ORIGINAL RESEARCH

The Effectiveness of Vestibular Physiotherapy for Benign Paroxysmal Positional Vertigo Patients with Residual Dizziness After Successful Canalith Repositioning Maneuver

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Abstract

Background: Benign Paroxysmal Positional Vertigo (BPPV) is considered a common cause of vertigo. Some patients experience residual dizziness (RD) even after canalith repositioning maneuver (CRM). Vestibular Physiotherapy (VP) is often used to manage these symptoms. This study aimed to investigate the effectiveness of VP combined with vestibular sedatives (VS) compared with VS alone in patients with BPPV and RD after successful CRM.

Methods: A quasi-experimental study was conducted in 48 patients with BPPV and RD following successful CRM. In the alternative (non-blind) sampling, consecutive participants were assigned to Group A and Group B, respectively, until the sample size was reached. Group A received only VS, while Group B received both VS and VP. Demographic data were collected using a biodata sheet. Dizziness Handicap Inventory (DHI) and a 10-point Likert scale were used as measuring tools.

Results: The study included 30 females and 18 males, aged 18-75. No significant baseline difference was observed between groups [DHI ($p=0.63$, $t=-0.48$); Likert scores ($p=0.26$)]. After 4 weeks, Group B showed a significant improvement in the Likert score and the DHI physical subscale ($p<0.05$). A statistically significant association was observed ($p<0.05$) between Age and DHI scores at baseline and after 4 weeks. Both groups showed significant improvements in total DHI score independently ($p<0.05$).

Conclusion: It is more effective to use VP with VS than VS alone for managing RD in patients with BPPV.

Keywords: vestibular physiotherapy, vestibular sedatives, canalith repositioning maneuver, residual dizziness, benign paroxysmal positional vertigo

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Introduction

Vestibular physiotherapy (VP) manages vestibular disorders through targeted exercises. Controlled head and trunk movements enhance balance, stimulate the vestibular system, and promote central compensation.[1] These techniques, introduced by Cawthorne and Cooksey, were designed to relieve dizziness and vertigo.

Benign Paroxysmal Positional Vertigo (BPPV) is the commonest vestibular disorder; it is triggered by sudden, rapid head or body movements and causes brief spinning sensations[2,3]. Its incidence is about 64 per 100,000 people,[4] mainly affecting women aged 50-70.[5] Diagnosis involves the supine roll and Dix-Hallpike maneuvers to provoke nystagmus and vertigo. In Sri Lanka, the canalith repositioning maneuver (CRM) is the primary treatment. However, many patients experience residual dizziness (RD), even after a CRM.[6,7]

RD is often treated with vestibular sedatives (VS) or anti-anxiety drugs. However, vestibular physiotherapy provides a non-pharmacological alternative. It improves postural stability, visual vestibular interaction, and RD and anxiety, thereby enhancing quality of life.[4,8] By safely exposing patients to symptom-provoking movements, rehabilitation fosters long-term neural adaptation.[9] This study specifically assessed VP as an adjunct to sedatives in managing BPPV.

Materials and methods

A quasi-experimental study was carried out on BPPV patients (newly diagnosed) with RD even after successful CRM. Participants were recruited from the Ear, Nose, and Throat (ENT) department clinics of both the National Hospital of Sri Lanka and University Hospital KDU. A non-probability convenience sampling method was used.

The sample size was calculated using a standard formula.[10] Based on previous literature,[11] the mean difference (d) was 24, and the standard deviation (SD) was 22.68. The required sample size was calculated to be 23.87 per group. Therefore, 24 patients were allocated to each group (Group A and Group B).

The patients aged 18-75, who were diagnosed with BPPV in the past 3 years, with persistent RD after successful CRM, were included, while patients who were pregnant, had vertigo from other peripheral or central causes, had other musculoskeletal or neurological conditions, and had cervical vertebral disease were excluded. The study was conducted from 24th of January 2022 to 31st of March 2022. A bio-data sheet was used to collect demographic data. International Standard Classification of Occupations (ISCO-08) was used to classify the occupations. The 25-item DHI (Dizziness Handicap Inventory) was used to measure quality of life and comprises 9 functional, 9 emotional, and 7 physical subscales (each subscale item carries a score).[12] According to the resulting score, dizziness-handicap level was categorized as mild (0-30), moderate (31-60), and severe (61-100).13 A validated Sinhala translation of DHI was used with the author's permission. To measure symptom severity, a 10-point Likert scale was used.

