

## Original Research Article

# Comparison of effectiveness of Cawthorne Cooksey exercise with Brandt Daroff exercise in managing post Epley's residual dizziness in patients with posterior canal benign paroxysmal positional vertigo

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## ABSTRACT

**Background:** Benign paroxysmal positional vertigo (BPPV) is the most common cause of peripheral vertigo. Vertigo and balance disorders are among the most common symptoms experienced in patients who visit ENT outpatient department. BPPV is a common vestibular disorder leading to significant morbidity and psychosocial impact. Residual dizziness is a common condition that manifests as persistent disabling imbalance after successful repositioning maneuvers for BPPV.

**Methods:** In this study we analysed and compared the effectiveness of Cawthorne Cooksey Exercise with Brandt Daroff Exercise to treat residual dizziness after successful Epley's maneuver for posterior canal benign paroxysmal positional vertigo. A total of 30 subjects with residual dizziness after successful Epley's maneuver for posterior canal BPPV were included in our study, 10 were male and 20 were female. The Group A received the Cawthorne Cooksey exercise post Epley's maneuver and Group B received the Brandt Daroff exercise post Epley's maneuver.

**Results:** We conclude that both the groups have significant improvement in their symptoms and balance. This was indicated by the results. Despite the significant results within the groups, there was no significant difference between the groups, means both exercises showed almost equal improvement in their respective group.

**Conclusions:** This study concludes that both Cawthorne Cooksey exercise and Brandt Daroff exercise are helpful in treating residual dizziness after successful Epley's maneuver in posterior canal BPPV patients. These exercises are safe and able to reduce subjective symptoms and imbalance hence, any of these can be recommended for treating post Epley's residual dizziness in patients with posterior canal BPPV.

**Keywords:** BPPV, Residual dizziness, Dix Hallpike maneuver, Cawthorne Cooksey exercise, Brandt Daroff exercise

## INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is a disorder of the inner ear characterized by repeated episodes of positional vertigo<sup>1</sup>. The term positional vertigo implies to the vertigo that occurs when the head is placed in a certain position i.e., the spinning sensation produced by changes in head position relative to gravity.<sup>1,2</sup> BPPV is the most common disorder of the

peripheral vestibular system.<sup>3,4</sup> It is displaying an incidence of 0.6% per year with variable prevalence<sup>5</sup>. BPPV may involve any semicircular canal, although the posterior canal involvement is most common, because of its relation to the otoliths when the person is in the recumbent position. Posterior canal BPPV constitutes approximately 80 to 90 percent of BPPV cases, while lateral canal BPPV occurs in 10-20% of cases. Anterior canal BPPV is very rare<sup>6</sup>. BPPV is believed to occur via

one of the two mechanisms; Cupulolithiasis theory proposed by Schuknecht who first theorized that fragments of otoconia break away and adhere to the cupula of the semi-circular canals (SCCs) and Canalithiasis theory proposed in 1979, according to which the otoconia float freely in one of the SCCs.<sup>7,8</sup> Both of the theories involve the otoliths becoming dislodged from the utricle and falling into the semicircular canals. BPPV is mainly encountered in older people and peak age is roughly 60. BPPV can occur in children also, but it is rare in children. Most cases of BPPV are idiopathic (35%), in these cases exact etiologic disorder cannot be identified. The most common known causes of BPPV include head trauma and vestibular neuritis. Others cited predisposing factors include Meniere's disease, infections, inner ear ischemia, prolonged bed rest and certain surgical procedures (including stapedectomy and insertion of a cochlear implant).

Symptoms of BPPV include vertigo with change in head position, imbalance, nausea and vomiting. Often the vertigo is accompanied by a nystagmus that reflects the stimulation of posterior canal. Symptoms occur suddenly and last less than one minute, but the subjective impression of attack reported by the patient is frequently longer. Dix MR, Hallpike CS. in 1952, described Hallpike-Dix test which is most common clinical test used to examine and diagnose BPPV.<sup>9</sup> Detailed history combined with bedside Dix-Hallpike test is key in making the diagnosis. Standard electro-oculography and the videonystagmography may be needed to look for the torsional eye movements induced by the Dix Hallpike test. First-line treatment for BPPV is organized around repositioning maneuvers. Epley's canalith repositioning maneuver is adequate treatment in the majority of patients.<sup>10,11</sup> Epley's maneuver is used to move the canaliths out of the canal to the utricle. Although the Epley's maneuver dramatically improves the positional vertigo some patients still complain of residual dizziness.

