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TO COMPARE THE EFFECT OF MODIFIED EPLEY'S MANEUVER AND CAWTHORNE-COOKSEY EXERCISE WITH BRANDT- DAROFF EXERCISE AND GAZE STABILITY EXERCISE IN POSTERIOR CANAL BENIGN PAROXYSMAL POSITIONAL VERTIGO

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Abstract

The purpose of *this to compare* effect of Modified Epley'sManeuver and Cawthrone-Cooksey exercise with Brandt- Daroff exercise and Gaze Stability exercise in posterior canal Benign Paroxysmal Positional Vertigo. In this experimental design a total of 30 subjects with an average age of 35 – 65 years of females those who had dizziness and balance disorder were assessed with Activities–Specific Balance Confidence scale (ABC), Dizziness Handicap Inventory (DHI) and Visual Analog Scale (VAS). 30 subjects were randomly allocated into group A (15 Subjects) who received Modified Epley's maneuver and Cawthorne–Cooksey exercise with medications and group B (15 subjects) Brandt –Daroff exercise and gaze stability exercise with medications. At the end of the treatment, ABC scale, VAS and DHI scale on comparison within and between the group A revealed statistically significant result with pre-test and post-test mean of ***p*** value < 0.05 whereas the group B revealed statistically significant result with pre-test and post-test mean of ***p*** value 0.05. Conclusion: The study concluded that the Modified Epley's manoeuver and Cawthorne–Cooksey exercise had statistically significant improvement in balance confidence and reduction in the intensity of dizziness in posterior canal benign paroxysmal positional vertigo participants as compared to Brandt-Daroff exercise and Gaze stability exercise.

Keywords: ***Modified Epley'sManeuver, Cawthrone-Cooksey exercise, Brandt- Daroff exercise, Gaze Stability exercise, Benign Paroxysmal Positional Vertigo (BPPV), Balance Confidence.***

INTRODUCTION

According to World Health Organization (WHO) It has been estimated that in the last ten years 50% of individuals experience Benign Paroxysmal Positional Vertigo (BPPV), 85% of the individuals experience vertigo and balance dysfunction due to inner ear defect. The prevalence of Benign Paroxysmal Positional Vertigo 2.4% all over the world.[1,5] Benign paroxysmal positional vertigo (BPPV) defined by Dix and Hallpike ,[2] is one of the most common disorders causing vertigo in adults and fortunately, is a very simple disorder to manage.[2,6]The cause of BPPV is mostly idiopathic. It may develop secondary to various disorders that damage the inner ear, head trauma, infection, and aging. Idiopathic BPPV is more prevalent in adults and in women, with women to men ration of 2:1.[2,11]

BPPV can be caused either by canalithiasis or by cupulolithiasis. Movement of the head causes these otoliths to inappropriately trigger the receptors in the semicircular canals and send false signals to the brain, causing vertigo and nystagmus. Posterior canal BPPV has been said to account for 60-90% of all BPPV cases.[12,13]

Anatomy

The vestibular section of the ear consists of the saccule, utricle and three semicircular canals (anterior or superior canal, posterior or inferior canal and horizontal or lateral canal)[6]. Each of these canals plays an essential role in maintaining 3759balance (vestibular). The SCCs are responsible for detecting rotational movement of the head. Situated at right angles to one another and contain fluid called endolymph. Inertial changes with rotation of the head cause this endolymphatic fluid to shift[12].

Semicircular Canals

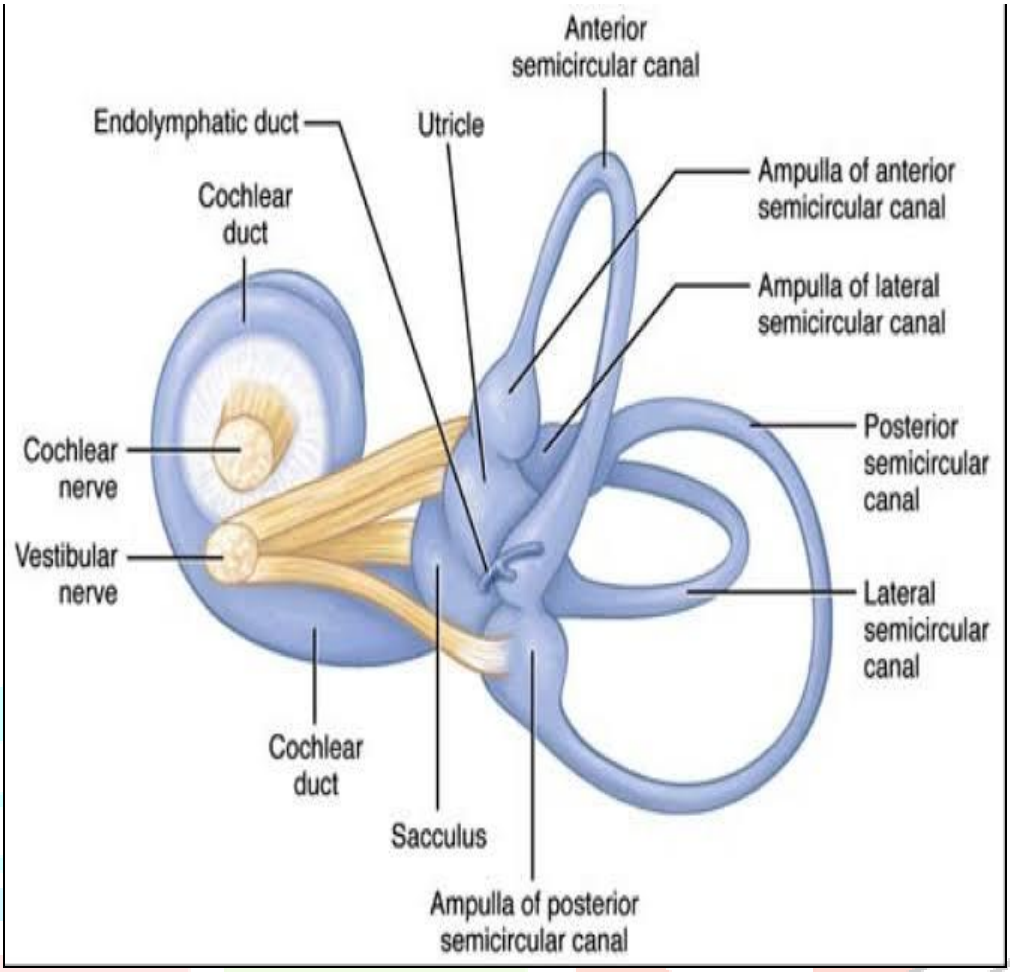


fig 1.1 Semicircular canals

The fluid shift lags behind movement of the head and as a result pressure is exerted on the cupula, the motion sensory receptor at the base of the canal. Each canal consists of a tubular arm (crura) that sprouts from a large barrel like compartment, much like the handle of a coffee mug sprouts from the mug[8,12].

