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ORIGINAL ARTICLE

Comparative Effects of Backward Walk Training and Vestibular Therapy on Balance in Patients with Vestibular Disorders

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ABSTRACT

Objective: To compare the effects of backward walking program and vestibular therapy on balance in patients with vestibular disorders.

Method: A randomized clinical trial was conducted on 46 patients into 2 groups that were allocated randomly. Group A consisted of 23 participants and were asked for backward walk across the room, by asking the patient to backward walk on a slope and steps in upward and downward direction with open eyes for the duration of 30 minutes, 3 sessions per week for about 6 weeks along with routine physical therapy treatment which included postural training while 23 participants of Group B received vestibular therapy that included gaze stabilization exercises, and Brandt-Daroff exercises along with routine physical therapy which included postural and balance trainings for the duration of 6 weeks for 3 sessions/week for 30 minutes. Statistics scrutiny was done by SPSS software version 23.

Results: Post treatment analysis indicated that a statistically significant difference was there in across the group comparison, and within the group comparison. An improvement was seen in the outcome measures of Berg Balance Scale that was statistically considerable within the group. Time for completing the task in Timed Up and Go Test also showed improvement within the groups ($p< 0.05$). The subjective estimation of the sign and symptoms evaluated with the usage of Visual Vertigo Analogue Scale showed a considerable improvement in each group.

Practical Implication: Backward walk training was found to be beneficial in enhancing the balance amongst people with excessive hazard of fall whereas vestibular rehabilitation improved signs associated with vestibular disorders such as dizziness, lightheadedness, vertigo and imbalance.

Conclusion: This study concluded that backward walk training and vestibular therapy were equally effective in dealing with vestibular related signs and symptoms and complications of the sufferers. Backward walk training was found to be beneficial in enhancing the balance amongst people with excessive hazard of fall whereas vestibular rehabilitation improved signs associated with vestibular disorders such as dizziness, lightheadedness, vertigo and imbalance. The results of this study helps the physiotherapist that they will add the vestibular therapy interventions and backward walk training for the patients having vestibular issue to reduce their balance issues and other symptoms such as dizziness , lightheadedness , gaze stabilization and vertigo for better results.

Keywords: Balance, Backward walk training, Vestibular therapy, Gaze stabilization exercises, Cawthorne-Cooksey exercises.

INTRODUCTION

The vestibular apparatus is mainly divided into central and peripheral. The peripheral system consists of 3 semicircular canals (superior, lateral, posterior) and the otolith organs (saccule and utricle) [(1)]. Vestibular system is a complex structure having neural pathways that has many functions that contribute to our sense of proprioception and balance. These characteristics include orientation and acceleration of the head in all directions, as well as maintenance of proper balance and posture during eye movements. This reflex is known as vestibulo-ocular or vestibulo spinal reflex [(2, 3)]. Patients with acute vestibular complications usually complain lightheadedness, dizziness, blurred vision, an oscilloscope, and a feeling of imbalance[(4)]. A detailed physical examination is required to make an approximate diagnosis. Physiotherapy examination and evaluation consist of assessing muscle strength, cranial nerve function, sensitivity, range of motion, balance, and coordination [(5)].

To reduce vestibular damage, gaze instability, dizziness, and postural instability, exercise uses three approaches: adaptation, habituation, and substitution [(6)]. Vestibular rehabilitation exercises are proved very effective in compensating and reducing vertigo and other sign and symptoms associated with vertigo, and also plays a vital role in improving body balance in people with vestibular dysfunction. Virtual reality is based on repetitive practice involving change in habits and relieving symptoms of dizziness [(7)].Gaze stabilization exercises are included in adaptive exercises that will refers to stabilizing the eye in space in order to see clearly [(8)]. The vestibule-ocular reflex increases ability of a person to use visual cues for balance, helping to maintaining the eye stability during head movements and postural balance [(9)]. Brandt-Daroff exercises are used to treat the symptoms of vertigo and benign paroxysmal positional vertigo due to cupulolithiasis or any damage to posterior canal [(10)]. These exercises were believed to produce habituation of vertigo. Cawthorne Cooksey exercises are used in vestibular rehabilitation therapy in which Eye and head movement are involved and can be performed in lying, first sitting and standing positions [(11)].