Residual dizziness is a common experience that manifests as persistent imbalance after successful repositioning maneuvers for BPPV. Residual dizziness may affect the quality of life and prevent carrying out daily activities. Decreasing postural control can contribute to falling and psychological problems. Although many hypotheses have been proposed, the exact origin of this condition is not yet clear. Several medications have been proposed to treat this condition but nothing has yet proved to provide relief.

Surgical treatment of BPPV includes posterior canal plugging and singular nerve section. Surgical procedure is recommended in rare situations when the canalith repositioning procedure doesn't work. Posterior canal plugging may be recommended if the exercises are ineffective in controlling symptoms and symptoms have persisted for longer period. Posterior canal plugging poses a substantial risk to hearing (3-20%), but success

rate is about 85 to 90%.<sup>12</sup> Gacek proposed transection of the posterior ampullary nerve for relief of BPPV. Most of the studies done earlier have compared the effectiveness of maneuvers but in this study, we compared the effectiveness of Cawthorne Cooksey exercise with Brandt Daroff exercise in patients with residual symptoms after successful Epley's maneuver. Our main aim was to assess if these exercises could improve the symptoms in this category of patients.

Cawthorne Cooksey, Brandt Daroff exercises and Gaze stability exercises can be given in vestibular dysfunction and all of them are effective via different mechanism. But this is not well understood, that which exercise is better and more effective for the BPPV patients. There is still some controversy regarding the most effective exercise program for BPPV patients. Cawthorne and Cooksey exercises were introduced in the 1940's by Sir Terence Cawthorne, an otolaryngologist and FS Cooksey a physical therapist and are being used to treat patients with vestibular dysfunction. These exercises include head and trunk movements to stimulate the vestibular system and lead to improved balance and reduced vertigo and dizziness.<sup>13,14</sup> Cawthorne and Cooksey exercises are effective method to improve unwanted symptoms related to vestibular dysfunction. These exercises encourage CNS adaptation and rehabilitation and help in compensation for the unequal balance of two ears.<sup>2</sup> Other exercise treatment approach, proposed by Brandt et al<sup>15</sup> requires the patient to move into provoking position repeatedly several times a day. The patient stays in the position until the vertigo stops and, they have to wait until the vertigo ceases. Brandt-Daroff exercises were designed to habituate the CNS to the provoking position. The peripheral vestibular response has also led to a complete remission of symptoms, sometimes after the first exercise session. In Brandt's exercises moving repeatedly into a side-lying position may aggravate neck and back pain. Brandt-Daroff exercise provokes the symptoms and some patients may not tolerate this approach.

### ***Aims and objectives***

To analyze and compare the effectiveness of Cawthorne Cooksey Exercise with Brandt Daroff Exercise to manage residual dizziness after successful Epley's maneuver for posterior canal benign paroxysmal positional vertigo patients.

### **METHODS**

#### ***Recruitment***

This prospective comparative study was performed between August 2019 and December 2020. Total 30 subjects both male and female with residual dizziness after successful Epley's maneuver for posterior canal BPPV in the age group between 18 and 65 years were recruited for this study through simple random sampling.

The subjects were taken from ENT Department RAMA Medical College Hospital and Research Centre, Hapur, India. Written and informed consent were taken from all the participants included in the study after the procedure was explained to them. The inclusion criteria include patients of both genders between 18 and 65 years of age, positive Dix-Hallpike test, unilateral posterior canal benign paroxysmal positional vertigo and residual dizziness after successful Epley's maneuver. Success was defined by the resolution of positional vertigo and nystagmus. Patients with pregnancy, presence of neck restriction, prior history of ear surgery, negative Dix-Hallpike test, anterior and lateral canal BPPV, other causes of peripheral vertigo, central vertigo and vertigo caused by CNS lesions were excluded from the study.

### ***Instrumentation and outcome measures***

#### ***Dizziness handicap inventory (DHI)***

The dizziness handicap inventory is one of the most commonly used tools to assess dizziness. The dizziness handicap inventory is a 25 item self-report questionnaire that quantifies the impact of dizziness on daily life by measuring self-perceived handicap. The patients required to answer questions sub-grouped into functional, emotional and physical components. Yes response is given 4 points while sometimes response given 2 points and no response given 0 points. There is a maximum score of 100 (36 points for functional, 36 points for emotional and 28 points for physical) and minimum score of zero. Higher the score, greater the perceived handicap due to dizziness.