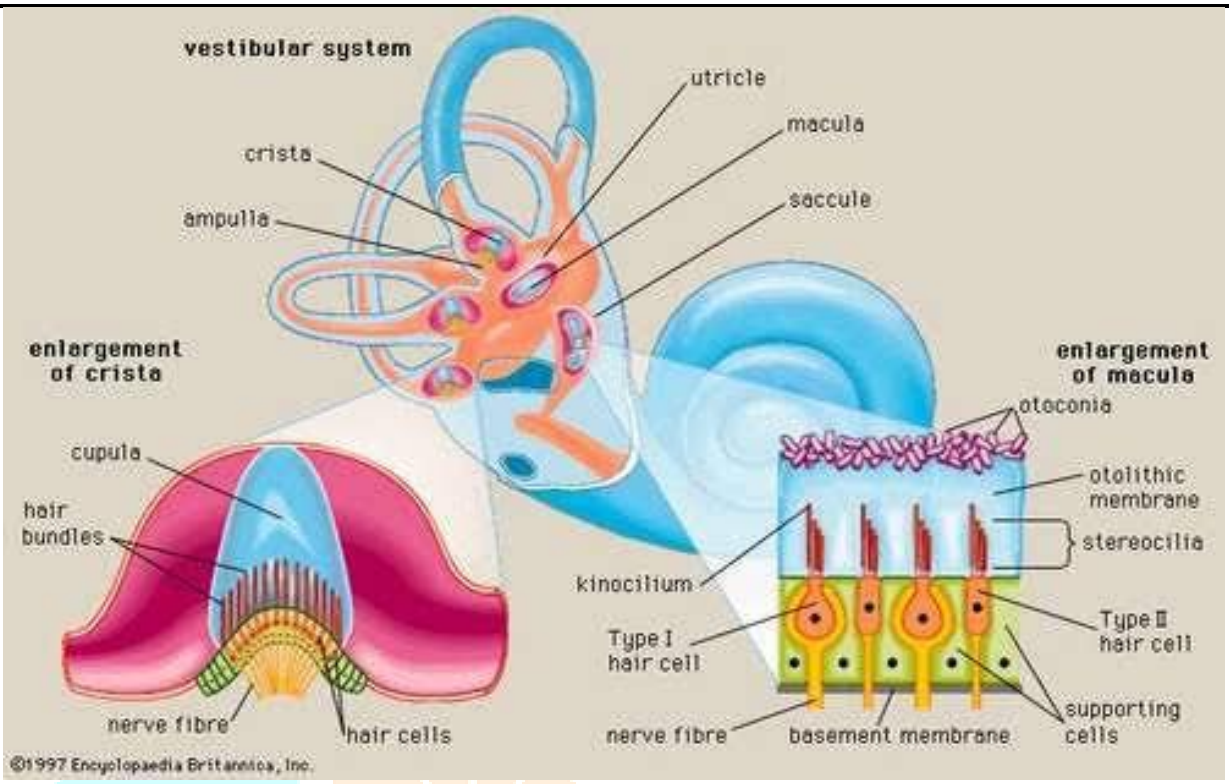


fig 1.2 Vestibular System

Vestibular System

The macula of the utricle is considered the structure at fault for BPPV. It contains otoconia (calcium carbonate particles) which are surrounded by a gelatinous matrix and stereociliary hairs. These calcium particles behave similarly to endolymph, reacting to changes in gravity and acceleration Each of these arms has a dilated (ampullary) end located near the top or front portion that houses the crista ampullaris (nerve receptors). The crista ampullaris has a sail-like tower, the cupula, that detects the flow of fluid within the SCC.[6,7,8] If a person turns suddenly to the right, the fluid within the right horizontal canal lags behind, causing the cupula to be deflected left (toward the ampulla, or ampullopetally). This deflection is translated into a nerve signal that confirms the head is rotating to the right. The information collected by the inner ear travels to the brain on the 8th cranial nerve also called the vestibulocochlearnerve or cochleo-vestibular nerve, auditory nerve or acoustic nerve.[8]In simple terms, the cupula acts as a 3-way switch that, when pressed one way, appropriately gives the body a sensation of motion. The middle or neutral position reflects no motion. When the switch is moved the opposite way, the sensation of motion is in the opposite direction. Particles in the canal slow and even reverse the movement of the cupula switch and create signals that are incongruous with the actual head movements. This mismatch of sensory information results in the sensation of vertigo.[7,8]

Pathophysiology

BPPV occurs when the otoconia of the macula are dislodged and transferred into the lumen of one of the semicircular canals. This unintentional movement interferes with the endolymphatic system and stimulates the motion receptor (ampulla) of the affected canal, resulting in vertigo.[6,12] Following this phenomenon, nystagmus ensures as a result of either canalithiasis or cupulolithiasis. The exact reason for the calcium crystals separating from the macula is not well understood. The condition is believed to arise following viral infection or trauma, but in the majority of cases it occurs in the absence of any identifiable illness or upset. It is also believed to be linked to age-related changes in the protein and gelatinous matrix of the otolithic membrane.[6]Canalithiasis refers to freely moving otoconia settling within the posterior semicircular canal, causing the canal to be gravitationally sensitive. This is thought to result in posterior canal BPPV, the most common form of the condition. In about 5% of cases cupulolithiasis occurs, where the otoconia adhere to the cupula of the lateral semicircular canal causing it to be heavier than the surrounding endolymph.[10,23] The direction of nystagmus is different depending on location of the calcium carbonate crystals. Nystagmus pattern is provoked by ampullary nerve excitation in the affected canal, which is directly connected to extraocular muscles of the eye.[6,12]