Jianping Wanget.al in 2021 published their article in which they considered the clinical safety and effectiveness of Vestibular Rehabilitation training in management of vertigo. After 4 weeks of treatment, balance test, and vertigo scores in the group receiving intervention were much progressive rather than the group as well as the total effective rate and the patient satisfaction in group A participants was also higher [(12)]. Katarzyna Smółka et-al published a journal in 2020 in which patients were assigned in 2 groups to evaluate the effectiveness of vestibular rehabilitation in diagnosed cases of vestibular dysfunction. Interventions given to Group A were vestibular rehabilitation for the duration of 1h 30min once in a week while Group B consists of patients who was supposed to perform Cawthrone-Cooksey exercise on for 15 min ,2 times per day along with some simple balance exercises for the duration of total 6 weeks. Tools used for this are “DGI”, “DHI” and “VAS”. Results showed an improvement patients of group A who were on vestibular therapy as compared to home-based Cawthorne-Cooksey and balance exercises [(13)]. Junjiewang et.al conducted a meta-analysis and published their research work in 2019 in which

they suggest the outcomes of backward walking (BW) on sense of balance. 11 studies (nine RCT's and two pre-post studies) were incorporated in their appraisal. Every single study stated a variety of advantageous outcomes of backward walking on balance. Their suggests that backward walk training might serve be useful in enhancing stability and steadiness, especially in folks with a high threat of fall [(14)]. Soraya Pirouzi and colleagues published their research in which 30 individuals of age above 60 years were randomly divided into 2 group's i.e:15 in each group. Therapy session consists of forward and backward treadmill training for 4 weeks in experimental group, for the duration of half an hour, 3times per week. Participants in the control group were allowed to perform their Activity of Daily Living. Progression on maintaining balance and is recorded in elderly people after 12 sessions of forward and backward treadmill walk training which was proved effectual in improving balance [(15)].

In literature there was no such evidence that described the comparison of backward ward walk training and vestibular rehabilitation such as gaze stabilization exercises, Cawthrown Cooksey protocol, and describes which treatment was more effective for improving balance and symptoms like dizziness, vertigo and other vestibular related complications. The ambition of this study was to highlight and explore the effects and outcome measures of backward walk training and vestibular therapy on balance in patients with vestibular disorders. This study targeted to help the patients to choose the most effective treatment for improving balance and dealing with vestibular related complications.

METHOD

The Subjects who met the inclusion/exclusion criteria were allocated for backward walk training group and vestibular rehabilitation group. Subjects were selected from the outpatient clinic of the concerned hospital. Subjects were divided randomly into two equal groups. Vertigo visual analogue scale was used as questionnaire. Berg balance scale and tug test was measure . After measuring score of BBS and TUG test, two types of treatments were given to both the groups.

Group A: Backward walk training+ Routine physical therapy treatment: Participants in group A were asked for backward Walk training throughout the room ,upward and downward on a slope and backward motion on a steps with eyes open for 30-minute, 3 session for six weeks along with routine physical therapy which included postural stability training. Started from the sitting position, asked the patient to stand up and backward ward for 3 meter distance with eyes open. In some patients parallel bars were also used to provide assistance to the patients. Firstly , it was practiced on plane / smooth surface when patient was skilled enough to practice backward walk on plan surface without any assistance than we moved to a bit harder task that was backward walking in upward and downward direction on a slope with eyes open. Assistance was provided in needed patients after that backward walk training was practiced on steps. Patients were asked to step up and step down. Routine physical therapy was also given to the patients which included postural stabilization exercises, positioning to maintain good posture and to improve balance.

Group B: Vestibular rehabilitation therapy +Routine physical therapy treatment: Group B participants were asked to perform vestibular therapy that included Cawthorne-Cooksey exercises, gaze stabilization exercises, proprioceptive and balance trainings 30-minute, 3 session for six weeks along with routine physical therapy which included postural stability training. Cawthrone Cooksey exercises were performed in bed, sitting or standing depending upon patient's condition. Eye first moved slowly, then quickly in an upward and downward direction and in sideways by keeping a target on finger move your eyes away from face. Head was moved slowly at first, then quickly later on asked patient to perform such moves with closed eyes. Bending onward and toward the back then turning sideways. In Sit up position, Shoulder shrugging, circling as well as bending ahead and holding up items from the floor was involved. In standing movement of head, eyes and shoulder were performed as mentioned before then switching from sitting to standing with open and closed eyes and passing a small ball in between hands after that patient asked to moving from sitting to standing and turning around.Gaze stabilization exercises was performed by asking patient to stabilize their gaze to the object and then moving the object in sideways.