#### ***Protocol***

Based on the inclusion and exclusion criteria the 30 subjects were included in our study. Demographic data and brief history of BPPV was recorded. 30 subjects were divided into two groups according to simple random sampling. Dix-Hallpike test was performed on all patients of both groups to confirm the side and diagnosis of BPPV. Before starting the intervention, all subjects of groups were made aware about response of exercises. The Group A (15 subjects) received the Cawthorne Cooksey Exercise post Epley's maneuver and Group B (15 subjects) received the Brandt Daroff Exercise post Epley's maneuver. All the subjects of both groups received the exercise for two weeks, repetition of each component of exercises five times per session and three sessions per day. Dizziness handicap inventory was recorded for both the groups at the beginning and two weeks after the intervention. Post intervention data was collected. Pre intervention and post intervention results were analyzed.

#### ***Procedure***

Epley's maneuver- this repositioning maneuver begins with the placement of head into the Dix-Hallpike position

to evoke vertigo and nystagmus. Hold the head in this position for at least 30 seconds or until the positional nystagmus stops. Rotate the patient's head 90 degrees to the opposite direction. Again, hold the head in this position for at least 30 seconds or until the positional nystagmus ceases. Next, roll the patient's head in the same direction that they are facing onto their side with offending ear is up (head facing 135 degrees from supine). The patient is then brought to the upright sitting posture. The maneuver is repeated until no nystagmus is elicited.

#### ***Cawthorne-Cooksey exercise***

Firstly, a series of eye head co-ordination exercises were performed to promote gaze stability during both sitting and standing position. Secondly VOR training with subjects standing combining movements of an image across the retina with head movement. Thirdly upright balance retraining exercises that enhance the use of various sensory cues for gaining postural control and head and trunk movement or with eyes closed during standing and walking. Patients were warned they might feel little discomfort and little increase in their symptoms. Patients were instructed to repeat each component of exercise five times per session and three sessions per day.

#### ***Brandt Daroff exercise***

The patients were instructed to sit on the side of the bed and then positioned to lie on their affected side and stay for 30 sec. The Patients were warned that this will provoke their dizziness, but they have to remain in this position until symptoms subsided. The Patients were then instructed to return to the upright position, stay for 30 sec and then positioned to lie on their unaffected side for 30 sec, then returned to upright position. Patients were instructed to repeat the exercise five times in a session and three sessions per day.

#### ***Ethical aspects***

The study protocol was approved by Institutional Ethics committee.

#### ***Statistical study***

Statistical package for social sciences (SPSS) statistics 22.0 version was used for data analysis. Participant's characteristics were presented as mean, standard deviation. Improvement within the study groups was analyzed using paired t test and the differences between the groups were analyzed using independent t test. The  $p < 0.05$  was considered significant.

## **RESULTS**

Data was analyzed for 30 patient's means 15 in each group. Mean age with SD is depicted in the Table 1.

**Table 1: Age distribution of patients**

Demographic	Group A		Group B	
	Mean	SD	Mean	SD
Age	53.47	8.34	53.67	8.423

**Table 2: Gender profile.**

Variables	Category	Group A (N=15)		Group B (N=15)		Total (N=30)	
		N	%	N	%	N	%
Gender	Female	10	66.67	10	66.67	20	66.67
	Male	05	33.33	05	33.33	10	33.33

**Table 3: Associated symptoms.**

Variables	Category	Group A (N=15)		Group B (N=15)		Total (N=30)	
		N	%	N	%	N	%
Associated Symptoms	Tinnitus	1	6.67	1	6.67	2	6.67
	Nausea and vomiting	6	40	4	26.67	10	33.33
	Nausea, vomiting and tinnitus	0	0	1	6.67	1	3.33

**Table 4: Table 4 Presence of associated systemic diseases.**

Variables	Category	Group A (N=15)		Group B (N=15)		Total (N=30)	
		N	%	N	%	N	%
Systemic Diseases	Hypertension	6	40	7	46.67	13	43.33
	Diabetes	5	33.33	6	40	11	36.67
	CAD and others	2	13.33	2	13.33	4	13.33

**Table 5: Pre and post intervention dizziness handicap inventory score within group A.**

DHI	Group A	
	Mean	SD
Pre intervention	43.07	7.01
Post intervention	38	4.47
T value	2.361	
P value	0.025 considered significant	

