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A Comparative Study to Assess the Effectiveness of Epley's Maneuver Vs Brandt Daroffs Home Exercises for Management of Benign Paroxysmal Positional Vertigo

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Abstract- *Background:* Vertigo is one of the most distressing symptom seen in patients encountered in clinical practice by otolaryngologist and neurologist. It results from dysfunction of vestibular system, among which most common is BBPV(benign paroxysmal positional vertigo). BPPV present with short episodes of vertigo lasting for few seconds, usually precipitated by change in head position. In BPPV, otoconia from utricles are thought to collect in semicircular canal making them abnormally gravity sensitive. BPPV is clinical diagnosis on the basis of typical history and Dix Hallpike testing. Dr. T Brandt and Daroff introduced Brandt daroff home exercises based on cupulolithiasis theory. In 1980, John M Epley introduced canalolith repositioning procedure of Epley in the treatment of BPPV. Because of lack of consensus regarding the optimal treatment maneuver, in our study we have compared the effectiveness of Brandt Daroff and Epleys maneuver.

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A Comparative Study to Assess the Effectiveness of Epley's Maneuver Vs Brandt Daroffs Home Exercises for Management of Benign Paroxysmal Positional Vertigo

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Aim: To compare the effectiveness of Epley's maneuver and Brand-Daroff home exercises for treatment of benign positional paroxysmal vertigo at tertiary care hospital.

Materials and methods: A prospective interventional and comparative study was conducted. A total of 240 patients complaining of giddiness were evaluated in this format out of which 68 patients were diagnosed to have BPPV. Due to Covid-19 pandemic there was loss of follow up to some patients. Remaining 54 patients were enrolled in the study and divided into 2 groups group 1 and group 2 by chit allocation.

Group 1 Received Epley's maneuver and Group 2 Brandt-Daroff home exercises was given. The outcome of 2 groups compared with Dixhallpikes test and DHI (dizziness handicap inventory) questionare.

Conclusion: In the treatment of BPPV, Brandt-Daroff vestibular exercises are as effective as Epley canalolith repositioning maneuvers with a similar mean Dizziness Handicap Inventory (DHI) Score between the groups. Hence, according to patient's circumstances both treatments may be utilized.

Keywords: dix hallpike test, brandt daroff home exercise, epleys maneuver, DHI (dizziness handicap inventory) questionnaire.

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I. Introduction

Vertigo is one of the most distressing symptom seen in patients encountered in clinical practice by both otolaryngologist and neurologist alike (1).

Vertigo is defined as an illusion of either oneself or the environment rotating. It indicates involvement of angular motion sensing system, that is semicircular canals and their central projection.(2)

It mostly results from dysfunction in vestibular system such as is Benign paroxysmal positional vertigo (BPPV), vestibular neuritis, Meniere's disease, labyrinthitis, superior canal dehiscence syndrome, vestibular migraine. Among which most common is Benign paroxysmal positional vertigo (BPPV). (2)

Dix and Hallpikes (1952) coined the term Benign paroxysmal positional vertigo (BPPV) in view of associated benign origin and momentary (paroxysmal) burst of intense vertigo upon head movements (positional). (2)

BPPV presents with short episodes of vertigo lasting for a few seconds, usually precipitated by change in head positions with respect to gravity and associated with nausea, vomiting and nystagmus.(3)

It accounts for about 17 % to 20% of all vertigo cases. (3–5) The prevalence of disease is 11 -64 / 10000.(5) The mean age of incidence is fourth and fifth decades, however cases have also been reported in children.(6)

Unlike the other causes of giddiness BPPV and cervical spondylitis shows more inclination towards female population. (7,8)

In vestibular system among 3 semicircular canal the most commonly affected canal is the posterior semicircular canal (60-90%), followed by horizontal canal (5-30%) and rarely anterior canal. (3,9,10)

The propensity for accumulation of particles in posterior semicircular canal is postulated to be related to anatomical factors such as size of common crus, its position below the utricle when supine and its dependent position when both erect and supine. (2)

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Otoconia are calcium carbonate crystals embedded in macula of utricle and saccule. they have a greater density than surrounding endolymph thus making the macula sensitive to changes in angular acceleration. (2)

In BPPV otoconia from the utricle are thought to collect in semicircular canal, making them abnormally gravity sensitive, this results in abnormal displacement of cupula and stimulation of corresponding vestibular afferents. which cause abnormal eye movements and vertigo.

BPPV is a clinical diagnosis as it lacks any objective test till date. BPPV is diagnosed with clinical history and Dix Hallpikes test. Further Dix Hallpikes test helps in determining the primarily affected canal, as the direction of nystagmus determines the affected canal. Determination of affected canal is the most important facet in the treatment of BPPV. Recent literature by Brandt, Daroff, Epley, Norre, Beckers, and McCabe have proposed several other maneuvers based on cupulolithiasis and canalolithiasis theories for BPPV treatment (11–13).