RESULTS

The histogram in figure-1 showed that the total number of participants in each group were 23 whereas the mean age of participants in group A that were included in backward walk training program was 34.09 and Standard Deviation was 12.57 , while the mean age of Group B participants were recorded as 49.52 and SD was 16.13.The histogram in figure-2 is showed that 23 subjects were involved in each group for study out of 23, 6 male and 17 female were allocated in backward training program while 5 male and 18 female were placed in group B for vestibular therapy.

Table-1: Results of test of normality

	Shapiro-Wilk		
	Statistic	Df	Sig.
Pre BBS	.947	46	.035*
Post BBS	.881	46	.000*
Pre Timed Up and Go Test (Seconds)	.939	46	.018*
Post Timed Up and Go Test (Seconds)	.961	46	.122

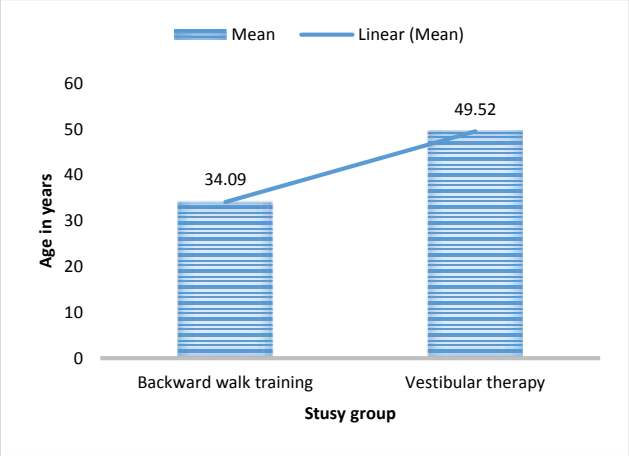

Figure-1: Histogram chart of age according to study group

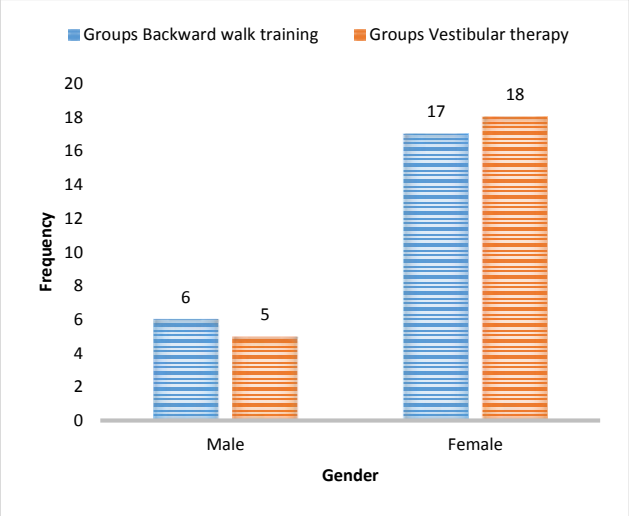

Figure-2: Histogram of gender regarding groups

To access the normality of data Shapiro-Wilk test was used and the significant p value was set as < 0.05. P value more than 0.05 indicated that data was normally distributed and if the p value was less than 0.05, it indicated the deviation of data from normal as shown in table 1.Table 2 showed the comparison of means by independent t test for Berg Balance Scale within the groups before and after the interventions. In group A pre-treatment BBS mean was 46.52 ± 2.84, and the post treatment mean was 52.87 ± 1.66, in comparison to Group B , BBS balance scale showed pre-treatment mean value as 41.65 ± 5.87 while post treatment values was 48.74 ± 5.33. A significant difference seen in p values and t test values that resulted in refusal of null hypothesis and support of alternative hypothesis. In table 2 also showed the comparison of means by independent t test for Time up and Time go Test within the groups before and after the interventions. In group A pre-treatment mean value for timed up go test was 17.96 ± 1.92, and the post treatment mean was 14.00 ± 1.71, in comparison to Group B pre-treatment mean was 20.65 ± 4.12 while post treatment values was 16.22 ± 3.46. There's a statistically significant differentiation within groups which rejected null hypothesis and supported alternative hypothesis.