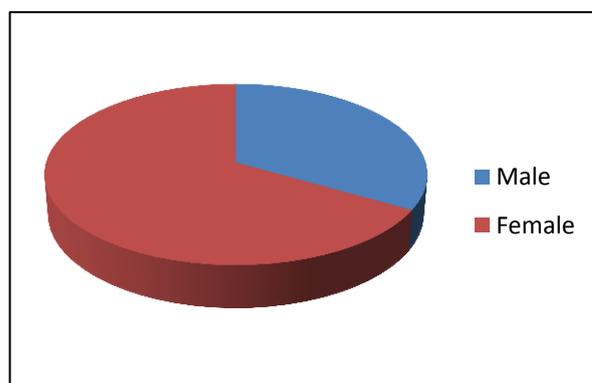
The median age of the participants was 55 years and mean age was 53.47 years with standard deviation of 8.34 years. Table1 compares the age profile of Group A and Group B. The age distributions of patients were comparable between the two groups with no significance in age distribution between the Group A and Group B. (Table 1)

Among all participants, 20 participants (60.67%) were female. Gender ratio was comparable between two group patients with no significant difference (Table 2, Figure1).

Group A and Group B were studied for the associated symptoms. 13 (43.33%) patients had associated symptoms of nausea and vomiting. Table 3 is showing

incidence of the associated symptoms between the two groups. (Table 3)

Hypertension and diabetes were found among 13 (43.33%) and 11(36.67%) participants (Table 4). Table 4 is showing associated systemic diseases between the two groups (Table 4).



**Figure 1: Gender profile.**

The side of BPPV between the Group A and Group B were compared. 33.33% of participants in Group A and

26.67 % of Group B participants had right sided BPPV. Remaining 66.67% of Group A participants and 73.33 % of Group B had left sided BPPV (Figure 2).

**Table 6: Pre and post intervention dizziness handicap Inventory score within group B.**

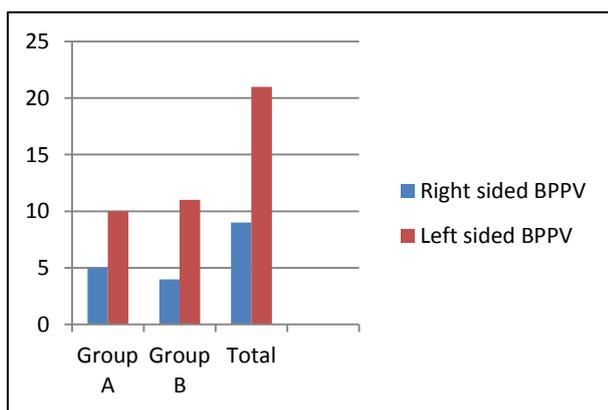
DHI	Group B	
	Mean	SD
Pre intervention	44.67	3.90
Post intervention	39.47	4.81
T value	3.25	
P value	0.003 considered very significant	

**Table 7: Pre intervention dizziness handicap inventory score between group A and group B.**

DHI	Mean	SD
Group A	43.07	7.01
Group B	44.67	3.90
T value	0.773	
P value	0.446 considered not significant	

**Table 8: Post intervention dizziness handicap inventory score between group A and group B.**

DHI	Mean	SD
Group A	38	4.47
Group B	39.47	4.81
T value	0.867	
P value	0.393 considered not significant	



**Figure 2: Side of BPPV among participants.**

Pre intervention and post intervention score of both groups were statistically analyzed. The improvement within the groups was analyzed using paired t test. The differences between Group A and Group B were analyzed using independent t test.

Pre intervention and post intervention dizziness handicap inventory score within group A were depicted in the table 5. There is significant difference between pre intervention and post intervention DHI scores (p value – 0.025). Thus, it can be concluded that a significant improvement has been taken place post intervention within group A. (Table 5)

Pre intervention and post intervention dizziness handicap inventory score within group B were depicted in the table 6. There is significant difference between pre intervention and post intervention DHI scores (p value – 0.003). Thus, it can be concluded that a very significant improvement has been taken place post intervention within group B. (Table 6)

There is no significant difference exist for pre intervention dizziness handicap inventory score between group A and group B (p value-0.446). So, it can be concluded that both the groups carry similar characteristics (Table 7).

Both the groups have significant improvement in their symptoms post intervention. But there is no significant difference exists for post intervention dizziness handicap inventory score between group A and group B (p value-0.393). So, it can be concluded that despite the significant results within the groups, there was no significant difference between the groups (group A and group B), means both interventions showed equal improvement in their respective group (Table 8).

**DISCUSSION**

The purpose of our study was to find out a better exercise therapy in terms of effectiveness for residual dizziness after successful Epley’s maneuver. Both Cawthorne Cooksey exercise and Brandt Daroff exercise improve the functional status of the patient by reducing the symptoms of dizziness.