Dr T. Brandt and R.B. Daroff introduced Brandt Daroff home exercises based on the cupulolithiasis theory of BPPV in 1980. The goal of these exercises was to loosen and disperse otoconia from the cupula of posterior semicircular canal. Brandt Daroff exercises were originally designed to habituate the CNS to the provoking positions, but they may act by dislodging debris from the cupula or by causing debris to move out of the canal. Presently, canalolith repositioning procedure of Epley is the most widely used maneuver for the treatment of posterior canal BPPV, which was developed by John. M. Epley and was first described in 1980. This aims to transport otoconia out of the canal towards the utricle with instant symptom resolution. (14)
Although there are many studies on efficacy of Epley's maneuver in the treatment of BPPV but little attention has been given to possible role of Brandt Darrof home exercises and there is lack of consensus regarding the optimal treatment maneuver.

In this study we have compared the effectiveness of Epley's maneuver and Brandt-Daroff home exercises for treatment of benign paroxysmal positional vertigo.

II. Aim

To compare the effectiveness of Epley's maneuver and Brandt-Daroff home exercises for treatment of benign positional paroxysmal vertigo (BPPV) at tertiary care hospital.

III. Materials and Methods

a) Study Design

This was a prospective interventional and comparative study of 240 patients who had complaint of giddiness, which was conducted in Department of Otorhinolaryngology in Grant Government Medical college and Sir JJ Hospital, Mumbai, India between February 2020 and November 2021. After receiving Institutional Ethical committee Clearance and informed written consents, Patients with symptoms suggestive of giddiness were screened and subjected to detailed clinical history (presentation of vertigo, predisposing factors, duration, recurrence of vertigo, accompanying hearing loss, tinnitus, sense of ear fullness, and sound intolerance). Patients were also questioned about neurologic symptoms, for example, headache, facial paralysis, change in mental status, slurred speech, loss of power, and syncope. All the patients were scored based on Dizziness Handicap Inventory scale (DHI)(15). Further these patients underwent a thorough physical examination which included general otolaryngological, neurological examination, and Dixhallpikes maneuver.

A total of 240 patients complaining of giddiness were evaluated in this format out of which 68 patients were diagnosed to have BPPV. Due to Covid-19 pandemic there was loss of follow up to some patients. Remaining 54 patients were enrolled in the study.

b) Inclusion Criteria

- Patient who are willing to participate after receiving their written consent.
- Patients of age more than 18 years with either gender attending ENT Out-patient Department.
- Patients whose medical history suggests Benign Positional Paroxysmal Vertigo (BPPV)

c) Exclusion Criteria

- Patients who are less than 18 years of age.
- Middle ear infections, cases with otorrhea, chronic otitis media and inner ear infections
- Patients with life threatening conditions like Myocardial Infarction, unstable Cardiac diseases, uncontrolled HTN, high grade carotid stenosis, severe rheumatoid arthritis.
- Patients with cervical spine dysfunction
- Recent neck trauma/orthopaedic disorder that impairs functional neck and trunk range motion.
- Pregnant women beyond 24 week gestation
- Patients with positive cerebellar signs
- Patient who are not willing to participate and have given negative consent

Further these patients were randomly divided into 2 groups based on chit allocation technique.

Patients in group 1 were subjected to Epley's maneuver and Patients in group 2 received Brandt Darrof home exercises as modality of treatment.

Vestibular suppressant medications if any were withheld 7 days prior to start of these maneuvers.

Proper instructions such as purpose safety measures, comfort, precautions and psychological

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support were given to the subjects. Both group 1 and 2 were involved for pre- test assessment.

All patients in group 1 and group 2 were followed up at 1week, 4weeks and 3rd month. On each follow up day patients were subjected to a similar DHI (Dizziness Handicap Inventory) questionnaire and Dix Hallpike testing.

d) Data Analysis

All the collected data was entered in Microsoft Excel sheet. It was then transferred to SPSS ver. 20 software for statistical analysis. Quantitative data was presented as mean and standard deviation and comparison of the two study groups was done using unpaired t-Test. Pre-test and post –test quantitative data of each method was compared using paired t-Test. Qualitative data was presented as frequency and percentage and analysed using chi-square test.

IV. Observations and Results

In our study a total of 54 patients of BPPV were assessed over a total study duration of 21 months. These 54 patients were then randomly divided into 2 groups of 27 each.

Group 1: Received Epley's maneuver

Group 2: Brandt- Darrof home exercises was given.

a) Demographic distribution

Age wise distribution

Majority of the patients (36%) in Group 1belonged to 5th decade with maximum age 77 years and minimum age being 19 years. The mean age of the patients in group 1 was 41.76 years.Majority of the patients (48%) in Group 2 also belonged to 5th decade with and minimum age being 19 years and maximum age 75 years. (Table 1)

The mean age of the patients was 41.48 years. On comparing the 2 groups based on mean age distribution, there was no significant difference between the 2 groups as per Student t-test (p>0.05). and hence they were comparable.