Posterior canal BPPV

The vast majority of all BPPV cases are of the posterior canal variant. The pathophysiology that causes most posterior canal BPPV cases is thought to be canalithiasis. This is probably because most free-floating endolymph debris tends to gravitate to the posterior canal, being the most gravity-dependent part of the vestibular labyrinth in both the upright and supine positions. Once debris enters the posterior canal, the cupular barrier at the shorter, more dependent end of the canal blocks the exit of the debris. Therefore, the debris becomes “trapped” and can only exit at the end without the ampulla (the common crus). Agrawal and Parnes[12] found obvious free-floating endolymph particles in 30% of ears operated on for posterior canal BPPV. The mechanism by which canalithiasis causes nystagmus in the posterior semicircular canal was described by Epley.[14,18] Particles must accumulate to a “critical mass” in the dependent portion of the posterior semicircular canal. The canalith mass moves to a more dependent position when the orientation of the semicircular canal is modified in the gravitational plane. The drag thus created must overcome the resistance of the endolymph in the semicircular canal and the elasticity of the cupular barrier in order to deflect the cupula. The time taken for this to occur plus the original inertia of the particles explains the latency seen during the Dix–Hallpike manoeuvre, which is described later.[6]

In the head-hanging position, the canalith mass would move away from the cupula to induce ampullofugalcupular deflection. In the vertical canals, ampullofugal deflection produces an excitatory response. This would cause an abrupt onset of vertigo and the typical “torsional nystagmus” in the plane of the posterior canal.[13,22] In the left head hanging position (left posterior canal stimulation), the fast component of the nystagmus beats clockwise as viewed by the examiner. Conversely, the right head-hanging position (right posterior canal stimulation) results in a counter clockwise nystagmus. These nystagmus profiles correlate with the known neuromuscular pathways that arise from stimulation of the posterior canal ampullary nerves in an animal model.[11] This nystagmus is of limited duration, because the endolymph drag ceases when the canalith mass reaches the limit of descent and the cupula returns to its neutral position. “Reversal nystagmus” occurs when the patient returns to the upright position; the mass moves in the opposite direction, thus creating a nystagmus in the same plane but the

opposite direction. The response is fatiguable, because the particles become dispersed along the canal and become less effective in creating endolymph drag and cupular deflection.

The main symptom of BPPV is vertigo 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, or bending forward. The symptoms may manifest with nonspecific dizziness, postural instability, light headedness, and nausea.[14,15] The vertigo in BPPV is typically intermittent and positioning dependent, which usually resolves within 30 seconds in posterior canal BPPV.[6]The Dix-Hallpike test is the most commonly used test to confirm the diagnosis of posterior canal BPPV.[6]

Aetiology

- Mild to moderate or severe head trauma.
- Head in the same position for a long time, such as in the dentist chair, at the beauty shop or on strict bed rest.
- Bike riding on rough trails.
- High intensity aerobics.
- Labyrinthine conditions-viral or vascular.
- Meniere's disease.
- Vestibular migraines.
- Hormone dysfunctions.
- In most cases, BPPV is idiopathic

Epley'smaneuver is based on cupulotherapy it directs foreign material out of canal into the utherical, [14]& thus relives the symptoms

Cawthorne and Cooksey exercises are based on canalith repositioning therapy.[1,3,18]These exercises are found to encourage head and eye movements that hastens the patient's recovery. (Their value in managing all forms of peripheral vestibular disorders rapidly became apparent, and they now form the mainstay of treatment for this group of patients. The exercises for vestibular rehabilitation can be categorized into two types: 1) physical therapy for vestibular hypofunction and 2) canalith repositioning therapy for benign paroxysmal positional vertigo (BPPV). Norre and Telian and Shepard expanded on the principles of Cawthorne and Cooksey and today vestibular rehabilitation, as it has come to be known, is a well established and accepted intervention for persons with balance and vestibular disorders.)

Brandt-Daroff exercise are habituation exercise, they do not reposition the particles, but disperse them and help brain to get used to vertigo symptoms with repeated head movements.[1,2,14]

Gaze Stabilization exercises are appropriate for patients who report problems seeing clearly because their visual world appears to bounce or jump around, such as when reading or when trying to identify objects in the environment, especially when moving about.[19]

Dix Hall-Pike Test is a diagnostic maneuver used for eliciting paroxysmal vertigo and nystagmus in which the patient is brought from the sitting to the supine position with the head hanging over the examining table and turned to the right or left; vertigo and nystagmus are elicited when the head is rotated toward the affected ear[6,12].

In this study, the effect of modified epley'smaneuverand cawthorne- Cooksey exercise will be compared with brandt-daroff exercise and gaze stability exercise in posterior canal BPPV.

Benign paroxysmal positional Vertigo is by far the most common form of Vertigo encountered in Clinical practice. Most of the patients who suffered from B.P.P.V have constant sense of imbalance and light headedness. This may be due to asymmetric dynamic gain of vestibular reflexes.[1,21,2]

This study looks at the effectiveness of Vestibular and Balance rehabilitation strategies used in B.P.P.V patients after the acute phase.[2,18,21]

In this study one group is clinical based other is HPE, one works on canalithiasis, clearance of otoconia and other is on habituation and group B of head eye movement reflex.[1,3,18]

Both group intervention are proven effective in treatment of posterior canal bppv; though the comparison of both group is not yet done. Most of the study up to date have only compared manneurs. Very few study have included home treatment and office treatment.[1,2]

With the help of this study, the efficacy of second group which is HPE; will be accounted as compared to clinical based programme.

