



To Compare the Effectiveness of Vestibular Habituation Training and Canalith Repositioning Procedure on Functional Performance in Patients with Benign Paroxysmal Positional Vertigo- An Experimental Study

Pranjal Patel¹, Subhash Khatri², Girija Murugan³, Mahendra Singh Lodhi⁴, Umashankar Panda⁵

¹ Assistant Professor at Shrimad Rajchandra College of Physiotherapy, Uka Tarasadiya University, Maliba Campus, Bardoli, Gujarat, India

² Principal at Nootan College of Physiotherapy, Sankalchand Patel University, Visnagar, Gujarat, India

³ Assistant Professor, Bangluru, Karnataka, India

⁴ Assistant Professor at College of Physiotherapy, MMC, WH, Miraj, Maharashtra, India

⁵ Assistant Professor, KTG College of Physiotherapy Bangluru, Karnataka, India

Background: Vertigo or dizziness is a condition in which the affected person has a false sense of his own movement or those of his surrounding objects. Benign paroxysmal positional vertigo (BPPV) is a common clinical disorder characterized by brief recurrent spells of vertigo often brought about by certain head position changes as may occur with looking up, turning over in bed, or straightening up after bending over. Both Canalith Repositioning Procedure (CRP) and Vestibular Habituation Training (VHT) seem to be cost effective because both give relief of symptoms in relatively few visits to the physician or therapist, almost eliminate the need for surgery and reduce the need for physician visits and medication. Benign carelessness may not be cost effective because these patients continue to seek less demanding treatment. This study is aimed to compare the effectiveness of Vestibular Habituation Training and Canalith Repositioning Procedure on functional performance in patients with BPPV.

Objectives: Primary objective of this study was to compare the effectiveness of Vestibular Habituation Training and Canalith Repositioning Procedure on modified vertigo symptom scale in patients with BPPV. Secondary objective was to compare the effectiveness of Vestibular Habituation Training and Canalith Repositioning Procedure on vestibular activities of daily living scale in patients with BPPV.

Methods: Thirty participants between the ages of 30-50 years, with the clinical diagnosis of peripheral BPPV. Thirty participants were divided into two groups, Group A received Canalith Repositioning Procedure (n=15) and Group B received Vestibular Habituation Training (n=15). In both of the groups, participants were assessed by using modified vertigo symptoms scale and vestibular disorder activities of daily living scale. In Group A, Canalith Repositioning Procedure was given four days in a week for three weeks. In Group B, instruction was given to repeat the positive maneuvers until the participant get fatigued under the guidance of therapist. And again repeat same for two times a day at clinical setting and to be continued for three weeks.

Result: Data was analyzed using Graph Pad Instat Trial Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as t test. Post intervention MVSS mean score for Group A and Group B were 1.6 ± 0.966 and 2.81 ± 1.32 respectively. On comparison of Post-intervention MVSS mean scores between Group A and Group B by using Un-paired t test, P value was >0.05 which is statistically significant. Post-Intervention mean score for domain F of VADL scale in Group A and Group B were 1.7 ± 0.823 and 1.09 ± 0.3015 respectively. For domain A and I post intervention mean scores in both the groups were 1.8 ± 0.6324 and 1.36 ± 0.6742 , and 2 ± 0.816 and 1.09 ± 0.7006 . On comparison of VADL post-intervention mean score between Group A and Group B, it was observed that this difference is not considerably significant. For domains F and A, p value is not less than 0.05 i.e., 0.33 and .1437 respectively and it is considered as not significant. For domain I p value was less than 0.05 i.e., 0.0129 so it was referred as significant value for both the groups.

Conclusion: Canalith repositioning procedure and vestibular habituation training are equally effective in patients with BPPV after 3 weeks of duration and improves the functional impairment which occurs after vestibular disorders as well.

Key words: Vertigo, BPPV, modified vertigo symptom scale, vestibular activities of daily living, quality of life, CRP vs. VHT

Introduction

Salman Rushdie, a novelist once said Vertigo is the conflict between the fear of falling and the desire to fall. Vertigo or dizziness is a condition in which the affected person has a false sense of his own movement or those of his surrounding objects.¹ Benign paroxysmal positional vertigo (BPPV) is a common clinical disorder characterized by brief recurrent spells of vertigo often brought about by certain head position changes as may occur with looking up, turning over in bed, or straightening up after bending over.² It is an important cause of vertigo with a prevalence of 11 to 64 per 100,000 and a lifetime prevalence in general practice of 2.4%.² In a large registry that included data collected from 4,294 patients with vertigo in 13 countries generated over a 28-month period (the Registry to Evaluate the Burden of Disease in Vertigo, the so-called REVERT registry) nearly 1/3 were diagnosed to have BPPV.³ In idiopathic BPPV, female to male ratio is approximately 2:1.⁴

The cause of BPPV is mostly idiopathic. In a view of the high prevalence of BPPV in middle aged women, hormonal factors may play a role in the development of BPPV.^{5,6} Patients rarely develop BPPV after mastoid surgery or if they engage in a persistent head-tilt position, such as among barbers or dentists.^{7,8}

The main symptom of BPPV is vertigo (spinning sensation) induced by a change in head position with respect to gravity. Patients typically develop vertigo when getting out of bed, rolling over in bed, tilting their head back, for example to look up shelves, or bending forward or when fastening their shoes. Patients with BPPV do not experience severe vertigo during usual daytime activities performed with an upright posture, but rather when they get out of bed.