Table 1: Distribution of patients according to Age

Age (years)	Group 1		Group 2		p Value
	N	%	N	%	
18-20 years	1	4%	3	12%	>0.05
21-30 years	4	16%	2	8%	
31-40 years	7	28%	4	16%	
41-50 years	9	36%	12	48%	
51-60 years	1	4%	2	8%	
61-70 years	2	8%	1	4%	
71-80 years	1	4%	1	4%	
Total	25	100%	25	100%	
Mean ± SD	41.76 ± 14.25		41.48 ± 13.67		

Group 1 constituted of 8 males (32%) and 17 females (68%) patients, whereas Group 2 had 6 males (24%) and 19 females (76%) patients. On comparing the male: female proportions in the two groups, there was no statistically significant difference as per Chi Square test. (Table 2)

Table 2: Distribution of patients according to Sex

Sex	Group 1		Group 2		p Value
	N	%	N	%	
Male	8	32%	6	24%	>0.05
Female	17	68%	19	76%	
Total	25	100%	25	100%	

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b) *Distribution of patients according to Comorbidities*

6 (24%) patients in Group 1 had diabetes mellitus while 5 (20%) and 3 (12%) patients had hypertension and ischemic heart disease respectively.7 (28%) patients in Group 2 had diabetes mellitus while 4 (16%) and 2 (8%) patients had hypertension and ischemic heart disease respectively. There was no significant difference between the groups as per Chi-Square test ($p>0.05$).(Table 3)

Table 3: Distribution of patients according to Comorbidities

Comorbidities	Group 1		Group 2		p Value
	N	%	N	%	
Diabetes Mellitus	6	24%	7	28%	>0.05
Controlled Hypertension	5	20%	4	16%	
Ischemic Heart Disease	3	12%	2	8%	

c) *Distribution of patients according to associated Symptoms*

20 (80%) patients in Group 1 had tinnitus while 7 (28%) and 5 (20%) patients had otalgia and impaired hearing respectively. 21 (88%) patients in Group 2 had tinnitus while 8 (32%) and 2 (8%) patients had otalgia and impaired hearing respectively. There was no significant difference between the groups as per Chi-Square test ($p>0.05$). Hence they were comparable. (Table 4)

Table 4: Distribution of patients according to symptoms

Symptoms	Group 1		Group 2		p Value
	N	%	N	%	
Tinnitus	20	80%	21	88%	>0.05
Otalgia	7	28%	8	32%	
Impaired hearing	5	20%	2	8%	

d) *Comparison of Dix Hallpikes Test between 2 groups during follow-up*

During 1st week follow-up, 10 (40%) of Group 1 had positive Dix-Hallpike Test which reduced to 3 (12%) patients during 4th week and 3rd month follow-up. There was significant improvement in patients of Group 1 during follow-up period as per ANOVA test ($p<0.05$). During 1st week follow-up, 13 (52%) of Group 2 had positive Dix-Hallpike Test which reduced to 5 (20%) patients during 4th week follow-up. 2 had negative Dix-Hallpike Test in 3rd month follow-up. There was significant improvement in patients of Group 2 during follow-up period as per ANOVA test ($p<0.05$). However, there was no significant difference between the groups as per ANOVA test ($p>0.05$). (Table 5)

Table 5: Comparison of Dix Hallpikes Test between groups during follow-up

Dix Hallpikes Test		Group 1		Group 2		p Value
		N	%	N	%	
1st Week	Positive	10	40%	13	52%	>0.05
	Negative	15	60%	12	48%	
	Total	25	100%	25	100%	
4th Week	Positive	3	12%	5	20%	>0.05
	Negative	22	88%	20	80%	
	Total	25	100%	25	100%	

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3rd Month	Positive	3	12%	0	-	>0.05
	Negative	22	88%	25	100%	
	Total	25	100%	25	100%	
p value		<0.05		<0.05		

e) *Comparison of Dizziness Handicap Inventory (DHI) Score between groups*

The mean Dizziness Handicap Inventory (DHI) Score of Group 1and Group 2 was 34.32±12.12 and 35.28±13.72 respectively. The difference between the groups was statistically not significant as per Student t-test (p>0.05). Hence they were comparable. (Table 6)

Table 6: Comparison of DHI Score between groups

	Group 1		Group 2		p value
	Mean	SD	Mean	SD	
DHI Score (Day 0)	60	12.70	58.92	12.2	>0.05
DHI Score (1st week)	54.2	13.7	54.88	14.47	>0.05
DHI Score (4th week)	42.72	14.9	43.04	15.89	>0.05
DHI Score (3rd month)	34.32	12.12	35.28	13.72	>0.05

V. Discussion

The aim of the study is to compare Epley's and Brandt Daroff home exercise in the treatment of BPPV. We divided the patients into two groups of 27 each based on chit allocation technique. The success was measured in terms of recovery from vertigo which was confirmed by Dix Hallpike test and DHI score on each follow-up.