Following an explanation of the study, written informed consent was obtained. Under the alternative (non-blind) sampling approach, participants were assigned to Group A or Group B in the order of their clinic visits until the required sample size was reached. They were given the bio-data sheet with the Likert scale and DHI. Follow-ups were done after two weeks and four weeks. All participants were given identical VS. Group B received physiotherapy, including Brandt-Daroff, Habituation, Adaptation, and balance exercises (Table 1), along with VS. Exercises were performed after a few relaxation exercises (shoulder shrugs, rotations, and neck stretches, etc.).

Participants were instructed to perform exercises twice a day, with the exercises demonstrated once under a physiotherapist's supervision. Participants were guided to progress the exercises weekly to gradually provoke vestibular symptoms. Patients were informed that symptoms might temporarily worsen but improve with practice.

Ethical clearance was obtained from the Ethics Review Committee, Faculty of Medicine, KDU (RP/S/2021/34), and permission was obtained from the study setting. Written consent was obtained from participants, and they were informed that participation was voluntary, that they could withdraw at any time, that there were no financial benefits, and that no physical or psychological risks were involved. To ensure anonymity, bio-data sheets were labeled with referral numbers. Digital data were password-protected, and hard copies were securely stored. All data will be destroyed after seven years of study.

Data were analyzed using SPSS v20. Independent t-tests were used to compare group means, paired t-tests to assess related measures, Chi-square test to find categorical relationships, and Mann-Whitney U test to compare non-parametric groups.

Table 1. Exercise protocol

Exercise	*Description*	*Repetitions / Duration*	
Head movements	Up-down and left -right	10 reps	Eyes close & Eyes open
Trunk movements	Forward bend, Lateral right and left bend	10 reps	Eyes close & Eyes open
Sit to stand	Standing up from a seated position	10 reps	Eyes close & Eyes open
Squats	Squat with head, neck straight forward	10 reps	Eyes close & Eyes open
Normal walking	Walk with feet less than shoulder width apart	3 min	
Tandem walking	Heel-to-toe walking	2 min	
Gaze stabilization - I	Eyes on card- move head up-down, left-right	10 reps	
Gaze stabilization - II	Keep eyes on the card – move the card up-down, left-right	10 reps	
Gaze stabilization - III	Move the card opposite to the head movement	10 reps	

Results

Age, baseline, and final Likert and DHI scores were analyzed descriptively. 37.5% (n=18) of the sample were male and 62.5% (n=30) female. Group A had 11 males (22.91%) and 13 females (27.08%), while Group B had 7 males (14.58%) and 17 females (35.41%). Mean age was 54.71 years (SD ±12.71; range 30-75); the most frequent ages were 62 and 67. All participants were aged 18-75; 29.17% were unemployed; 16.67% were service/sales workers, and 4.17% were managers or craft/trade workers.

Comparison between Likert scores and DHI scores between Group A and Group B

The Mann-Whitney U test was used to compare Likert scores between Groups A and B at baseline, after the first two weeks, after the second two weeks, and for total improvement. The highest percentage was at grade 5 (moderate severity). Grades 6-8 each recorded 14.6%, while grade 3 was the lowest. No significant difference was observed between baseline Likert scores ($p>0.05$), while at the end of four weeks, there was a statistically significant difference between Groups A and B (Table 2).

DHI scores were categorized as mild (0-30), moderate (31-60), and severe (61-100).[13] An independent-samples *t*-test was used to compare DHI scores between Groups. No significant differences were observed at baseline, and no overall improvement was observed between groups during the study period ($p>0.05$). However, baseline physical subscale scores showed no significant difference, but there was an improvement at the end of the study between the groups ($p=0.04$) (Table 3).

Association between demographic characteristics and the DHI Scores between groups

Pearson's chi-square test was used to assess associations (Table 4). Age showed a significant association with baseline DHI scores and DHI scores at four weeks in the total sample ($p=0.02$ and $p=0.03$, respectively). No significant associations were observed between gender or occupational level and baseline DHI scores in either Group A or Group B ($p> 0.05$).

Improvement of the DHI Score in Group A

A paired sample *t*-test was used to assess changes in DHI scores within Groups A and B. Both groups showed statistically significant improvements ($p<0.05$) in DHI scores during the first two weeks, the fourth week, and over the total study period. In Group A, significant improvements were observed at all-time points (first two weeks: $t = -5.52$; second two weeks: $t = -6.00$; total period:

t = -9.58; p=0.000). Similarly, Group B demonstrated significant improvements (first two weeks: *t* = -4.10; second two weeks: *t* = -7.29; total period: *t* = -7.44; p=0.000) (Table 5).