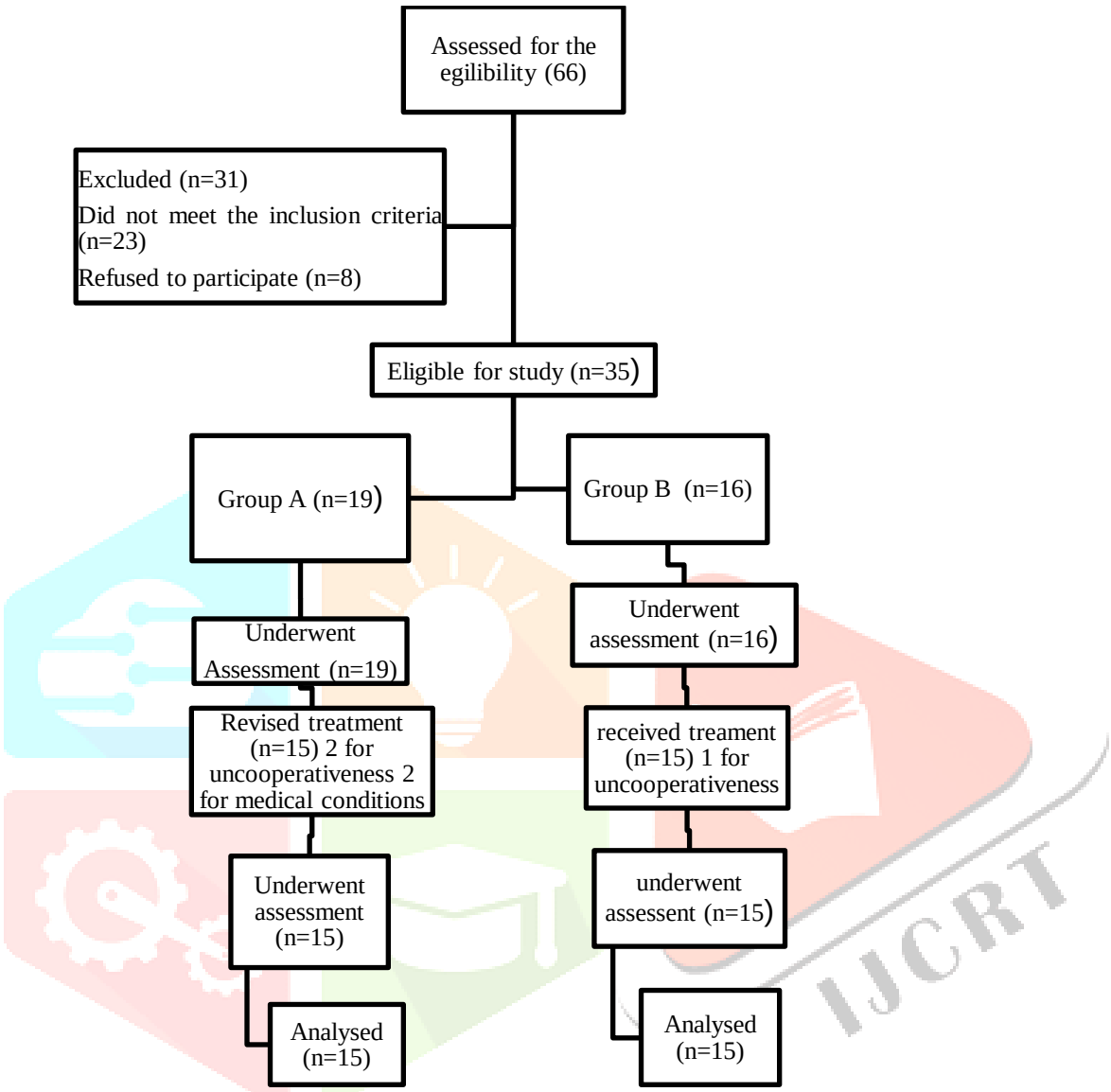
The result of the study will enlighten whether simple, convenient, easy and feasible home programme exercise are as effective as clinical based, and need monitoring – technique, or should be combined tighter and whether the addition of gaze stability exercises improve the home programme exercise efficacy.[18,12,21]

These will be helpful for those patients who can't come regularly to clinical setup and having commuting difficulty.[2,3.]

Methodology

An experimental study was conducted at physiotherapy department of medical college and hospital for the duration of 10months. A total no.of 66 participants suffering from Benign Paroxysmal Positional Vertigo were recruited in study duration. From that 35 patients were eligible for the study those who meet the inclusion criteria. Before being tested, participants were divided into 2 groups (group A and group B) according to a simple randomization sampling. Dizziness Handicap Inventory, Activity- Specific Balance Confidence Scale, Visual Analogue Scale- dizziness were used to assess balance and dizziness. Age group 36-65year old Diagnosed by ENT- posterior canal BPPV with Recurrent episodes of vertigo, No improvement after 2 weeks of medications, Positive Dix-Hallpike Test, Percentage of confidence on ABC scale < 50% were included in the study. Patients with Anterior or Lateral Canal BPPV, CNS Pathology, patients who have undergone any vestibular surgery, patients with age related dizziness and vertigo, Head Injury, Psychiatric conditions (Anxiety, Stress, and Depression), Associated metabolic disorder, Degenerative conditions of cervical spine were excluded from the study.

SAMPLING PROCEDURE



Study Procedure

Ethical clearance and written consent form each concerned patient was taken from concerned hospital and institution. Clinically diagnosed B.P.P.V patients (by using DIX- Hallpike test)was included in the study. Patients was explained about the safety and simplicity of the procedure. Patients were randomisely divided into two groups i.e. group A & group B. Patients in group A received Modified Epley'smaneuver and Cawthorne-Cooksey exercise in clinical setup with medication for 3 session per week (20 minutes per session) for a period of 3 weeks, whereas patients in group B was explained and demonstrated and asked to perform the Brandt-Daroff exercise and Gaze Stability exercise in 1st visit, once the patient understands and can easily perform exercise; the protocol is given as the home program as 3 times per day for 3 weeks with medications. Patients were evaluated before and after the treatment procedures using Activities-specific Balance confidence (ABC) Scale, Visual analog scale (VAS) and Dizziness Handicap Inventory (DHI). In post-test, confidence level of

balance, Visual analog scale (VAS) and Dizziness Handicap Inventory (DHI) after intervention. The subject's telephone number was obtained for follow-up. They were instructed to do their exercises at home. The participants were asked to come to setup twice a week with prior telephonic reminder, there they were asked to perform exercises and verbal feedback was taken for their improvement in symptom's also, the technique was observed and corrected if necessary. During these visits participants were continuously emphasised on doing regular exercise for three times per day for a session of three weeks. They were motivated that they assured of doing exercises regularly. In between these sessions telephonic reminder was sent to participant about doing exercises. After a period of three weeks subjects were called up for follow-up through the telephone and asked to come to the physiotherapy OPD. They were asked to perform the Brandt-Daroff exercise and Gaze Stability exercise; dizziness and balance was assessed, and data was tabulated for further implications.

Clinical diagnosis of BPPV

Clinical diagnosis of BPPV was done by the concerned Physician by using Dix-Hall test. In this test, patient was in sitting upright position with the legs extended. The patient's head will then rotate by approximately 45 degrees. The patient lies down backwards quickly with the head held in approximately 20 degrees of extension. This extension may either be achieved having the clinician supporting the head as it hangs off the table or by placing a pillow under their upper back. The patient's eyes was then observed for about 45 seconds as there is a characteristic 5–10 seconds period of latency prior to the onset of nystagmus. If rotational nystagmus occurs, then the test was considered as positive. If the test is positive latency of onset (usually 5-10 seconds); torsional nystagmus, if no torsional nystagmus occurs but there was up-beating or down-beating nystagmus, a central nervous system dysfunction is indicated; up-beating or down-beating nystagmus, indicates that the vertigo is present in the posterior semicircular canal of the tested side. If the test is negative: it makes benign paroxysmal positional vertigo a less likely diagnosis and central nervous system should be considered. Repositioning manoeuver, "particle repositioning manoeuver" are very effective in treating posterior canal BPPV and can be done for about 15 minutes.