In our study of 240 patients, 54 patients were diagnosed to have BPPV on the basis of clinical history, physical examination and Dix Hallpikes maneuver which accounted for 22.5% as Indian population has nutritional deficiency leads to osteopenia which causes dislodgement of otoconia from utricle. Similar results were seen by Bhattacharyya N et al, Froehling DA et al.(4,5)

The mean age group of patients were 41.48± 13.67 years. There was no significant difference between two groups as per student t- test. This is comparable with the study of Gaur S et al.(6)

In our study, Group 1 constituted of 8 male (32%) and 17 female (68%) patients. Whereas Group 2 had 6 male (24%) and 19 female (76%) patients. There was no statistically significant difference between the groups as per Chi-Square test (p>0.05), female: male ratio-2.5:1. This is similar to the studies of Bhattacharyya N et al(4)and Bronstein AM et al(16). They observed females are approximately 2 times more likely to experience BPPV than males as the present study showed majority of the cases were predominantly females in both the groups. This can also be related due to endocrinal and degenerative changes causing otoconial debris, which float freely and find their way into the semicircular canals, causing BPPV.

It was observed in the present study that 6 (24%) patients in Group 1 had diabetes mellitus while 5 (20%) and 3 (12%) patients had hypertension and ischemic heart disease respectively. 7 (28%) patients in Group 2 had diabetes mellitus while 4 (16%) and 2 (8%) patients had hypertension and ischemic heart disease respectively. There was no significant difference between the groups as per Chi-Square test (p>0.05).

Similarly no statistically significant association was observed by Saxena A et al (17) in each comorbid illness i.e. hypertension, diabetes mellitus, ischemic heart disease and cerebrovascular stroke (cardiovascular diseases) with either group (BPPV vs. non-BPPV)

It was observed in our study that 20 (80%) patients in Group 1 had intermittent non-pulsatile tinnitus while 7 (28%) and 5 (20%) patients had otalgia and impaired hearing respectively. 21 (88%) patients in Group 2 had intermittent non-pulsatile tinnitus while 8 (32%) and 2 (8%) patients had otalgia and impaired hearing respectively. There was no significant difference between the groups as per Chi-Square test (p>0.05). This is comparable to the studies of Saxena A et al(17) which stated that the association of intermittent non-pulsatile tinnitus with the BPPV group was found to be statistically significant but impaired hearing, otalgia and ear discharge were not significantly associated with either group i.e. BPPV vs. non-BPPV.

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In our study, according to Dix-Hallpike Test during 1st week follow-up, recuperation rate was 60% in Group 1 which increased to 88% in 4th week. And in and 3rd month follow-up recovery rate was 100% in group 1. This was found to be significant as per ANOVA test ($p<0.05$). Similarly, in Group 2 recuperation rate was 48%, 80% and 100% in 1st week, 4th week and 3rd month respectively. when compared between recuperation rate of both groups there was no statistically significant difference on each follow up. Success rates between 80 and 100% have been reported for reposition maneuvers in BPPV. (18)These observations were similar as noted in the studies of Saxena A et al(17), Cohen HS et al(19), Mani P et al(20), Mohamad Hanapi NH et al(21), Choi SY et al(22) and Pavithralochani V et al(23).

The mean dizziness Handicap Inventory (DHI) score of Group-1 at day 0 was 60 ± 12.70 and at the end of 1st week, 4th week and 3rd month was 54.2 ± 13.7, 42.72± 14.9 and 34.32±12.12 respectively. For Group- 2, DHI Score at day 0 was 58.92± 12. 2 and at the end of 1st week, 4th week and 3rd month was 54.88 ± 14.47, 43.04± 15.89 and 35.28± 13.72 respectively. This was found to be statistically non-significant as per Student t- test (p-value >0.05) and hence they are were comparable. Similar observations were noted in the studies of Saxena A et al (17), and Cohen HS et al(19).

VI. Conclusion

- In our study we found female preponderance in BPPV, this could be attributed to endocrinal changes and nutritional deficiency in females.
- In the treatment of BPPV, Brandt-Daroff vestibular exercises are as effective as Epleycanalolith repositioning maneuvers with a similar mean Dizziness Handicap Inventory (DHI) Score between the groups. Hence, according to patient's circumstances both treatments may be utilized. In this Covid era patients hesitate to visit OPD for follow up, Hence Brandt Darrof home exercises can also be used as a modality of treatment with equal efficacy and more effective to build up confidence of patients.

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