6	
Age(year)	69.33±3.039	69.07±3.283	0.8191

Values represented as Mean±SD, GA: Group A, GB: Group B.

Table 1. Depicts that In Group A, males make up 53% of the total, while females account for 47%. The frequency of males is 8, and females is 7, indicating a nearly balanced distribution. In Group B, males have a higher percentage (60%) compared to females (40%). The frequency of males is 9, and females is 6, showing a slightly larger male representation.

Table 2. The comparison of outcome measures on Baseline and 4th week in Intra-group for GA and GB

	Group	Baseline (Day "0")		4th Week	T-test	T-Value	P-Value
TINETII TEST	GA	12.20±1.265		13.27±1.163	9.025	2.15	<0.001
	GB	12.13±1.552		13.53±1.598	8.573	2.15	<0.001
TUG TEST	GA	13.07±1.668		11.93±1.280	5.906	2.15	<0.001
	GB	13.80±1.568		12.13±1.457	7.906	2.15	<0.001
ABC SCALE	GA	45.64±6.009		52.95±6.031	11.933	2.15	<0.001
	GB	51.78±10.170		59.57±9.383	10.361	2.15	<0.001

The Mean±SD score for Tinetti Test increased from 12.20 ±1.265 at 0 week to 13.27±1.163 at the 4th week. The mean difference was 1.07 and the paired t-test value was 9.025. *P*-value was < 0.001. This shows these changes to be statistically significant. The results from within-group analysis indicates improvement in balance in group A as measured by Tinetti Test.

The Mean±SD scores for TUG test were 13.07±1.668 at 0 week to 11.93±1.208 at the 4th week. The mean difference was 1.13, the paired t-test value was 5.906 and p-value was < 0.001. This indicates strong significant improvement, implying that mobility improves during the intervention. The timed up and go test values suggests beneficial effects on participants in group A.

The Mean±SD scores for ABCs increased from 45.64±6.009 at 0 week to 52.95±6.031 at the 4th week. The mean difference was 7.31, the paired t-test value was 11.933 and the p-value was < 0.001. The results from within-group analysis indicates improvement in Confidence in group A as measured by ABCs shown as in table 2.

Table 3a. The comparison for Tinetti test between GA and GB

	Group	Baseline (Day "0")	4th Week
TINETII TEST	GA	12.20±1.265	13.27±1.163
	GB	12.13±1.552	13.53±1.598
Unpaired t-test		0.129	0.523
P-value		0.8983	0.6053
T-value		2.05	2.05

Table 3b. The comparison for Timed up and go Test between GA and GB

	Group	Baseline (Day "0")	4th Week
TUG TEST	GA	13.07±1.668	11.93±1.280
	GB	13.80±1.568	12.13±1.457
Unpaired t-test		1.241	0.399
P-value		0.2249	0.6927
T-value		2.05	2.05

Table 3c. The comparison for Activity specific balance confidence scale between GA and GB

	Group	Baseline (Day "0")	4th Week
ABC SCALE	GA	45.64±6.009	52.95±6.031
	GB	51.78±10.170	59.57±9.383
Unpaired t-test		2.013	2.299
P-value		0.0538	0.0292
T-value		2.05	2.05

Values represented as Mean±SD; Tinetti test, TUG Test: Timed up and go, ABC: Activity specific balance confidence scale. GA: Group A, GB: Group B.

The Mean±SD scores of Tinetti Test for group A and group B at week 0 were 12.20±1.265 and 12.13±1.552 whereas the mean±SD for Tinetti test of group A and group B at 4th week were 13.27±1.163 and 13.53±1.598. The mean difference for group A and group B were 0.07 and 0.27, respectively. Both groups showed improvement from the baseline scores (pre-intervention) to the post-intervention assessment. The improvement in Group B was slightly greater (13.53) than in Group A (13.27). However, these differences were not statistically significant. The P-value for both groups is greater than the 0.05 threshold (0.8983 for Group A and 0.6053 for Group B), indicating that the improvements observed in both groups are not statistically significant.

The Mean±SD scores of TUG test for group A and B at week 0 were 13.07±1.668 and 13.80±1.568 whereas the mean±SD scores of TUG test for group A and B at 4th week were 11.93±1.280 and 12.13±1.457. The mean difference for group A and group B were 0.73 and 0.20, respectively. Both groups showed improvements in their Timed up and go test times, with Group A showing a greater reduction in the time it took to complete the task (from 13.07 seconds to 11.93 seconds), compared to Group B (from 13.80 seconds to 12.13 seconds). Despite these improvements, the differences between the groups were not statistically significant. P values for both groups were greater than the commonly used threshold of 0.05. This means that the observed differences in the Timed up and go test times between pre- and post-intervention assessments were not statistically significant for either group.