Procedure of Modified Epley's Maneuver

Modified Epley's maneuver is performed by placing the head of the patient in the Dix-hallpike position that evokes vertigo. The posterior canal on the affected side is in the vertical plane when the head in in this position. After the cessation of nystagmus, the head is rolled to 180 degrees (this is done in two 90 degree increments, stopping in each position until the nystagmus resolves) to which the offending ear is up. The patient is then brought up to the upright sitting position. This procedure was likely to be successful when nystagmus of the same direction continues to be elicited in each of the new position

Procedure of Cawthorne-Cooksey Exercise

Patient is made to lie in supine only if patient cannot sit up. Otherwise, patient made in sitting position without arm rest.

A. Eye movements; head immobile; at first slow; then quick

1. Up and down

2. Side to side

3. Repeat (1) and (2), focusing on finger

4. Focusing on finger, moving about 3 feet to 2 inches away and back

B. Head mobile: head movements at first slow, then quick; later with eyes closed

1. Bending forward and backward

2. Turn from side to side

Patient was made in sitting position without arm rests Repeat as in A and B of previous section.

C. Shrug shoulders and rotate.

D. Bend forward and pick up objects from the ground

E. Rotate head and shoulders slowly, then fast; first with eyes open, then close

F. Rotate head, shoulders, and trunk with eyes open, then close Patient is made in standing position Repeat as in A, B, then E

G. Change from a sit to a stand position with eyes open then shut

H. Throw ball from hand to hand (above eye level)

I. Throw ball from hand to hand under knees

J. Change from sitting to standing and turn around in between

K. Repeat Patient was made to walk

L. Walk across the room with eyes open, then closed

M. Walk up and down slope with eyes open, then closed N. Do any games involving stooping or stretching and aiming, such as bowling, shuffleboard, etc.

O. Stand on one foot with eyes open then closed

P. Walk with one foot in front of the other with eyes open then closed.

Procedure of Brandt-Daroff Exercise

Sit on the edge of the bed and turn your head 45 degrees to one side. Quickly lie down on your opposite side (that is, to the left if you turned your head to the right, and vice versa) so that the back of your head behind your ear touches the bed, Hold this position for about 30 seconds or until the dizziness symptoms stop. Return to the sitting position. Repeat on the other side, alternating until you have completed repetitions on each side.

Procedure of Gaze Stabilization Exercises

1. Look straight ahead and focus on an object at eye level in front of you.

2. Move your head from side to side, staying focused on the target letter.

Build up the speed of your head movement. It is crucial that the letter stays in focus. If you get too dizzy, slow down

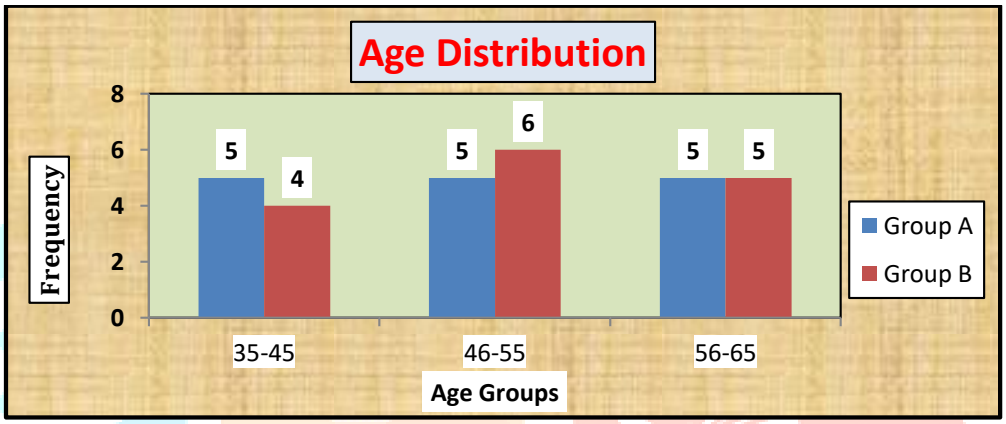
3. Try to continue for up to one minute (the brain needs this time in order to adapt). Build up gradually to repeat three to five times a day)

You can also do this exercise with an up and down (nodding) movement.

TABLES & RESULTS

Table 1: Frequency and percentage wise distribution of subjects according to Age

Sr. No.	Variable	Groups	Group A		Group B	
			Frequency	Percentage	Frequency	Percentage
1	Age	35-45	5	33.33	4	26.67
		46-55	5	33.33	6	40.00
		56-65	5	33.33	5	33.33



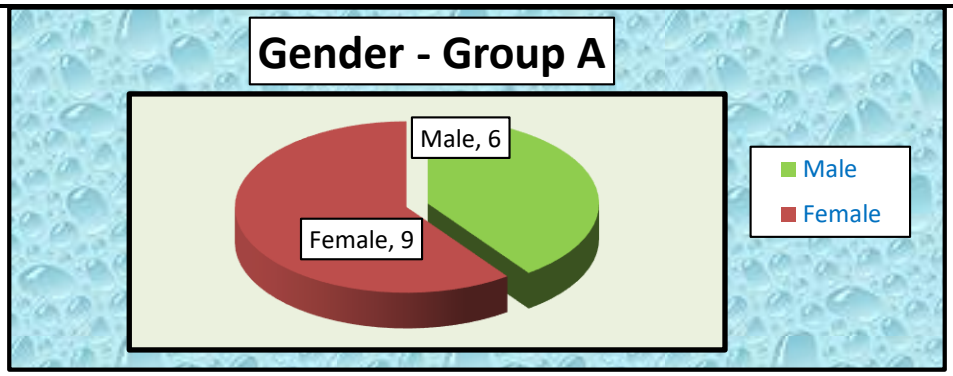
Age	Mean	SD
Group A	49.67	8.75
Group B	50.8	7.96

Above table and following figure depicts that, In case of group A 33.33% were between 36 - 45, 46 -55, 56-65 years of age group respectively. In case of group B 26.67% were between 36- 45 years of age group, 40% between 46 - 55 years, 33.33% belonged to 56-65 years of age groups.