Analysis of subscales at four weeks also showed statistically significant improvements in both groups across all time intervals ($p < 0.05$), indicating improvements in DHI subscale scores.

Table 2. Comparison between Likert scores in Group A and Group B

Likert Scale	*Group*	*Mean Rank*	*Mann Whitney U*	*p-value*
At the baseline assessment	Group A	22.23	233.50	0.26
	Group B	26.77		
Improvement within 1st two weeks	Group A	21.42	214.00	0.12
	Group B	27.58		
Improvement within 2nd two weeks	Group A	21.35	212.50	0.12
	Group B	27.65		
Improvement at the end of four weeks	Group A	20.67	196.00	0.05
	Group B	28.33		

Table 3. Comparison between DHI Scores of Group A and Group B

Overall DHI	*DHI mean*					
	Group A	*SD*	*Group B*	*±SD*	*T*	*p-value*
Baseline	50.00	16.23	52.50	19.54	-0.48	0.63
Improvement within 1st 2 weeks	9.29	8.32	14.08	10.72	-1.73	0.09
Improvement within 2nd 2 weeks	15.25	12.66	20.42	12.68	-1.41	0.16
Total improvement	24.83	12.99	31.08	20.48	-1.26	0.21
Physical subscale of DHI	*DHI mean*					
	Group A	*SD*	*Group B*	*±SD*	*T*	*p-value*
Baseline	15.58	3.59	14.50	5.32	0.83	0.41
Improvement within 1st 2 weeks	3.38	3.20	3.00	3.68	0.38	0.71
Improvement within 2nd 2 weeks	7.42	3.41	8.17	5.87	-0.54	0.59
Total improvement	6.92	3.28	8.25	5.90	-0.97	0.04

Table 4. Association between demographic features and DHI Scores between groups

		Pearson Chi-square Value	*df*	*p-value*
(Age) Baseline	Group A	320.67	306	0.27
	Group B	303.00	288	0.26
	Total	834.20	754	0.02
(Age) After 4 weeks	Group A	304.68	288	0.23
	Group B	300.00	288	0.30
	Total	793.33	729	0.03
		Pearson Chi-square Value	*df*	*p-value*
(Gender) Baseline	Group A	21.32	17	0.21
	Group B	15.53	16	0.49
	Total	32.14	26	0.18
(Gender) After 4 weeks	Group A	16.62	16	0.41
	Group B	18.35	16	0.30
	Total	24.18	25	0.51
		Pearson Chi-square Value	*df*	*p-value*
(Level of Occupation) Baseline	Group A	138.93	136	0.41
	Group B	149.00	144	0.37
	Total	260.83	234	0.11
After 4 weeks	Group A	128.13	128	0.48
	Group B	144.11	147	0.37
	Total	233.79	225	0.33

Table 5. Improvement of the DHI Score in Groups A & B

Group A	*Paired sample t-test*				
	Mean	*±SD*	*Correlation*	*T*	*p-value*
Within the 1st 2 weeks	-9.58	8.51	0.87	-5.52	0.00
Within the second two weeks	-15.42	12.59	0.65	-6.00	0.00
Within 4 weeks	-25.00	12.79	0.62	-9.58	0.00
Group B	*Mean*	*±SD*	*Correlation*	*T*	*p-value*
Within the 1st 2 weeks	-11.42	13.64	0.87	-4.10	0.00
Within the second two weeks	-19.67	13.22	0.65	-7.29	0.00
Within 4 weeks	-31.08	20.48	0.25	-7.44	0.00

Discussion

This study primarily aimed to evaluate the effectiveness of VP in BPPV patients who continued to experience RD following CRM. The principal assessment tool used was the DHI, which demonstrates high internal consistency ($\alpha = 0.87$) and excellent test-retest reliability for both the total score and its subscales.[12]

Another aim of this study was to determine patients' perceived level of handicap using the DHI after successful CRM. 56.4% reported above-average RD severity (severity score > 5). Additionally, 27.1% of the sample reported a severe level of handicap. This finding is comparable to the results of a study[14], which reported a severe handicap in 27.5% of patients when correlating DHI and Visual Analog Scale (VAS) scores in individuals with vestibular dysfunction.

