

Comparative Study of Vestibular Rehabilitation and Dual Task Training on Balance and Quality of Life in Young Stroke Patients

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Abstract:-

➤ *Question:*

Is there any impact of vestibular rehabilitation and dual task training alongside conventional therapy on balance and quality of life in young stroke patients.

➤ *Design:*

Quasi-experimental study with treatment duration of 8 weeks. Simple random sampling was used to divide patients into 3 groups.

➤ *Participants:*

30 subjects in the age group 18-45 years both males and females with diagnoses of unilateral hemiplegia within the previous six months.

➤ *Intervention:*

Group A received vestibular rehabilitation along with conventional therapy; Group B received dual task training alongside conventional therapy and Group C received only conventional therapy.

Outcome measures: Assessment using Berg Balance Scale and Stroke Specific Quality of Life was conducted pre- and post-treatment.

➤ *Results:*

The results revealed a significant improvement ($p < 0.05$) in balance and quality of life scores in Group A as compared to Groups B and Group C.

➤ *Conclusion:*

Hence, it was concluded that vestibular rehabilitation along with conventional therapy is more effective in enhancing balance among young stroke patients compared to dual task training along with conventional therapy or conventional therapy alone.

➤ *Registration:*

BFUHS/2K23p-TH/11527.

I. INTRODUCTION

As per the Global Stroke Fact Sheet 2022 by the World Stroke Organization (WSO): the incidence of stroke in age group between 15-49 years showed the crude rate per 100,000 per year (95% UI) with the percentage of 50.29 (43.02-58.71) and there is an increment of young stroke cases in each year, over 16% of all strokes occur in people 15-49 years of age.¹ The ability to maintain balance is the most essential skill for people to perform their activities of daily living. However, stroke patients often experience impaired balance and postural control, which hampers their movement capabilities and disturb their gait pattern. Recovering balance after a stroke is considered crucial and can be influenced by a range of factors, including alterations in muscle tone, motor coordination, strength, joint mobility limitations, and sensory organization.

Vestibular rehabilitation is an exercise program that aims to reduce vertigo and improve gaze, postural stabilization and functional activities. It is a highly accepted interventional program used commonly in patients with peripheral vestibulopathy.² Another rehabilitation program is Dual-Task training, where one primary task is performed concurrently with another secondary, or multiple tasks are carried out continuously and simultaneously. Each task can be performed independently as a single activity, with each having its own distinct goal³. However, there appears to be a scarce of studies focused on young stroke patients concerning the impact of these rehabilitation techniques on enhancing balance and quality of life.

➤ *The Research Questions Were:*

- What is the impact of vestibular rehabilitation and dual task training alongside conventional therapy on balance and quality of life in young stroke?
- Is Vestibular rehabilitation better than dual task training or conventional therapy in improving balance and quality of life in young stroke patients?

II. METHOD

A. *Design*

Quasi-experimental

B. *Participants, Therapists, Centres*

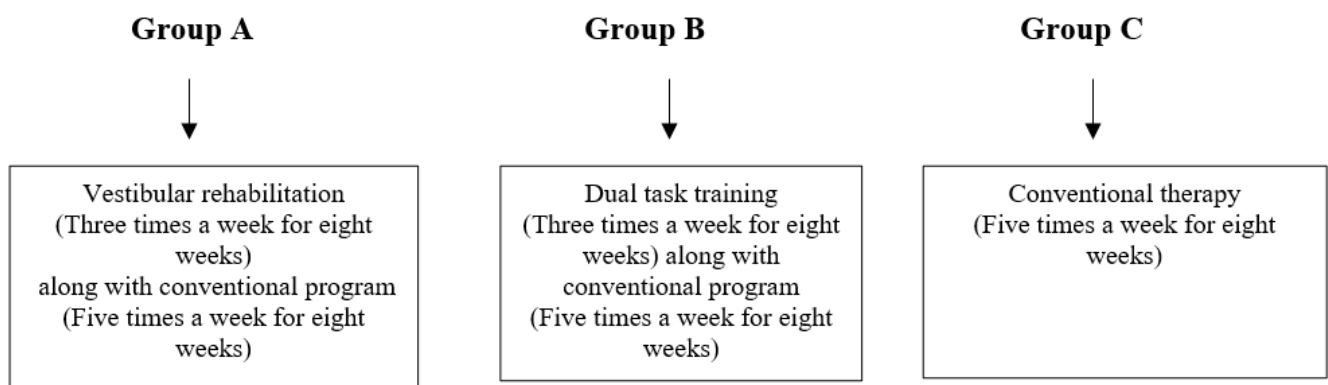
➤ *This Study was Conducted in:*

- Department of Neurology (Guru Gobind Singh Medical College and Hospital, Faridkot).
- Department of Medicine (Guru Gobind Singh Medical College and Hospital, Faridkot).