The classic test to diagnose BPPV of the posterior semicircular canal is the Dix-Hall pike maneuver.⁴ In PC-BPPV, the positioning nystagmus is typically induced by this maneuvers in the direction of the involved canal.⁵ During this maneuver, it is thought that the free-floating otolithic debris (canalolithiasis) in the posterior canal moves away from the cupula and stimulates the posterior canal by inducing ampullo-fugal flow of the endolymph.^{5, 9} The Dix-Hall pike maneuver results in torsional up-beating nystagmus corresponding in duration to the patient's subjective vertigo, and occurring only after Dix-Hall pike positioning on the affected side. A presumptive diagnosis can be made by history alone, but paroxysmal positional nystagmus confirms the diagnosis.²

Delayed diagnosis and treatment, as a result of recommendations to specialists, extends waiting times and provokes financial costs that leads to unnecessary use of prescribed medication known to be ineffective.¹⁰ Treatment of BPPV with medication in experience of Steenerson RL et al and that of McClure and Willett's has not been helpful and may be unfavorable.¹¹ In many cases, spontaneous remission occurs before medical advice is sought, and patients may simply seek an explanation for their symptoms without needing or demanding treatment.¹² Even after successful administration of treatment for BPPV, vertigo will improve dramatically but after some time there may be complain of residual dizziness.¹³ The clinician has several options for care and may tailor the treatment plan to meet the needs of the individual with BPPV.¹⁴ BPPV tends to present with cluster of episodes in a limited period of time, followed by an interval of no attacks before recurring another time.¹⁵

Canalith Repositioning Procedure (CRP) was first described as a treatment of BPPV by Epley in 1992 hence sometimes referred to as the "Epley maneuver" or "Canalith repositioning maneuver".² The procedure involves laying the patient back onto an examination table into a position that causes movement of the canaliths, which is the trigger of the vertigo symptoms and the nystagmus. Dix-Hallpike test is necessary to confirm the diagnosis of BPPV and localize the side (left or right) and the site (posterior, anterior, or horizontal semi-circular canal) of the canaliths causing the patients' symptoms.¹⁶

Brandt and Daroff, Norre and Beckers and McCabe have found Vestibular Habituation Training (VHT) to be successful in subjects with BPPV.¹¹ VHT is an exercise treatment for BPPV based on the assumption that such a type of vertigo can be treated by habituation effect. Clinical experience with VHT battery (consisting of nineteen maneuvers) showed that in each subject only a limited number of responses were positive in various combinations constituting several interindividual different patterns. The positive maneuvers were advised as the adequate exercises. An accurate list of exercises was imposed on the subject to be repeated several times a day.¹²

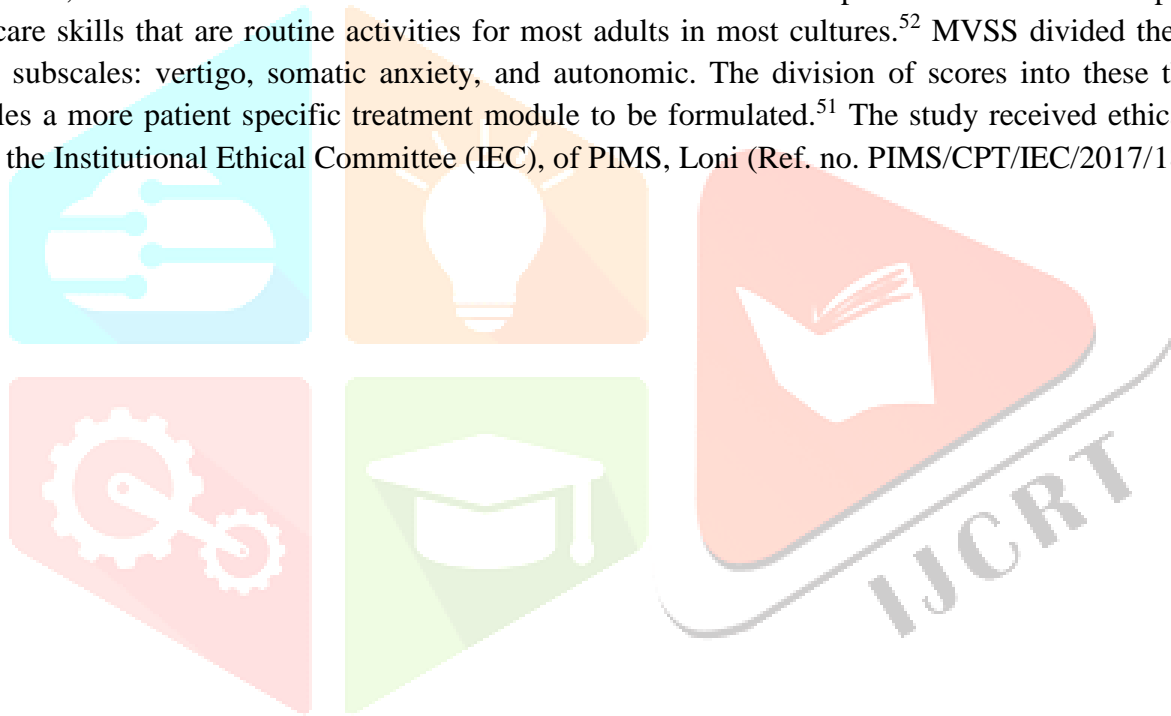
Both CRP and VHT seem to be cost effective because both give relief of symptoms in relatively few visits to the physician or therapist, almost eliminate the need for surgery⁶⁸ and reduce the need for physician visits and medication. Benign carelessness may not be cost effective because these patients continue to seek less demanding treatment.

Methods

A quasi experimental design study of 30 participants using convenient sampling method was done. Participants who were diagnosed with BPPV by using Hallpike Dix Manuever (HDM), included in the study according to selection criteria. The inclusion criteria for this study were both male and female diagnosed with BPPV on HDM, participants who were complaining of vertigo during twelve month of period. And exclusion criteria were participants who were diagnosed with other ENT disorders, restricted head movements and other metabolic disorders. By using the simple random allocation method, participants were divided into Group A (15 participants) and Group B (15 participants). Group A received CRP and Group B received VHT for 3 weeks of duration.