Table-2: Comparison using independent t− test, within the groups

	Groups	N	Mean	SD	t test	p value
Pre Berg Balance Scale	Backward walk training	23.00	46.52	2.84	3.58	0.001*
	Vestibular therapy	23.00	41.65	5.87		
Post Berg Balance Scale	Backward walk training	23.00	52.87	1.66	3.55	0.001*
	Vestibular therapy	23.00	48.74	5.33		
Pre TUG test values (Seconds)	Backward walk training	23.00	17.96	1.92	-2.85	0.007*
	Vestibular therapy	23.00	20.65	4.12		
Post TUG test values (Seconds)	Backward walk training	23.00	14.00	1.71	-2.75	0.009*
	Vestibular therapy	23.00	16.22	3.46		

*Significant (p value < 0.05)

DISCUSION

Primary goal of this study was to find out comparative outcome of Backward Walk Training and Vestibular rehabilitation on balance in subjects suffering with complications of vestibular system. Many researchers have conducted to check the usefulness of backward walk training for Balance and Mobility. In this study it was a first effort to evaluate the impact of backward walk training and vestibular rehabilitation for maintaining balance and mobility in patients with vestibular disorders. Many studies augmented that backward walk training was beneficial for patients in improving balance whereas vestibular Rehabilitation therapy had an impact in improving the symptoms of vestibular disorder such as dizziness, vertigo. Balance and Mobility was taken as dependent variables which ware measured using Time Up and Go test (TUG) and (BBS). These both tools were standard tools to measure balance and mobility [16, 17].

In this study the age of participants was over 18 which was in accordance with the research of Jianping Wang et.al that was published in 2021 in which the participants of age 18 to 85year were involved. Their study also supported the effectiveness of vestibular therapy in managing the sing and symptoms of vertigo [12]. Mayra Cristina Aratani et-al, in 2020 did a RCT with follow up duration of 3 months to study the impact of dizziness on spiritual belief, competence, and quality of life in older adults. Their results were in contrast with this study which indicated that, by adding up other type of exercises to the conventional Cawthorne & Cooksey treatment no longer suggested health advantages on the consequences of affected person with persistent dizziness [18]. Junjiewanget.al in 2020 did their research in which they suggested the outcomes of (BW) training on sense of balance. 11 studies (nine RCT and two pre-post studies) were in corporated in their appraisal. Every single study stated a variety of advantageous outcomes of backward walking on balance. Their study was in accordance with this study which suggested that backward walk training had an ability to be useful in enhancing stability and steadiness ,especially in folks with a high threat to fall [14]. Sana Saleem in 2018 did a research project in which they assess the efficacy of vestibular rehabilitation versus dual task training on balance & gait in older adults in which were randomly assigned into 2 groups.

Outcome measures showed there was a significant improvement after vestibular therapy that was in favor of this study and supported the use of VRT as a part of treatment plan to get better balance and gait and gaining confidence of walking by reducing the danger of fall [19]. Hence, this study emphasized on the effect of backward walks training and vestibular rehabilitation on balance in patients with vestibular problems. In Berg Balance Scale and TUG test (p value < 0.05) showed no significant difference. The results of this study helps the physiotherapist that they will add the vestibular therapy interventions and backward walk training for the patients having vestibular issue to reduce their balance issues and other symptoms such as dizziness , lightheadedness , gaze stabilization and vertigo for better results.

CONCLUSION

This study concluded that Backward walk training and Vestibular therapy were equally effective in dealing with vestibular related the sign and symptoms and complications of the sufferers. Backward Walk training was found to be beneficial in enhancing the balance amongst people with excessive hazard of fall whereas vestibular rehabilitation improved signs associated with vestibular disorders such as dizziness, lightheadedness, vertigo and imbalance. Post treatment analysis indicated a statistically significant difference was seen across the group comparison, and within the group comparison. An improvement was seen in the outcome measures of Berg Balance Scale that was statistically considerable within the group. Time for completing the task in Timed Up and Go Test also showed improvement within the groups (p< 0.05). The subjective estimation of the sign and symptoms evaluated with the usage of Visual Vertigo Analogue Scale showed a considerable improvement in each group.

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