C. *Intervention*

- Outdoor Patient Department (OPD), University College of Physiotherapy, Faridkot.

30 subjects, aged between 18-45 years, both males and females with diagnoses of unilateral hemiplegia within the previous six months, who were able to walk for at least 10 meters (with or without mobility aid), spasticity grade less than 3 (Modified Ashworth Scale); pre-treatment score on the Berg Balance Scale less than 45/56; confirmed presence of impaired balance (positive Rhomberg Test). Whereas, the subjects with cognitive deficits (Mini Mental State Examination > 24), neurological disorders such as multiple sclerosis, secondary stroke (traumatic brain injury), vestibular disorders (benign paroxysmal positional vertigo), oculomotor nerve defects or the presence of eye movement disorders, spontaneous or nonspontaneous nystagmus, diagnosed with any form of vision or hearing impairment, psychiatric or psychological disorder, and with severe unilateral spatial neglect were excluded from the study. The time period for data collection was June, 2023 to January, 2024.



- **Group A-** The subjects in Group A were administered vestibular rehabilitation therapy along with conventional therapy.
- **Vestibular Rehabilitation Programme:** The subjects performed the following exercises 20-30 times, keeping the target at arm’s length with gradually increased speed and also standing on a firm surface to a compliant surface.

➤ *Adaptation Exercises-*

- Vestibulo-ocular reflex stimulating exercise: It included Gaze stabilization exercises.
- ✓ Head and eye in same directions: head movements with a target held at arm’s length and eyes focused on the target.
- ✓ Head and eye in opposite directions: head movement “out of phase” with target and moves the head to the right and the target to the left and vice versa.

- *Ocular Motor Exercises:*

- ✓ Smooth pursuit (visual tracking): Subjects moved the target left and right across the visual field, tracking with eye movement and keeping the head still.
- ✓ Saccade latency (target in both hands): Subjects kept the target in each hand approximately 15 inches apart at arms’ length with the head still. Eyes were moved back and forth from target to target with 1 second per target.

➤ *Balance and Gait Exercises-*

- *Balance Exercises:*

- ✓ Subjects stood with feet shoulder-width apart, arms across the chest and difficulty level were raised by bringing the feet closer together with closed eyes.
- ✓ Ankle sways, medial-lateral and anterior-posterior later on with circle sways with closed eyes.
- ✓ Walk with the heel touching toe on the firm surface and progression made on the carpet.

- ✓ Walk five steps and turning 180° (left and right). Smaller turns with closed eyes increased the difficulty level.
- ✓ Walk and moved the head side to side, up and down.
- ✓ Wall diagonal: took a ball in hand, lifted it up, transferred it to the other hand, followed the arch visually.
- ✓ Circle with ball: the eyes were emphasized on the ball and then the subject moved it in a circular fashion in both directions with accelerating speed. The difficulty level was raised by progressing from sitting to standing to a narrower stance.

• *Gait Exercises:*

- ✓ Walking on the straight line next to wall with the hand out for support. Subjects gradually decreasing the support and increasing the number of steps.
- ✓ Walking with head in motion going right to left with increasing speed.
- ✓ Sitting to standing, then returning to sitting from one chair to another chair position 10 feet away. Difficulty level raised by adding head movements, increasing walking speed and decreasing the width of gait.
- ✓ Gait with wide and sharp turn to the left and right.

- **Group B-** The subjects in Group A were administered Group B received dual task training along with conventional therapy.

D. Dual Task Training⁶:

➤ *Stance Activities-*

- Semi tandem, eye open, arm alterations-Spell words forward
- Semi tandem, eye open, arm alterations-Spell words backward
- Draw letter with the foot-Name any word that starts with A-K
- Perturbed standing holding the ball-Remember prices.

➤ *Gait Activities-*

- Walk narrow base of support- Count forward by three

- 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 the ball
- **Group A, B, C-** All the subjects in three groups received conventional therapy. Group A received vestibular rehabilitation along with conventional therapy; Group B received dual task training alongside conventional therapy and Group C received only conventional therapy.

E. Conventional Therapy Program:

The conventional therapy program included the comprehensive lower extremity rehabilitation program for affected and unaffected side which comprised of stretching (especially for calves, hamstrings and quadriceps muscles), Range of motion exercises (passive which were progressed to active assisted, active and resisted exercises) of ankle, knee, hip joints. Along with these exercises, range of motion as well as strengthening exercises of upper extremities, back strengthening exercises, weight bearing activities and Gait training in parallel bar was also included. The repetitions, sets, resistance and weight of the exercises in conventional therapy program was according to the motor abilities of the subjects⁶.

F. Outcome Measures

- *Primary outcome:* The subjects were assessed for balance using Berg Balance Scale⁴ (BBS) before and after the intervention.
- *Secondary outcome:* The subjects were assessed for quality of life using Stroke Specific Quality of Life⁵ (SS-QOL) before and after the intervention.

