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Effectiveness of Ganz Repositioning Maneuver (GRM) Compared with Epley's Repositioning Maneuver (ERM) in the Management of Posterior Canal-Benign Paroxysmal Positional Vertigo (PC-BPPV): Implications for quality of life, daily functioning and psychosocial Well-being

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Abstract:
Background: Vertigo, with a prevalence of 5–10 %, is a common complaint of patients presenting to otolaryngology and neurology departments. Benign paroxysmal positional vertigo (BPPV), coined by Barany in 1921, is the most common cause of true vertigo. The condition is described as brief episodes of intense vertigo, provoked by changing position of head/neck, and typically accompanied by nystagmus with the superior pole of the eyes beating toward the affected ear. Causative factor is the displacement of Otoconia from the utricle to these semicircular canal. BPPV may be associated with a reduced quality of life, falls and depression. Different Maneuvers are reported in literature for treatment of BPPV. Treatment can be performed in clinic with a good outcome, making it the most rewarding vestibular condition to manage.
Objective: This study was designed to compare between the effectiveness of Gans Repositioning Maneuver and Epley's Repositioning Maneuver in improving postural stability in patients of Posterior Canal-BPPV.
Method: A total of 140 patients were enrolled in this study where 70 were recruited into Group-A who were treated with Gans Repositioning Maneuver and the 70 in Group-B ,treated with Epley's Maneuver , for Posterior Canal-BPPV. All the patients were examined and treated at ENT department KEMU/Mayo Hospital Lahore between January 2021 to October 2021. Patients who were clinically positive on Dix-Hallpike test, having unilateral canal involvement and aged between 18 years to 65 years were included and those with bilateral canal involvement, past ear surgery and severe neck or back restrictions for movement were excluded from our study.
Every patient received one treatment maneuver per appointment once a week. Maneuver was repeated each week until resolution of symptoms of vertigo and nystagmus. No post-maneuver restrictions were taken into account for any patient. Participants provided a subjective report of intensity of their vertigo using a visual analog scale (VAS) from 0 to 10. A rating of 0 indicated no subjective vertigo and a rating of 10 indicated the greatest magnitude of vertigo. After every session, each participant was assessed with this scale to quantify the level of improvement. Once the patient became vertigo free, follow up for the incidence of recurrence at 1, 3 and 6 months' period of time from final successful treatment was done. Success was defined by the absence of nystagmus and positional vertigo during Dix-Hallpike test.
Result: Out of total 140 patients , 91 (65%) patients were female and 49 (35%) were of male gender. Posterior canal BPPV was found to be more common in patients above 40 years of age, with 89 (63.6%) patients were over 40 years of age and 51 (36.4%) were below 40 years of age. Nausea was reported to be among 27.1 % (19 patients) in group-A and it was 38.5% (27 patients) in Group-B. Similarly; Vertigo was reported to be among 52.8 % (74 patients) in group-A and it was 47.14% (66 patients) in Group-B. The recurrence rate for group-A turned out to be 8.5% (6 patients) and for Group-B it came 20% (14 patients) at 6 month follow up from last successful maneuver. Group-A patients were successfully treated with success rate of 91.4% (64 patients), while the success rate of Group-B patients came out to be 80% (56 patients).
Conclusion: We concluded with the results of our study that Gans repositioning maneuver (GRM) is a safe and more effective particle repositioning maneuver for the treatment of vertigo in patients with posterior SCC-BPPV than Epley's Repositioning Maneuver (ERM), having less recurrences and less complications.

Keywords: Benign Paroxysmal Positional Vertigo, Gans repositioning maneuver (GRM), Epley's Repositioning Maneuver (ERM).

Introduction:

Vertigo, with a prevalence of 5–10 %, is a common complaint of patients presenting to otolaryngology and neurology departments. Benign paroxysmal positional vertigo (BPPV), coined by Barany in 1921, is the most common cause of true vertigo(1).The condition is described as brief episodes of intense vertigo, provoked by changing position of head/neck, and typically accompanied by up-beating, torsional nystagmus with the superior pole of the eyes beating toward the affected ear.
Causative factor is the displacement of otoconia from the utricle to the semicircular canal and irritation of its cupula. Approximately 90 % of BPPV cases involve the posterior semicircular canal(1-3).Head trauma is the most common cause of BPPV in people 50 years of age (4). With advancing age,BPPV becomes much more common and in older people, it is the degeneration of the vestibular system, which is the most common cause(5).
Pharmacological treatments only give temporary control with high recurrence rates(6).Non-pharmacological options are vestibular rehabilitation maneuvers, such as Semont and Epley maneuvers, which have been developed for treating the BPPV with a high rate of success(7).The goal of these maneuvers is to move the displaced otoconial debris around the long arm of the posterior semicircular canal, through the common crus, and back into the utricle using gravity and alleviating the symptoms of the patient. These maneuvers are claimed to be successful in approximately 80 % of cases(7).
The Semont liberatory maneuver (SLM) needs enbloc movement of the patient, involving a series of briskly performed position changes (7)which is contraindicated for patients with orthopedic issues, such as recent hip replacements or hip fractures . While Epley maneuver requires the rolling movement of the head, neck, and also the body of the patient(8) ,which is again harmful in patients having limitation in cervical movement because of different orthopedic injuries and vertebrobasilar or carotid insufficiency. Therefore, despite a good success rate, safety is a big concern and question in both of these maneuvers. Sakata et al. stated that the Epley or Semont maneuvers should never be performed in the elderly patients(9).
For this reason, searching for a safer maneuver for treating PC-BPPV has been demanded. One of the safe hybrid treatments called the Gans-repositioning maneuver (GRM) is thought to be equally effective or even superior to the previously introduced repositioning maneuvers .The Gans repositioning maneuver (GRM) is a relatively new treatment maneuver for BPPV. It is a hybrid of the Semont and Epley. It may give preference for use in patients commonly presenting with BPPV, and also particularly with comorbid factors (such as vertebrobasilar insufficiency, cervical spondylosis, or limited range of motion of the hip or back) that contraindicate the use of already established maneuvers.Gans et al. stated the recurrence rate after Epleys as 10-30% and after Gans maneuver as 5% only (2, 3). The GRM incorporates the side-lying maneuver, as its first position the second position is a roll from the involved side to the uninvolved side. Aliberatory headshake is then performed. Finally, the patient is returned to an upright, seated position (10, 11).
The rationale /aim of this study was to compare the effect of Gans repositioning maneuver with Epleys repositioning maneuver in resolving the episodic vertigo with improvement in postural stability with better outcome, lesser complications and lesser recurrence rates in patients with PC-BPPV. In Pakistan, rare comparative studies dealt with the effect of GRM versus different repositioning maneuvers on postural stability, yet no data available and published showing efficacy of GRM. The results of my study were to help the doctors and patients with better post-maneuver outcome.