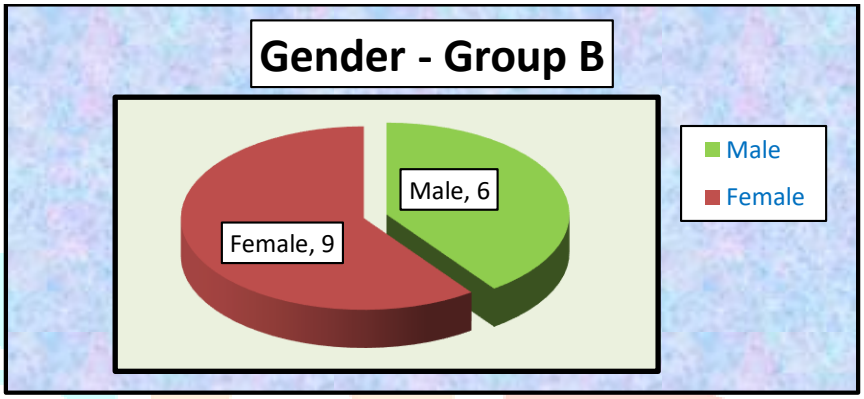
Table 2: Frequency and percentage wise distribution of subjects according to the gender

Sr. No.	Variable	Groups	Group A		Group B	
			Frequency	Percentage	Frequency	Percentage
2	Gender	Male	6	40.00	6	40.00
		Female	9	60.00	9	60.00

Above table and following figure depicts that in case of groupA most of them 60.00% were female and remaining 40.00% were male. In case of group B also most of them 60.00% were female and remaining 40.00% were male.



Graph 2 A: Distribution of subjects according to Gender (Group A)



Graph 2 B: Distribution of subjects according to Gender (Group B)

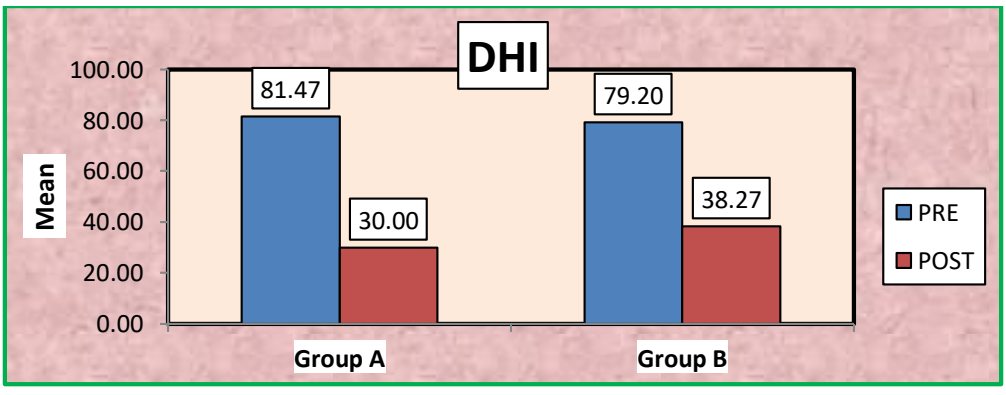
Table 3: Comparison of Pre and post test average with Dizziness Handicap Inventory (DHI)

DHI	PRE	POST
Group A	81.47	30.00
Group B	79.20	38.27

The average pre test score with the Dizziness Handicap Inventory (DHI)

in case of group A group was 81.47 and in case of post test was 30.00

The average pre test score with the Dizziness Handicap Inventory (DHI) in case of group B group was 79.20 and in case of post test was 38.27.



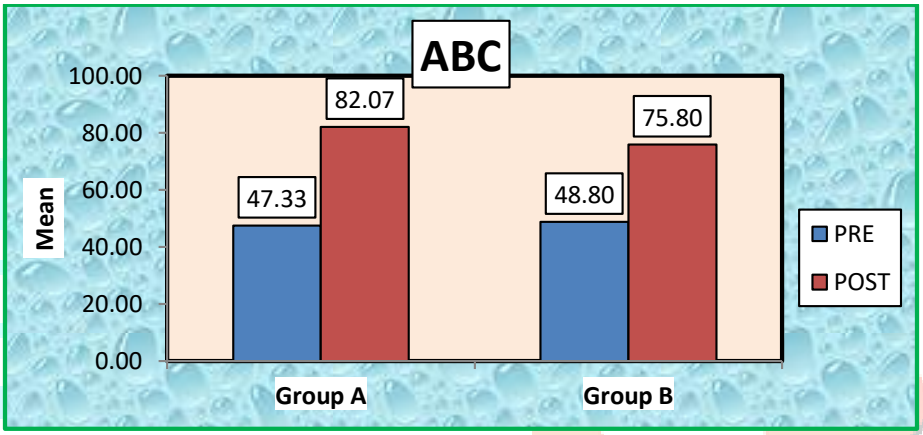
Graph 3: Comparison of Pre test and Post test scores with DHI

Table 4: Comparison of Pre test and Post test with Activity- Specific Balance Confidence (ABC) Scale

ABC	PRE	POST
Group A	47.33	82.07
Group B	48.80	75.80

The average pre test score with the Activity- Specific Balance Confidence (ABC) Scale in case of group A group was 47.33 and in case of post test was 82.07

The average pre test score with the Activity- Specific Balance Confidence (ABC) Scale in case of group B group was 48.80 and in case of post test was 75.80.



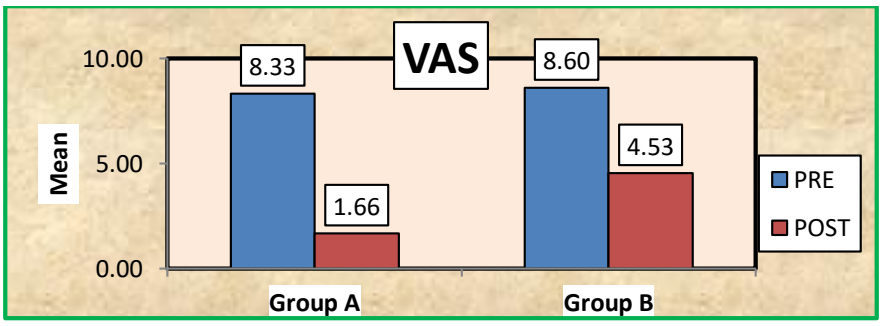
Graph 4: Comparison of Pre test and Post test scores with ABC

Table 5: Comparison of Pre test and Post test with Visual Analog Scale (VAS)

VAS	PRE	POST
Group A	8.33	1.66
Group B	8.60	4.53

The average pre test score with the Visual Analog Scale (VAS) in case of group A group was 8.33 and in case of post test was 1.66

The average pre test score with the Visual Analog Scale (VAS) in case of group B group was 8.60 and in case of post test was 4.53.