G. Data analysis

A paired t-test was used to compare the pre and post scores of BBS and SS-QOL within each group. One-way ANOVA test was used to compare the pre and post scores of BBS and SS-QOL in between the three groups. After significant difference in the pre and post scores of BBS and SS-QOL in between the three groups, Tukey’s Post Hoc test was conducted. The results were calculated at a 0.05 level of significance.

III. RESULTS

Table 1: Comparison of the Demographic Characteristics in between Three Groups

Demographic Characteristics	Group A (n=10)	Group B (n=10)	Group C (n=10)
Age (in years) (Mean±SD)	36.7±7.211	37.6±6.086	36.2±4.728
Males (n)	6	7	8
Females (n)	4	3	2

Table 2: Comparison of Pre and Post Treatment Scores of BBS and SS-QOL within Group A, Group B, and Group C using Paired t-test.

GROUP- A					
BBS			SS-QOL		
Pre-treatment scores (Week 1 st) Mean±S.D	Post-treatment scores (Week 8 th) Mean±S.D	P value	Pre-treatment scores (Week 1 st) Mean±S.D	Post-treatment scores (Week 8 th) Mean±S.D	P value
17.30±2.214	36.70±5.034	<0.001	84.90±5.343	191.3±7.514	<0.001
GROUP- B					
17.60±2.875	31.00±2.160	<0.001	81.60±4.551	158.9±12.76	<0.001
GROUP- C					
18.40±3.373	25.20±3.011	<0.001	81.00±3.944	132.7±10.53	<0.001

Table 3: Comparison of Pre and Post Treatment Scores of BBS and SSS-QOL in between Group A, Group B, and Group C using ANOVA test

SCORES OF ANOVA (GROUP A, B, C)			
BBS		SS-QOL	
Pre-treatment (Week 1 st)	Post-treatment (Week 8 th)	Pre-treatment (Week 1 st)	Post-treatment (Week 8 th)
F Test= 0.420 P=0.663 (NS)	F Test= 24.380 P<0.001 (S)	F Test= 2.120 P=0.149 (NS)	F Test= 75.880 P<0.001 (S)

Table 4: Comparison of Pre and Post Treatment Scores of BBS and SSS-QOL in between Group A, Group B, and Group C using Tukey’s HSD Post Hoc Analysis

	BBS		SS-QOL	
	Pre-treatment (Week 1 st)	Post-treatment (Week 8 th)	Pre-treatment (Week 1 st)	Post-treatment (Week 8 th)
Group A vs Group B	0.31 NS	5.7 Sig	3.31 NS	32.4 Sig
Group A vs Group C	1.1 NS	11.5 Sig	3.91 NS	58.6 Sig
Group B vs Group c	0.8 NS	5.8 Sig	0.6 NS	26.2 Sig

S: significant; NS: non-significant

➤ *Brief Subheading to Introduce Research Question 1*

The findings of the present study indicated significant impact of vestibular rehabilitation and dual task training alongside conventional therapy in improving balance and quality of life in young stroke patients.

➤ *Brief Subheading to Introduce Research Question 2*

The vestibular rehabilitation therapy along with conventional therapy was more effective in improving the balance and quality of life than the dual task training along with conventional therapy and conventional therapy alone.

IV. DISCUSSION

These results of this study indicated that combining vestibular rehabilitation along with conventional physiotherapy is particularly effective and safe as a complementary therapy that appears to offer significant benefits for young stroke patients, including improvements in balance and overall quality of life. Additionally, dual task training alongside conventional therapy, as well as conventional therapy alone, were also effective for improving balance and quality of life in young stroke patients.

Anabela Correia et al.,2020;⁷ documented statistically significant improvement in BBS score with the use of Vestibular Rehabilitation (domiciliary program of oculomotor and gaze stability exercises) and the reasons for improvement may include these exercises can enhance the integration of sensory afferents, hence stimulating the vestibulo-ocular reflex and improving balance in individuals recovering from stroke. Balci, Birgül Donmez et al.,2013;⁸ Tsubasa Mitsutake et al.,2017;⁹ Marco Tramontano et al.,2018;¹⁰ also supported the results and documented that vestibular rehabilitation programs were equally effective in improving balance and gait in stroke cases. This program is effective, which may be because the reflex mechanism related to vestibular function plays an important role in postural control.

The results of this study showed a significant improvement in balance and quality of life in young stroke cases; however, there were some limitations such as a small sample size, short duration of interventions with no follow-up assessments. For future studies, a larger sample size, use of different outcome measures, and patients along with other neurological disorders, such as those with head injuries should be included.

What was already known on this topic: Most of the studies which included the rehabilitation of post-stroke patients, included older adults or elderly patients.

What this study adds: This study included the sample from young stroke patients and different intervention programs were compared for improving balance and quality of life in these patients.

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