Our results showed beneficial effect of exercises and significant improvements within the group A (Cawthorne Cooksey exercise post Epley’s maneuver) and group B (Brandt Daroff exercise post Epley’s maneuver). The outcome measures used in our study (DHI) revealed improvements within the groups. Despite the significant results within the groups, there was no significant difference between the groups, means both exercises showed almost equal improvement in their respective group.

In group A, DHI Score showed improvements in all subjects, which proved the effectiveness of Cawthorne Cooksey adaptation exercise. After the intervention all subjects showed improvement. This exercise improved quality of life and symptoms of the patients. This goes in accordance with Hu and Woollacott, who reported improved balance as a result of exercises aiming to optimize the interaction of visual, vestibular and

somatosensory system.<sup>16</sup> The sensory inputs are required for balance. The Cawthorne Cooksey exercises stimulate each of the sensory inputs in a progressively more difficult manner.<sup>17</sup> Cawthorne Cooksey exercises theoretically fatigue the vestibular response and force the central nervous system to compensate. This was in accordance with already stated facts which say that the potential mechanisms of recovery following a vestibular lesion, is by vestibular compensation. This exercise was used with a variety of patients who were having complains of dizziness and disequilibrium and had been shown to be effective. This exercise builds a tolerance mechanism in the brain which compensates the imbalance. The exercise stimulates the development of this tolerance mechanism and vestibular system hence, promotes central compensation while at the same time allowing patients to overcome their fear of activities that may elicit disorientation and to regain both skill and confidence in balance.<sup>18</sup> Central nervous system compensation is facilitated by exercises with visual and somatosensory stimulation. This exercise relies on the plasticity of the CNS, which enables reorganization of the mechanisms sub serving balance and symptomatic vestibular compensation. Vestibular compensation further relies on recalibration of the vestibular reflex, sensory and motor substitution in terms of input and predictive activities. Vestibular compensation has been reported to demonstrate that visual input and motor activity are indeed crucial for synaptic recovery. There was also improvement in subjective response of the patients. Evidences through present study suggest that Cawthorne Cooksey Exercise is safe and effective for residual dizziness after successful Epley's maneuver for patients with posterior canal BPPV. This exercise proved to be beneficial for patients with poor exercise tolerance.

In group B, all subjects demonstrated improvement in DHI Score which means Brandt Daroff exercises gave relief from symptoms after 14 days of intervention. This exercise improved quality of life and symptoms of the patients. This exercise uses gravity to move the debris away from where it is causing problems. Brandt Daroff exercises have been described as home repositioning exercises that involve a sequence of rapid lateral head and trunk tilts repeated serially to promote loosening and ultimately dispersion of debris toward the utricular cavity.<sup>19</sup> Brandt and Daroff reported improvements in BPPV within 2 weeks in 95% of patients who received these exercises, suggesting that this may be an effective intervention for patients with posterior canal involvement. This goes in accordance with the results of our study. The cause for improvement is habituation, which reduces the symptoms of dizziness by repetitive exposure to the specific movement that provokes dizziness. Vestibular habituation retains a useful role in the treatment of BPPV.<sup>19</sup> This Brandt Daroff exercise group B showed improvement in all aspects as group A, but it was relatively unsafe because some patients could not tolerate repeated provocation of symptoms.

Our study has been reported to be significantly efficient in resolving symptoms in both the groups. Results of present study, when compared between groups from pre to post intervention revealed that there was no statistically significant difference between the group A and group B. Similar findings also reported by Szturm et al who made comparison between vestibular adaptation exercises with Cawthorne-Cooksey exercises, which were not customized to the individual patient.<sup>14</sup>

However, our study has some limitations, like small sample size, only posterior canal BPPV patients were included and lack of use of proper nystagmus recording system like videonystagmography. We recommend further studies with larger sample size and customized vestibular rehabilitation exercise protocol.

## CONCLUSION

The study concluded that the Cawthorne Cooksey exercise and Brandt Daroff exercise had statistically significant improvement in residual dizziness after successful Epley's maneuver for posterior canal BPPV. Both exercises are safe, easy to perform and helpful in treating post Epley's residual dizziness. Thus, use of both exercises for patients with residual dizziness after successful Epley's maneuver for posterior canal BPPV can be recommended, and they can be effectively implemented in the peripheral vestibular rehabilitation. Close cooperation and teamwork among otorhinolaryngologists, physiotherapist, neurologist and audiologist are required for the proper management of these patients. Exercises for vestibular rehabilitation have been established to be an effective alternative for managing residual dizziness by relieving symptoms and improving balance.

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