Outcome Measures

Hallpike-Dix maneuver (HDM), Vestibular Activity of Daily Living Scale (VADL) and Modified Vertigo Symptom Scale (MVSS) were used in this study as an outcome measures. HDM was performed for both sides to detect which ear is problematic. The VADL has 28 questions divided into three subgroups: functional, ambulation and instrumental skills. The 12 functional skills provide a detailed list of personal and self-care skills that are routine activities for most adults in most cultures.⁵² MVSS divided the items into three subscales: vertigo, somatic anxiety, and autonomic. The division of scores into these three scales enables a more patient specific treatment module to be formulated.⁵¹ The study received ethical approval from the Institutional Ethical Committee (IEC), of PIMS, Loni (Ref. no. PIMS/CPT/IEC/2017/187).



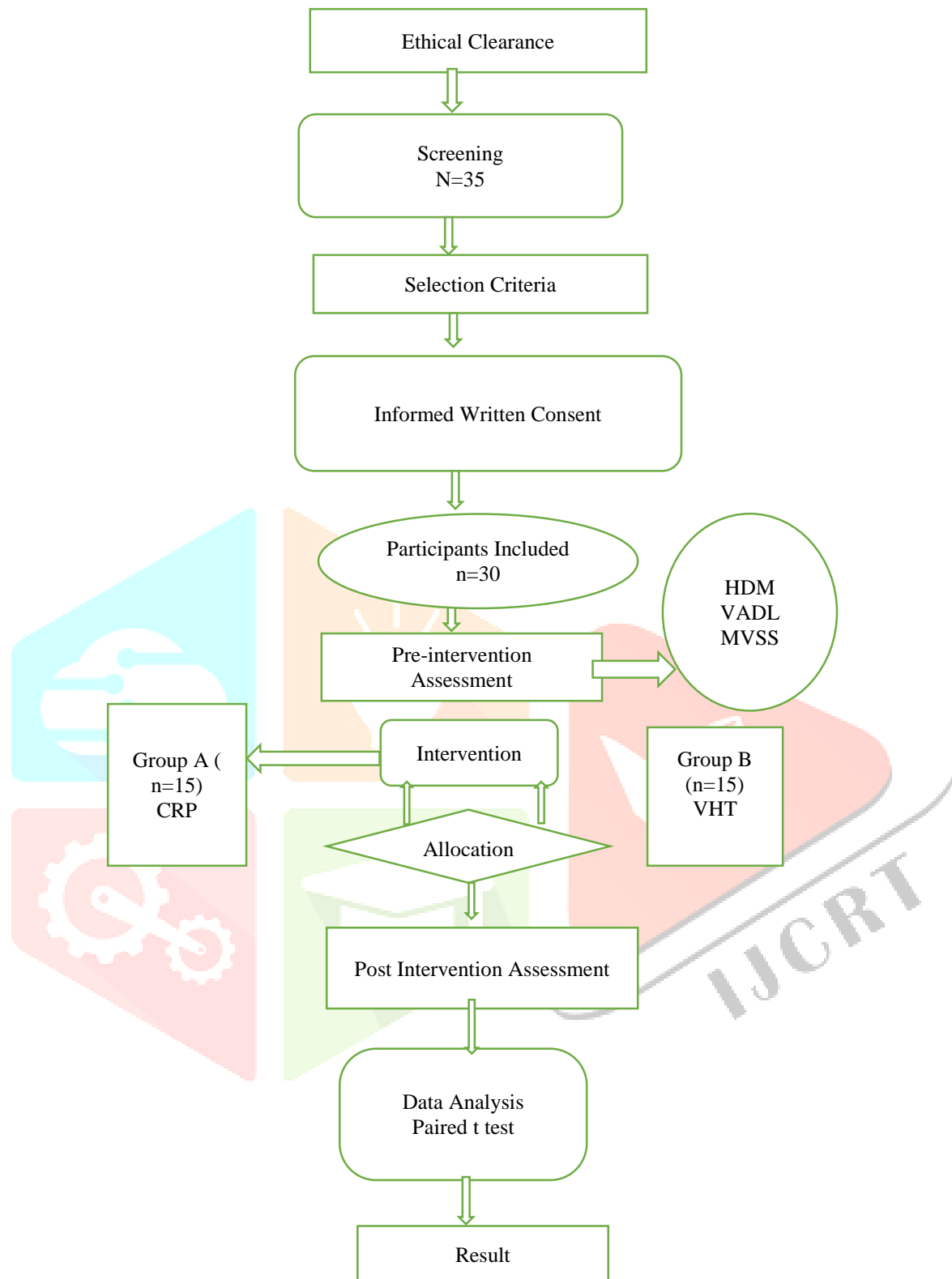


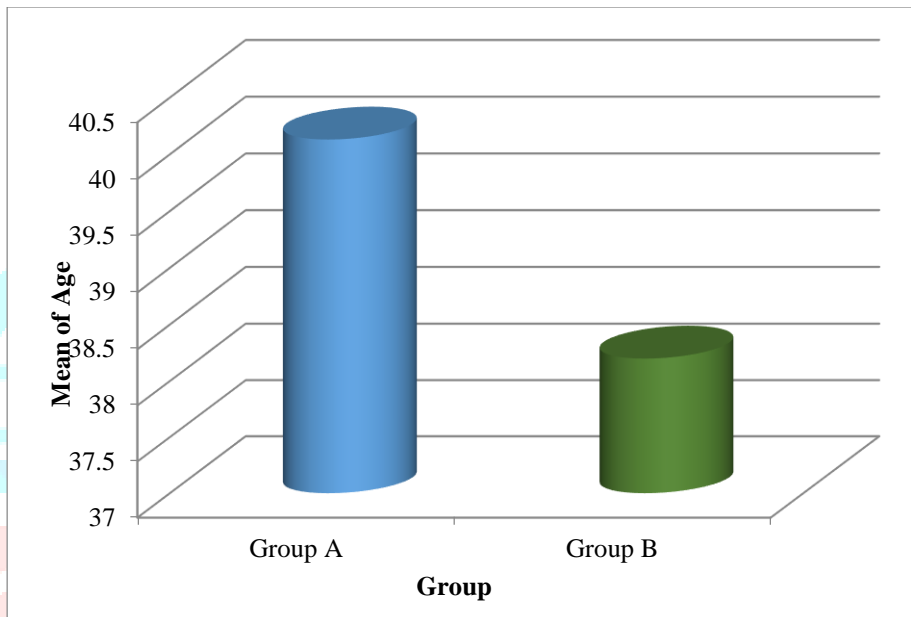
Figure:1 The flow chart represents procedure of study