Graph 5: Comparison of Pre test and Post test scores with VAS

Table 6: Comparison of Pre test and Post test scores in Group A (Paired 't' test)

DHI	Frequency	Mean	S.D.	Mean Difference	t value	P value
PRE	15	81.47	6.52	51.47	35.73	0.00
POST	15	30.00	2.83			
ABC	Frequency	Mean	S.D.	Mean Difference	t value	P value
PRE	15	47.33	7.71	34.74	10.27	0.00
POST	15	82.07	7.25			
VAS	Frequency	Mean	S.D.	Mean Difference	t value	P value
PRE	15	8.33	0.97	6.67	19.19	0.00
POST	15	1.66	1.04			

In group A, the pre test DHI mean was 87.47 with SD of 6.52 and post test DHI mean was 30.00 with SD of 2.83.

The test statistics value of the paired t test was 35.73 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between pre and post test..i.e. there is significant decrease in post DHI score than pre DHI score.

The pre test ABC mean was 47.33 with SD of 7.71 and post test ABC mean was 82.07 with SD of 7.25.

The test statistics value of the paired t test was 10.27 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between pre and post test. .i.e. there is significant increase in post ABC score than pre ABC score

The pre test VAS mean was 8.33 with SD of 0.97 and post test VAS mean was 1.66 with SD of 1.04.

The test statistics value of the paired t test was 19.19 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between pre and post test. .i.e. there is significant decrease in post VAS score than pre VAS score

Table 7: Comparison of Pre test and Post test scores in Group B (Paired 't' test)

DHI	Frequency	Mean	S.D.	Mean Difference	t value	P value
PRE	15	79.20	5.33	40.93	21.20	0.00
POST	15	38.27	4.27			
ABC	Frequency	Mean	S.D.	Mean Difference	t value	P value
PRE	15	48.80	8.33	27.00	17.19	0.00
POST	15	75.80	5.76			
VAS	Frequency	Mean	S.D.	Mean Difference	t value	P value
PRE	15	8.60	0.98	4.07	10.27	0.00
POST	15	4.53	0.91			

In the Group B, the pre test DHI mean was 79.20 with SD of 5.33 and the post test DHI mean was 38.27 with SD of 5.33.

The test statistics value of the paired t test was 21.20 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between pre and post testaverage.i.e. there is significant decrease in post DHI score than pre DHI score.

The pre test ABC mean was 48.80 with SD of 8.33 and post test ABC mean was 75.80 with SD of 5.76.

The test statistics value of the paired t test was 17.19 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between pre and post test average. i.e. there is significant increase in post ABC score than pre ABC score

The pre test VAS mean was 8.60 with SD of 0.98 and post test VAS mean was 4.53 with SD of 0.91.

The test statistics value of the paired t test was 10.27 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between pre and post test. .i.e. there is significant decrease in post VAS score than pre VAS score

Table 8: Comparison of the post test scores in Group A VS Group B (Unpaired t test)

DHI	Frequency	Mean	S.D.	Mean Difference	t value	P value
Group A	15	30.00	2.83	8.27	6.25	0.00
Group B	15	38.27	4.27			
ABC	Frequency	Mean	S.D.	Mean Difference	t value	P value
Group A	15	82.07	7.25	6.27	2.62	0.01
Group B	15	75.80	5.76			
CVAS	Frequency	Mean	S.D.	Mean Difference	t value	P value
Group A	15	1.67	1.05	2.86	7.98	0.00
Group B	15	4.53	0.91			

In the Group A group, the post test DHI mean was 30.00 with SD of 2.83

In the Group B group, the post test DHI mean was 38.27 with SD of 4.27

The test statistics value of the unpaired t test was 6.25 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between the average scores.

There is significant decrease in DHI score in group A group than group B group.

In the Group A, the post test ABC mean was 82.07 with SD of 7.25

In the Group B group, the post test ABC mean was 75.80 with SD of 7.56

The test statistics value of the unpaired t test was 2.62 with the p value 0.01.

Here, the p value less than 0.05, shows the significant difference between the average scores.

There is significant increase in ABC score in group A group than group B group.

In the group A, the post test VAS mean was 1.67 with SD of 1.05

In the group B, the post test VAS mean was 4.53 with SD of 0.91

The test statistics value of the unpaired t test was 7.98 with the p value 0.00.

Here, the p value less than 0.05, shows the significant difference between the average scores.

There is significant decrease in VAS score in group A group than group B group.

DISCUSSION

This study compared the effects of two different treatment strategies of BPPV. In this 35 participant were eligible in the study. The subjects were divided into two groups (group A & group B). We determined that (Group A) Modified Epley'sManeuver with Cawthorne-Cooksey exercise was more effective as compared with the (Group B) Brandt-Daroff exercise and Gaze Stability exercise. The results showed that, group A (modified epley'smaneuver and cawthorne-Cooksey exercise) could improve the balance confidence and reduce the dizziness while performing daily activities and reduce the symptoms of vertigo. In this study 40% subjects were male and 60% were female so here we also found female predominance as in other studies[2]Benign paroxysmal positional vertigo is a most common disorder of the inner ear vestibular system which is the vital part of maintaining the balance. Benign paroxysmal positional vertigo produces a sensation of spinning called "vertigo" that is both paroxysmal and positional meaning it occurs suddenly and with a change in head position. The technique involves a series of four movements of the head and body from sitting to lying, rolling over and back to sitting The technique can be modified by the addition of a headband which vibrates: putatively to encourage the movement of the particles through the semicircular canals (Li 1995).

The main outcome of this study to assess dizziness is VAS, and DHI ,were VAS score in our study, after treatment is decreased. Similarly Toupet M et al,[22]found that after repositioning manoeuvres there was dramatically decreased in the VAS scores and had a treatment positive effect in BPPV patients.DHI is the inventory develop for use with individual with complaints of dizziness symptoms. In our DHI score is decreased after treatment. According to Pereira AB et al,[53]Epley'sManeuver had a positive and significant effect on emotional, physical and functional dimensions, as measured by the DHI scores before and after therapy. ABC, is a tool developed for used to assess balance confidence and fear and falling. In our study we found there is increase in specific confidence level and physical function. According to Kristine M C Talley et al the ABC has stronger association with physical functioning and may be more appropriate on improving physical function.