Although random assignment was not feasible in quasi-experimental studies, participants were selected using an alternative sampling procedure independent of investigator involvement, thereby minimizing potential selection bias. Moreover, the absence of a true control group limits causal interpretation of the findings to the intervention; however, this design was necessary because no setting in Sri Lanka treated BPPV patients exclusively with VP during the study period.

Despite those minimized limitations, a key strength of the present study is the absence of statistically significant differences between Groups at baseline. Baseline DHI scores and DHI subscale results showed no significant differences between the two groups ($p > 0.05$), indicating comparable baseline characteristics prior to treatment initiation. This baseline equivalence strengthens the internal validity of the study and supports meaningful comparison of treatment outcomes.

Similar findings have been reported in previous research.[11] In a comparative study evaluating the effects of adding high-dose betahistine to VP, no significant baseline differences in DHI and other outcome measures were reported between their study groups ($p>0.05$). Likewise, in a study[15] investigating the combined effect of Brandt-Daroff and Cawthorne-Cooksey exercises in patients with posterior canal BPPV, the authors found no baseline differences between groups and identified this comparability as a methodological strength, as both groups demonstrated comparable baseline characteristics.

Descriptive analysis revealed a reduction in mean DHI scores in both groups after a four-week intervention, expressing an improvement in patients' perceived handicap. Baseline total DHI scores ranged from 14 to 96, while post-intervention scores ranged from 6 to 62. The mean improvement in total DHI score for the overall study sample was 28.04 ± 6.03. According to the authors of DHI[12], an 18-point reduction in the total DHI score reflects the minimal clinically important improvement for patients with vestibular disorders; therefore, the observed improvement in the present study can be considered clinically meaningful. These findings are consistent with a study[16] that reported a mean improvement of 22 points in total DHI scores among 53 patients and concluded that functional outcome measures such as the DHI demonstrate statistically significant improvements in elderly patients following VP.

In the present study, Group A demonstrated a mean improvement of 24.83 in DHI scores, whereas Group B showed a mean improvement of 31.08. These findings suggest that combining VP with sedative medication was more effective than sedative treatment alone in reducing dizziness-related handicap. Consistent with these results, a study[17] assessing quality of life after VP reported a mean DHI improvement of 24.82 among 23 patients who completed a six-week VP program. The authors concluded that VP significantly improves patients' quality of life.

One of the studies[11] demonstrated statistically significant improvements in DHI scores ($p < 0.05$) in patients receiving combined VP and VS. Further, the addition of betahistine to VP was more effective in reducing disability than rehabilitation alone. Similarly, another study[18] reported significant improvements ($p < 0.05$) in total and subscale DHI scores when treated with VP alongside pharmacological therapy compared with VS alone. Moreover, suggested that combining VP with medication leads to greater reductions in vertigo symptoms and enhanced patient satisfaction and quality of life.

In the present study, a statistically significant difference in improvement between Group A and Group B was observed in the physical subscale of the DHI after 4 weeks. Supporting this, another study[19] also outlined a statistically significant association ($p = 0.03$) in the physical DHI subscale.

Regardless of the treatment modality, both groups demonstrated significant within-group improvements in DHI scores over time ($p < 0.05$). Furthermore, statistically significant differences between the two groups were evident in DHI score improvements during both the first two weeks and the subsequent two-week period following baseline ($p < 0.05$), indicating a consistent and progressive reduction in perceived handicap across both groups. Comparable findings were reported in another study, in which a significant improvement in DHI scores after two weeks of intervention ($p< 0.001$) was observed among 112 patients undergoing an eight-week supervised Cawthorne-Cooksey and Norre VP program.[20] They concluded that even short-term supervised vestibular exercise programs are effective in reducing vestibular symptoms.

Conclusion

RD after successful CRM in BPPV impairs quality of life. This first Sri Lankan study compared the effects of VS alone and VS combined with VP; the findings show that both approaches reduced dizziness and improved outcomes. Improvements were assessed on the Likert scale and the physical subscale of the DHI. Age was significantly associated with baseline DHI and its improvements, while gender and occupation showed no association. Both approaches alleviate RD. The generalizability of the findings could be enhanced by conducting multicenter randomized controlled trials island-wide.

Authors' contributions

Concept and design: SS, PK, HK
Literature review: SS, PK, HK
Data collection: SS, PK, HK
Data analysis: SS, HK
Compilation of manuscript: SS
Reviewing of the manuscript: SS
Proofreading of the manuscript: SS, PK

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