Results

The objective of the study was to compare the effectiveness of CRP and VHT in patients with BPPV within 3 weeks of duration. The data was entered in the excel spread sheet tabulated and subjected to statistical analysis. Data was analyzed using Graph Pad Instat Trial Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as t test. The confidence interval was set at 95% and data was considered statistically significant with $p < 0.05$ and highly or considerably significant with $p < 0.001$.

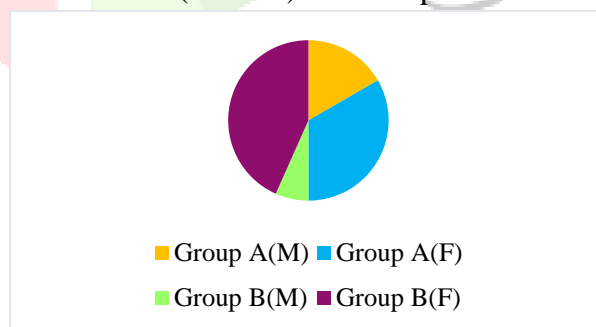
Table:1 Age Distribution

Groups	Mean of Age in Years	SD of Age in Years
Group A	40.13	7.02
Group B	38.2	7.12
Total	39.16	7.07



Graph 1: Age Distribution in Group A and B

The average age of Group A (CRP) was 40.13 ± 7.02 years and in Group B (VHT) was 38.2 ± 7.12 years. There were (66.67 %) were female and male (33.33%) in Group A which were receiving CRP treatment.



Graph:2 Percentage of Male and Female in the groups

There were 13 (86.66%) female in Group B and (13.34%) male and, receiving VHT treatment. The duration of treatment in both the groups was for 3 weeks.

In group A, 11 participants have completed treatment for 3 weeks. Two participants lost follow up and rest two were living far from the clinical setting so it was not suitable for them to come regularly for 3 weeks. And in Group B, 10 participants have completed treatment for 3 weeks. Three of them had severe neck pain because of VHT maneuvers and two of them discontinued treatment at the end of two weeks.

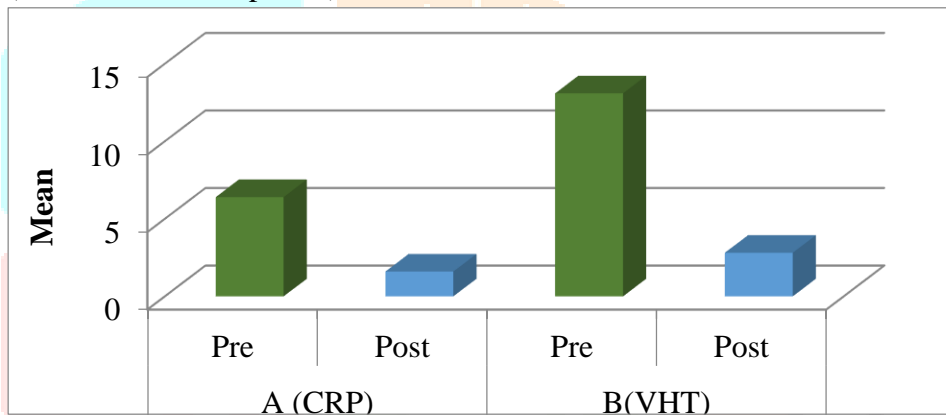
Comparison of Pre-Intervention and Post- Intervention MVSS score in both the Groups:

Severity of positional vertigo and functional impairment due to vertigo were measured by using Modified Vertigo Symptom Scale. The mean value of MVSS score in Group A before intervention was 6.4 ± 1.264 and after intervention it was 1.6 ± 0.966 . On comparing the pre and post-intervention

Table:2 MVSS Score of Participants

MVSS SCORE	Groups	Pre Mean± SD	Post Mean± SD	t value	p value	Result
	Group A	6.4 ± 1.264	1.6 ± 0.966	9.374	<0.0001	Highly significant
	Group B	13.09 ± 3.986	2.81 ± 1.32	11.473	<0.0001	Highly Significant

Score of Group A, it was observed that this difference is considerably significant. ($p < 0.05$), (< 0.0001), $t = 9.374$ with $df = 10$) (Table 4.3 and Graph 4.3). On the other hand in Group B, the mean value of pre and post-intervention MVSS score was 13.09 ± 3.986 and 2.81 ± 1.32 respectively. On comparing this both scores in Group B, it was observed that this difference was highly significant. ($p < 0.05$, < 0.0001 , $t = 11.473$ with $df = 9$) (Table 4.3 and Graph 4.3).