The goal of modified epley'smaneuver is to restore equilibrium of the vestibular system more specifically to the semicircular canals to treat the symptoms associated with benign paroxysmal positional vertigo. There is compelling evidence that free floating otoconia, probably displaced from the otolithic membrane in the utricle of the main cause of this equilibrium. The improvement in this study by Cawthorne Cooksey exercises is may be due to loosening up the muscles of the neck and shoulders in order to overcome the protective muscular spasm and tendency to move "in one piece". Here subjects were trained to do independent head and eyes movements which reduced the giddiness[1,24]. This encouraged the restoration of self-confidence and easy spontaneous movement. The possible mechanism behind these exercise was to build a tolerance mechanism in the brain which compensates for the unequal balance of the two ears and particularly helpful for the dizziness[1,] Cawthorne and Cooksey exercises are simple, inexpensive and beneficial form of exercise used to improve balance and vertigo.[3]

Cawthorne-Cooksey are the most common forms of vestibular rehabilitation (VR) exercises. The vestibular rehabilitation (VR) is a form of physical therapy using head and trunk movements and improves balance by developing vestibular system stimulation and central compensation:[28] As showed by Helminski et al.,[28] VR increases the patient's control of the disease process and reduces healthcare cost. VR is an exercise-based group of approaches that began with the aim of maximizing central nervous system compensation for vestibular pathology[29]. These oculomotor exercises are designed to improve balance stability and visual–vestibular interaction.

- The repeated head movement exercises are used to promoting visual stabilization and reducing individual sensitivity.
- The balance training exercise emphasizes the use of the vestibular system inputs by altering visual or proprioceptive sensory inputs.
- The functional activities facilitate the vestibulospinal response, help regain balance and improve physical function through exercises that took place during walking in different environments.[31,32]
- Postural control exercises, falls prevention, relaxation training.[32]

It has already been widely proven that VR programmes like modified epley'smaneuver and Cawthrone- Cooksey exercise have an important role in the treatment of BPPV and could be alternative to medications because they have longer lasting efficacy and are lack of side effects[31] Brandt-Daroff exercises (Brandt 1980) and canalith repositioning manoeuvres (Epley1992;Semont1988) are the main therapies for most patients who seek active treatment for their symptoms. They are purported to act by dispersion of the canal debris from the posterior semicircular canal into the utricle, where it is inactive. These modalities of treatment all have a sequence of head and/ or trunk positioning manoeuvres as a common factor.

In GS (Gaze Stability) and balance exercises, One possible explanation for the reduction in motion sensitivity is that, it included sufficient provocative stimuli to cause habituation of the motion-provoked symptoms[19]. Another possible explanation for the reduction in the motion sensitivity is that the GS intervention led to adaptation of the vestibular system[33,34]. This adaptation would result in resolution of the sensory mismatch among vestibular, visual, and somatosensory inputs. With the loss of the sensory mismatch, which is thought to produce the symptoms of motion sensitivity, there would be no motion-provoked dizziness. It may be that the head movements pose a challenge (sensory mismatch) to the CNS, which then attempts to resolve the challenge. As the CNS learns to compensate for the sensory mismatch, it may also learn strategies for improving visual acuity during head movements. The common factor in the exercises performed by both the GS and habituation groups is the head movement, which may be the enabling factor in the compensation process. A similar result was described by Cohen and Kimball.[22]These investigators demonstrated improvements in measures of ataxia, as well as static and dynamic postural stability, in individuals with unilateral vestibular hypofunction after a rehabilitation program consisting solely of habituation exercises. This explanation, that head movement enables the compensation process, is also supported by the clinical observation that those individuals with a vestibular, who are active and move, tend to improve (decreased symptoms and increased functional levels) without intervention.

The preliminary results of this study indicate that both exercises (Gaze stability and Brandt-Daroff exercises) interventions lead to a reduction in the self-report measure of the impact of symptoms on the ability to function, a decrease in the sensitivity to movements, and an improvement in the ability to see clearly during head movements. Richard A[19] et al suggested that, Gaze stabilization and habituation exercises have previously been shown to decrease symptoms of dizziness and increase function in individuals with vestibular disorders.

Many researchers suggested that Epley'smaneuver (canalith repositioning maneuver) is effective in reducing vertigo and response to the Dix-Hallpike manoeuvre[22-39,40]. Even there are many researches supporting these modifications. Brandt- Daroff exercise demonstrates superior treatment outcomes compared with placebo[41,42]. However, many researchers found Brandt-Daroff exercises to be less effective than Epley'smaneuver in producing complete symptoms resolution [25,26]. Amor Dorado[27] compared Epley treatment versus Brandt-Daroff exercises and found an 80.5%complete symptom resolution[23,24,25], resolution rate in the Epley group versus 25% resolution in the Brandt-

Daroff exercises group after seven days. There was no difference in resolution after one month. Similar in our study we found that modified epley'smaneuver were more effective than Brandth- Daroff exercise and gaze stability exercises. Few researchers[28,29]found that CRP plus a home program does not improve the outcome. Devangi S et al in there study found that combination of modified epley'smaneuver with brandtdaroff exercise to be more effective in reducing symptoms and making patient independent. Tanimoto[30] et al and Chang[31] also found similar results.

Though we found the significant improvement in patients with BPPV after giving modified Epley'smaneuver with Cawthrone- Cooksey exercise, Brandt-Daroff exercises & GS exercises are also found to be effective in reducing the symptoms. Hence Brandt-Daroff& GS exercises can also be given as home exercise program for BPPV patients along with Epley'smaneuver with Cawthrone- Cooksey exercise.

CONCLUSION

The study concluded that the Modified Epley's manoeuver and Cawthorne – Cooksey exercise had statistically significant improvement in balance confidence and reduction in the intensity of dizziness in posterior canal benign paroxysmal positional vertigo participants as compared to Brandt-Daroff exercise and Gaze stability exercise.

LIMITATIONS

- The study has been conducted on small sized sample.
- The study limitations include only posterior canal involvement patients, other canal BPPV was not assessed. Hence limiting the window of application of treatment.
- Quality of life of BPPV patient after treatment in group A and group B was not assessed.

CLINICAL IMPLICATION-SUGGESTION

- A similar study can be carried out with larger sample size.
- A similar study can be conducted by including the BPPV patients with anterior canal and lateral canal involvement.
- A similar study can be carried out by assessing the Quality of life of BPPV Patients.
- We recommend additional research to further investigate current guidelines and close supervision for people with vertigo in this self-management behaviour.

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