The Mean±SD scores of ABCs for group A and B at week 0 were 45.64±6.009 and 51.78±10.170 whereas the mean±SD for Activity-Specific Balance scale for group A and B at 4th week were 52.95±6.031 and 59.57±9.383. The mean difference for group A and B were 6.14 and 6.62, respectively. After the 4-week intervention, both groups showed improvements in the confidence levels. Group A showed an increase from 45.64% to 52.95%, while Group B showed a slightly larger improvement from 51.78% to 59.57%. The Task oriented training group demonstrated a statistically significant increase in balance confidence, while the improvement in the Dual task Training group did not reach statistical significance. This suggests that task-oriented training may have a more substantial impact on balance confidence than Dual task training, within the study's timeframe shown as in table 3a, 3b and 3c.

Discussion

A study conducted by A. Anas Ahamad et al[18] 2019 evaluated the effectiveness of balance exercises on postural stability in stroke patients with superior task-oriented training was elaborated in this study. Task-oriented training may be able to replace missing or diminished proprioceptive input from the afflicted body side and provide adequate visual input. When Compared with balance training, task-oriented training

enhances daily functioning, motor performance, motor control interventions and sensory. Following task-oriented training, learning about brain plasticity in association with function acquisition leading to recovery. Additionally, the research which uses brain-functional imaging depicts that following the task-oriented training, there is a remarkable reorganisation of the activation patterns developed in particular brain areas, which are being linked to recovery from hemiplegic stroke.

A study conducted by Krutika Sujit Whaval et al[13] 2023 explored the possible mechanism connected with responsiveness to an intervention that incorporates task-oriented training to improve activities of daily living in patients of diabetic neuropathy. Task-oriented training develops the control mechanisms for resolving movement disorders by practicing functional, goal-directed movements in a natural setting. Diabetic patients with peripheral neuropathy and balance issues might obtain greater balance and stability with gradual balance training emphasising on the anterior posterior neuromuscular elements of stability. Exercise therapy, particularly balance exercises, contributes in increasing oxygen pressure in the lower limbs, skin, and chests of diabetic patients, promoting skin blood flow. The task-oriented training program shows improvement in activity-specific balance in individuals with diabetic neuropathy, resulting in being clinically significant. Another study by Bo Hyun Kim et al[14] 2012 present study which demonstrate that task-oriented training can improve balance. Several items for balance and lower extremity strength were completed by changing position in the frontal, sagittal, and horizontal planes. Trunk rotation between the shoulder and pelvic girdle is necessary to enable efficient walking. There were significant improvements in both groups on the BBS, the general functional balance scale, and the experimental group change was significantly larger than the control group. The study conducted by Jin – Hyuck Park et al[19] 2022. The results has clinical implications because dual-task training being used to help older adults who are not able to benefit from physical component-focused balance training because of their diminished muscular strength and flexibility. Balance improvements in both groups confirms the beneficial effects, which involve intricate interactions between the somatosensory, visual, and vestibular systems that regulate the relationships between body parts and the external environment. However, those with high attention capacity exhibited less postural sway than those with low attention capacity, indicating that cognitive factors may be important for balance. These findings suggest that dual-task training is clinically useful for enhancing executive function and balance in older persons with a history of falls.

Another study conducted by Paolo Riccardo Brustio et al[20] 2017 determined the effects of dual-task training in older adults and additional motor tasks on mobility performance. The timed up and go test was used to measure functional mobility. Attentional resources and integrity of executive function are required for performing two concurrent tasks. Older adults in dual task training might have developed an ability to manage attention in between the two tasks. Certainly, the two different streams of visual information being related to walking task and the other one related to secondary task must be coordinated at the same time. The automatization of tasks, and the coordination skills that are required for performing two concurrent tasks might be improved by enrolment of older adults in dual task training. At the end significant improvement was noted in timed up and go (TUG) test.

Within the groups analysis showed that there is improvement in Tinetti Test, TUG and ABCs scores after 4 weeks training programs in both the groups. Between the groups, analysis showed that there is significant improvement in ABCs scores in group B when compared with group A. Task oriented training is more effective in improving confidence among geriatric population with balance impairment. But the study results have shown that both techniques are not superior to each other except for Task Oriented Training which improved confidence as compared to Dual Task Training.

Future scope

Study could be controlled on large sample size and for longer duration. Neuroimaging can be used in future studies as an objective measure to show neuroplasticity. Varying age group and geriatric population with balance impairment could be explored. Task-oriented training in combination with Dual task training may provide stronger results by addressing the physical and mental components of balance, mobility and Confidence.

Conclusion

Although both Task-Oriented Training and Dual-Task Training led to improvements in balance and mobility, the differences between the two groups were not statistically significant based on the Tinetti and TUG. This suggests that both types of interventions are beneficial for improving balance and mobility in the geriatric population with balance impairments. However, Task oriented Training produced a statistically significant increase in confidence, suggesting that it may be more effective than Dual task training in enhancing confidence levels in older adults with balance impairments. The cognitive engagement involved in dual-tasking likely contributes to its greater impact on balance confidence, providing an important implication for rehabilitation programs aimed at preventing falls and promoting independence in older populations.

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