Graph:3 Comparison of MVSS score in Group A and Group B

Comparison of Pre and Post- Intervention VADL score in Group A and Group B:

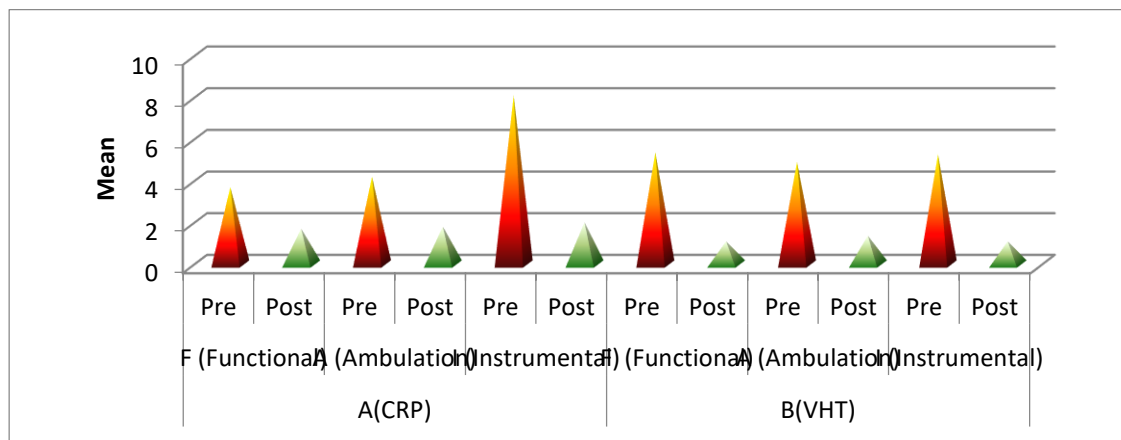
Vertigo and balance disorders on independence in routine activities of daily living were evaluated by using Vestibular Activity of Daily Living Scale in both groups.

Table:3 VADL Scores of participants

Groups	VADL	Intervention	Mean	SD	t value	p value	Result
A(CRP)	F (Functional)	Pre	3.7	1.494	7.746	<0.0001	Highly Significant
		Post	1.7	0.823			
	A (Ambulation)	Pre	4.2	1.751	6	<0.0001	Highly Significant
		Post	1.8	0.6324			
	I (Instrumental)	Pre	8.1	3.813	6.13	<0.0001	Highly Significant
		Post	2	0.816			
B(VHT)	F (Functional)	Pre	5.363	1.9633	7.899	<.0001	Highly Significant
		Post	1.09	0.3015			

A (Ambulation)	Pre	4.9	1.64	7.8	<0.0001	Highly Significant
	Post	1.36	0.674			
I (Instrumental)	Pre	5.272	2.76	5.88	0.002	Highly Significant
	Post	1.09	0.7			

Pre and Post-Intervention average value of F domain was 3.7 ± 1.494 and 1.7 ± 0.823 respectively in Group A. Same as for domain A average value was 4.2 ± 1.751 and 1.8 ± 0.6324 . And for domain I Pre and Post-Intervention average value was 8.1 ± 3.813 and 2 ± 0.816 respectively. On comparing the Pre and Post-Intervention average values of Group A, it was observed that this difference is highly significant i.e., $p < 0.0001$. (F, A and I $t = 7.746, 6$ and 6.13 with $df = 10$ respectively) (Table 4.4) (Graph 4.4). On the basis of t value of these three domains, it is cleared that I domain got more improved than the other two domain of this scale



Graph :4 Scores of VADL in Group A and Group B

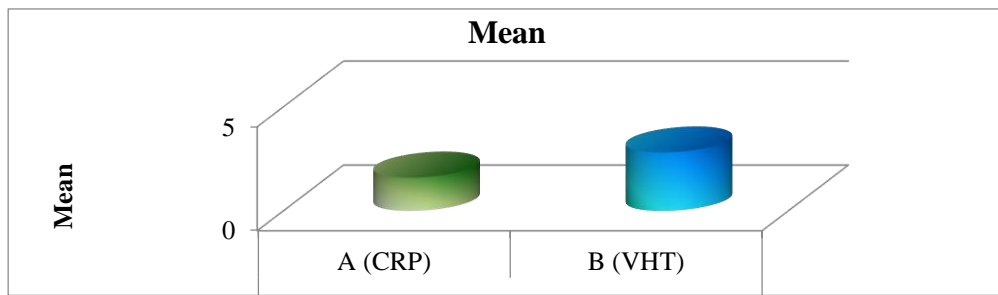
Pre and Post-Intervention mean value of F domain was 5.363 ± 1.9633 and 1.09 ± 0.3015 in Group B. For domain A and I, Pre and post- Intervention mean values were 4.9 ± 1.64 and 1.36 ± 1.64 , and 5.272 ± 2.76 and 1.09 ± 0.7 respectively. On comparing the Pre and Post-Intervention values of group B, it was observed that this difference is extremely significant. P value for all three domain falls underneath < 0.10 i.e., for F, A & I it was < 0.0001 , < 0.0001 and 0.002 . (F, A and I $t = 7.899, 7.8$ and 5.88 with $df = 09$ respectively). In accordance with t value of this three domain the scale, is said that F and A, enhanced more at the end of three weeks than I in Group B.

Comparison of MVSS score after Intervention between Group A and Group B:

Post intervention MVSS mean score for Group A and Group B were 1.6 ± 0.966 and 2.81 ± 1.32 respectively. On comparison of Post-intervention MVSS mean scores between Group A and Group B by using Un-paired t test, it is observed that this difference is significant. With the reference of Table 4.5 and Graph 4.5, Group B shows more scores in MVSS after 3 weeks of duration than the Group A. ($p < 0.0278$ and $t = 2.328$ with $df = 19$).

Table:4 Comparison of post-intervention MVSS score between group A and Group B

Scale	Groups	Mean	SD	t-value	p value	Result
MVSS	A (CRP)	1.6	0.966	2.328	0.0278	Statistically Significant
	B (VHT)	2.81	1.32			

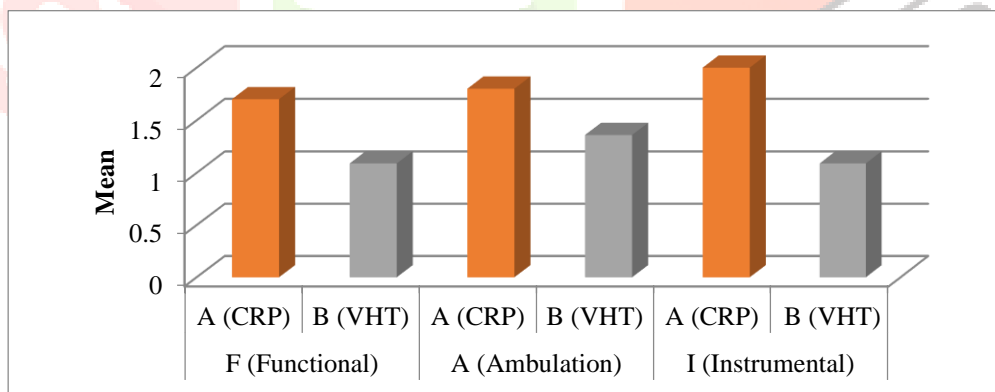


Graph:5 Comparison of post-intervention MVSS score between group A and Group B
Comparison of Post Intervention VADL score between Group A and Group B

Post-Intervention mean score for domain F of VADL scale in Group A and Group B were

Table:5 Comparison of post intervention score of VADL between Group A and Group B

Scale	Groups	Mean	SD	t- value	p value	Result
VADL F (Functional)	A (CRP)	1.7	0.823	2.295	0.333	Not significant
	B (VHT)	1.09	0.3015			
A (Ambulation)	A (CRP)	1.8	0.6324	1.525	0.1437	Not significant
	B (VHT)	1.36	0.6742			
I (Instrumental)	A (CRP)	2	0.816	2.764	0.0129	Statistically significant
	B (VHT)	1.09	0.7006			



Graph:6 Comparison of post-intervention score of VADL between Group A and Group B

1.7±0.823 and 1.09±0.3015 respectively. For domain A and I post intervention mean scores in both the groups were 1.8±0.6324 and 1.36±0.6742, and 2±0.816 and 1.09±0.7006. On comparison of VADL post-intervention mean score between Group A and Group B, it was observed that this difference is not considerably significant. For domains F and A, p value is not less than 0.05 i.e., 0.33 and .1437 respectively and it is considered as not significant. For domain I p value was less than 0.05 i.e., 0.0129 so it was referred as significant value for both the groups. And also mean difference was more observed in Group A hence, it is believed that participants improved more in instrumental activities in Group A than Group B.

Discussion

This study aimed at comparing the effectiveness of Canalith Repositioning Procedure (Group A) and Vestibular Habituation Training (Group B) on functional performance in participants with Benign Paroxysmal Positional Vertigo after 3 weeks of duration. In the present study, MVSS and VADL scores were obtained from the participants with BPPV in both groups of Group A and Group B. After obtaining the data, treatment was given to the participants according to their groups and then again, after 3 weeks data were collected in data sheet. At then, comparison between this two groups were done.

The result of this study showed that MVSS and VADL scores were increased in both the groups after 3 weeks of intervention when comparing these scores with pre-intervention scores by using paired t test. (Table 2 and 3). It also revealed that after the receiving the treatment participants showed more improvement in group B when compared on MVSS after 3 weeks. However, participants showed more improvement when compared on VADL score in group A.(Table 4 and 5)

Improvement in Modified Vertigo Symptom Scale

In this study we used Modified Vertigo Symptom Scale, English Version 2, developed by Davies et al in 1998. This scale divides the symptoms in three sub-scale which are: 1) Balance disorder 2) Somatic anxiety and 3). Pre-intervention mean for group A was 6.4 (SD=1.264) and post intervention mean was 1.6 (SD=0.966). By using test of significance, it is proved that there is significantly improvement is seen after intervention. P value is >0.010 (t value is 9.374 with $df=9$) In group B, pre-intervention score was higher than the group A and consequently mean of pre and post intervention in group B were 13.09 (SD= 3.986) and 2.81 (SD=1.32). Evidently, VHT is effective in treating BPPV and that is why, probably more difference was noted in group B. Now, when we compared MVSS score between group A and group B by using unpaired t test. We found that the difference was more in group B compared to group A. Value of unpaired t test for group A and group B were 9.374 ($df=9$) and 11.473 ($df=10$) respectively. As a result VHT is more effective in improving MVSS score because it mainly works on the adaptation and specificity principal than the CRP.

Improvement in VADL scale:

We used this scale because this is the perfect measuring tool for vertigo and balance problem on independence in routine activities of daily living. Since the Dizziness Handicap Inventory scale mainly emphasized on psychosocial function affected by vestibular impairments and not on ADL. So, we used this scale to assess routine impairments due to vestibular disorders.¹⁷ And this scale has 3 domains and these are 1) Functional, 2) Ambulation and 3) Instrumental scores.

Additionally, this scale has many potentially uses. It should be particularly useful for treatment planning, chiefly for vestibular rehabilitation. It should also be useful for assessing progress in response treatment with medication, surgery and rehabilitation.

As given in graph 4 most affected domain of VADL in group A was Instrumental (I) and pre and post-intervention mean for this was 8.1 (SD=3.813) and 2 (SD=.816). Other two domain were also affected and improvement was seen after intervention. Functional activities impaired least of all three in group A and mean for this pre and post-intervention were 3.7 (SD=1.494) and 1.7 (SD=.823) respectively. Same as in group B functional and instrumental activities influenced by BPPV very nearly and pre and post intervention mean scores for these activities were 5.363 (SD=1.9633) and 1.09 (SD=0.3015), and 5.272 (SD=2.76) and 1.09 (SD=0.7). When we compared mean of VADL between group A and B, we came up with significant improvement in Group A rather than Group B. Neither CRP nor VHT were significantly effective in improving VADL score after 3 weeks because p value was not >0.0010 for all the three domains in both the group. Although, Instrumental impairments influenced more by Vestibular Rehabilitation. And CRP is more effective than VHT because mean value for this domain were 2 (SD=0.816) and 1.09 (SD=0.7006)

respectively. Most influenced activity by CRP and VHT in ascending manner was instrumental, functional and ambulation activities as t values for these domains were 2.764, 2.295 and 1.525 (with df=20).

Vertigo often hampered activities of daily living by giving sensation like nausea and vomiting during head movement or moving around. Which creates difficulty in performing daily activities for individual with BPPV.¹⁸ In this study 16 patients with labyrinthine and brainstem lesion were included and were examined before and after physical therapy by using Activities of Daily Living (ADL) Scale. Result of this study showed that significant differences among the level of ADL when comparing normal, pre-PT and post-PT scores. Wilcoxin matched pairs signed ranks tests showed that Pre PT-scores were significantly worse than Normal scores ($z = 3.52, p < 0.001$) and that Post PT scores were significantly better than Pre PT-scores ($z = 3.41, p < 0.001$). Post PT scores were significantly worse than Normal ($z = 2.67, P < 0.001$)¹⁸.

Previous study of Ronald LS et al on comparison of CRP and VHT with BPPV explains that there was not any improvement in a single patient after 1 session of treatment. Average session for CRP were 9 in their study for patients to become an asymptomatic.¹¹ Usha UK et al studied to compare the effectiveness of CRP and VHT with BPPV patients.¹² Therefore in our study we kept duration of treatment for both the groups were 3 weeks and 4 days in a week. And also, treatments were given until the patient became asymptomatic in both groups. Karim AMMR et al studied to evaluate the efficacy of CRP in 80 patients with BPPV. They compared anti-vertigo drug and CRP VS anti-vertigo drug and instituted that there was significant improvement in patients treated with both CRP and anti-vertigo drug. This study also found that there was low drug dependence in group treated with drug and CRP. Hence, this study demonstrated that canalith repositioning procedure was effective in the treatment for BPPV.¹⁹

Helen SC et al studied on canalith repositioning procedure with variation in BPPV patients. In their study one of variant was self-CRP. They compared self-CRP with Brandt Daroff exercise. They established that there was no significant difference in improving vertigo symptoms and severity at the end of treatment. There were very few studies which supports the self-treatment in patients with BPPV.¹⁴ Patient showed improvement in self-administered canalith repositioning procedures at home but sometimes home exercise seems to pose little risk in most patients and can be used as adjunct to treatment. And also, it is less effective than the treatment administered by expert therapist or clinician.² Therefore in this study CRP and VHT were administer by the therapist for 3 weeks of duration in 12 sessions. At the end of the 3 weeks of intervention there were significant improvement shown in both the groups.

CRP is designed to clear the calcium debris from posterior semicircular canal by moving it back into the vestibule by the effects of gravity because the calcium carbonate crystals sink into the endolymph. Once, the calcium carbonate crystal back into the vestibule, they are absorbed within a period of days in most patients. If properly done, canalith repositioning maneuver eliminate BPPV immediately in 85% of patients.² Seok JI et al studied on residual dizziness after repositioning maneuver in Benign Paroxysmal Positional Vertigo. In their study all the patients were treated with CRP until complete resolution of all symptoms and for maximum period of 3 months. They collected data on characteristic and duration of any residual illness and they instituted that maximum duration of residual illness after successful CRP was 16.4 ± 17.6 days.¹³ So we considered 21 days of protocol for both the groups to overcome residual dizziness after treatment. We caught expected improvement in this period of time. (Table 2 and 3, Graph 4 and 5)

Vestibular Habituation Training (VHT) has already been proven its efficacy in the treatment of positional vertigo. In this treatment the emphasis is on the specificity of exercises (Exercises are selected individually for each particular patient).²⁰ Norre ME et al studied on vestibular habituation training as an adjunctive treatment for BPPV. In their study sixty patients were treated according to the protocol of VHT battery. And patients were examined by VHT test battery. The patients were motivated and instructed by the therapist how to execute correctly the training exercises and these exercises were repeated 2-3 times a day. The therapy

was always followed at home. The patient was followed weekly until the score become 0. Result of this study showed that there was progressive reduction in positive cases as well as in number of maneuvers.²⁰

Among the special senses of human nervous system, vestibular function is possibly the most multifaceted. It requires corresponding bilateral input from the vestibular end organs, which then must be combined with visual and somatosensory signals in the central nervous system. Vestibular compensation can be defined as the process of recovery following a vestibular lesion by which an ideal functional state is re-established. This process requires a wide reformation of central nervous system activity at the brainstem and cerebellar level. When this process successfully achieves compensation, functional deficits are eliminated and the individual has appropriate equilibrium during daily activities.²¹ This concept is based on experimental observations in human beings and animals, showing that the mechanisms of adaptation and compensation do not work in a stereotypic way, but large inter-individual differences can be observed. Experiments have shown that compensation after labyrinthine lesions is preferred by active movements and repeatedly presenting the "error" situation to the system." Moreover, it has become obvious that compensation and adaptation develop in a progressive way. Satisfactory stimulus is the repeated presentation of the situation that has to be adapted. This process is called "error controlled," which was confirmed by showing that drugs that induce reversible decompensation by a single injection accelerate the compensatory process.⁸¹ According to these experimental data, VHT technique has been based on the assumption that the exercises have to elicit vertigo to be effective, which is also the assumption of McCab. VHT exercises designed to facilitate habituation of specific pathologic response. The exercises are repeated because habituation trials have shown that repetition of the same stimulus (identical direction and type) causes a decline in response. They also show that only the effect of the stimulus is specifically reduced.²⁰

In this Study VHT maneuver were decided and listed out in Data sheet and according to that treatment was given to the patients for three weeks. Maneuvers were given in that same vertigo eliciting position until the symptoms get reduced and patients has to perform that all maneuvers during 3 weeks of duration. After 3 weeks of intervention we again took reassessment and significant improvement was noted in both scale.

Thus, it can be said that full Dedication, Self-confidence and Accuracy in treatments are three main requisites to achieve willing improvement in patients with any kind of diseases

Limitation of the study:

Limitation of this study was that it lost follow up and this study included small sample size.

In this study there is no follow up after 3 weeks so long- term effect of intervention could not be suggested.

Recommendations:

Future study can be conducted with larger sample size and with long term follow up.

Conclusion

This study concludes that the both canalith repositioning procedure and vestibular habituation training are equally effective in patients with BPPV after 3 weeks of duration and improves the functional impairment which occurs after vestibular disorders as well. This study also showed that by following the principle of repositioning of carbonate particles and "specificity of adequate exercises" can be used as one of effective treatment protocol for patients with BPPV. Hence, null hypothesis is rejected and alternative hypothesis is accepted because both the treatments are effective in alleviation symptoms of BPPV

Competing Interests: None

References:

1. Abrol R, Nehru VI, Venkatramana Y. Prevalence and etiology of vertigo in adult rural population. *Indian Journal of Otolaryngology and Head & Neck Surgery*. 2001 Jan 1; 53(1):32-6.
2. Fife TD. Benign paroxysmal positional vertigo. In *Seminars in neurology* 2009 Nov (Vol. 29, No. 05, pp. 500-508). © Thieme Medical Publishers.
3. Agus S, Benecke H, Thum C, Strupp M, Gasteyer C. Clinical and demographic features of vertigo: findings from the REVERT registry. *Frontiers in neurology*. 2013 May 10;4:48.
4. Von Brevern M. Benign paroxysmal positional vertigo. In *Seminars in neurology* 2013 Jul (Vol. 33, No. 03, pp. 204-211). Thieme Medical Publishers.
5. Lee SH, Kim JS. Benign paroxysmal positional vertigo. *Journal of Clinical Neurology*. 2010 Jun 1;6(2):51-63.
6. Vibert D, Kompis M, Häusler R. Benign paroxysmal positional vertigo in older women may be related to osteoporosis and osteopenia. *Annals of Otolaryngology, Rhinology & Laryngology*. 2003 Oct;112(10):885-9.
7. Hong SL, Kim JS, Koo JW. A case of contralateral benign paroxysmal positional vertigo after mastoidectomy. *Journal of the Korean Balance Society*. 2005 Jun 1;4(1):45-8.
8. Kaplan DM, Attal U, Kraus M. Bilateral benign paroxysmal positional vertigo following a tooth implantation. *The Journal of Laryngology & Otolaryngology*. 2003 Apr;117(4):312-3.
9. Dix MR, Hallpike CS. The pathology symptomatology and diagnosis of certain common disorders of the vestibular system. *Proc R Soc Med* 1952;45:341-354.
10. Munoz JE, Micklea JT, Howard M, Springate R, Kaczorowski J. Canalith repositioning maneuver for benign paroxysmal positional vertigo: randomized controlled trial in family practice. *Canadian Family Physician*. 2007 Jun 1;53(6):1048-53.
11. Steenerson RL, Cronin GW. Comparison of the canalith repositioning procedure and vestibular habituation training in forty patients with benign paroxysmal positional vertigo. *Otolaryngology—Head and Neck Surgery*. 1996 Jan;114(1):61-4.
12. Udupa, K., 2010. To compare the effect of canalith repositioning procedure and vestibular habituation training techniques on the functional performance of subjects with benign paroxysmal positional vertigo. (Doctoral dissertation).
13. Seok JI, Lee HM, Yoo JH, Lee DK. Residual dizziness after successful repositioning treatment in patients with benign paroxysmal positional vertigo. *Journal of Clinical Neurology*. 2008 Sep 1;4(3):107-10.
14. Cohen HS, Haghpeykar HS. Canalith repositioning variations for benign paroxysmal positional vertigo. *Otolaryngology—Head and Neck Surgery*. 2010 Sep;143(3):405-12.
15. Saeed BM, Omari AF. Climatic variations and benign paroxysmal positional vertigo. *Journal of Otolaryngology*. 2016 Mar 1;11(1):33-7.
16. Epley JM. The canalith repositioning procedure: for treatment of benign paroxysmal positional vertigo. *Otolaryngology Head Neck Surgery* 1992;107:399-404.

17. Cohen HS, Kimball KT. Development of the vestibular disorders activities of daily living scale. Archives of Otolaryngology–Head & Neck Surgery. 2000 Jul 1;126(7):881-7.
18. Cohen H. Vestibular rehabilitation reduces functional disability. Otolaryngology—Head and Neck Surgery. 1992 Nov;107(5):638-43.
19. Karim AM, Hasanuzzaman M, Chowdhury MA, Tayeb MA. Efficacy of the Canalith Repositioning Procedure in Benign Paroxysmal. Medicine Today. 2016 Oct 22;27(2):23-7.
20. Norre ME, Beckers A. Vestibular habituation training: exercise treatment for vertigo based upon the habituation effect. Otolaryngology—Head and Neck Surgery. 1989 Jul;101(1):14-9.
21. Telian SA, Shepard NT, Smith-Wheelock M, Kemink JL. Habituation therapy for chronic vestibular dysfunction: preliminary results. Otolaryngology—Head and Neck Surgery. 1990 Jul;103(1):89-95.