Material and Methods

Study Design: Randomized Clinical Trial
Study Setting: Department of ENT, Mayo Hospital, KEMU, Lahore.
Duration of Study: 12 months after approval of synopsis.
Sample Size: Sample size of 140 patients, with 70 patients in each group, is estimated by using 5% level of significance, 90% power of test with expected percentage of objective response of Epleys as 70% and Gans as 46.7% in one-week duration for improvement of vertigo. (2)

$$n=\frac{\{Z1-\alpha\sqrt{2\bar{P}(1-\bar{P})}+Z1-\beta\sqrt{P1(1-P1)+P2(1-P2)}\}^2}{(P1-P2)^2}$$

Where,
Z1 –α = confidence level 95% = 1.96
Z1 –β = Power of test 90%
P1 = Population mean I = 70%
P2 = Population mean II = 46.7%

Sampling Technique: Non-Probability, Purposive sampling
Sample Selection:
Inclusion Criteria:
1-Patiets with clinically positive on Dix-Hallpike test during vestibular evaluation for PC-BPPV.
2- Patients having unilateral involvement of posterior semicircular canal.
3-Patients above 18 years of age and below 65 year of age.
4-Patients having true spells of vertigo for less than 1 min that revealed by the change of position of head and neck with up-beating rotary nystagmus toward the affected ear which had a short duration less than 45 s.
5-Patients who have the ability of to follow verbal instructions.

Exclusion Criteria :

1-Patients who have anterior or horizontal semicircular canal involvement.
2-Those who had previous surgery in the involved ear, or diseases affecting vestibular function rather than BPPV (vestibular neuritis, labyrinthitis, Meniere's disease, or central lesion in the dorsal medulla).
3-Patients having severe systemic disorders that not allows them to cooperate in maneuvers, consumption of tranquilizers or anti-vertigo medications recently or during 1 week of follow-up, and not referring again for follow-up are excluded.
4-Patients with obesity (weight >100kg) ,owing to the limitations of neck and body movement.
5-Patients with severe restrictions of neck or back movement.
6-Patients with recent hip replacement surgery.
7-Patients with clinical suspicion of cervical radiculopathy or myelopathy to avoid precipitating neurological deficits.
8-Patients using vestibular suppressants or anti-histamines as it would obscure the findings of maneuver.

Data Collection Procedure

Study was started after approval from Board of studies & IRB committee,KEMU. Total 140 patients were recruited and 70 were in each group.After fulfilling the inclusion criteria, the patients were recruited into two groups by conveniently odd (Group A as Gans Group) and even number (Group B as Epleys Group). Informed written consent was taken from all the patients.

All patients were examined by the same otolaryngologist. The Dix-Hallpike test was applied at the beginning of each appointment before the maneuver was applied. The duration of nystagmus was recorded to the nearest second by a stop watch. Each patient received the specific treatment maneuver according to the group he or she allocated.

Regardless of the group, every patient received one treatment maneuver per appointment once a week. Maneuver was repeated each week until resolution of symptoms of vertigo and nystagmus. No post-maneuver restrictions were taken into account for any patient.

Participants provided a subjective report of intensity of their vertigo using a visual analog scale (VAS) from 0 to 10. A rating of 0 were indicate no subjective vertigo and a rating of 10 indicated the greatest magnitude of vertigo. After every session, each participant assessed with this scale to quantify the level of improvement.

Once the patient wasvertigo free, he or she was assessed for the incidence of recurrence at 1, 3 and 6 months period of time from final successful treatment. Success was defined by the absence of nystagmus and positional vertigo during Dix-Hallpike test.

Data Analysis Procedure

Data was entered in SPSS-26. Quantitative variables like age was presented on mean ± SD. Qualitative Variables like gender, age, symptoms, recurrence of symptoms and response ratewere presented as frequency and percentage.Comparison of two groups score i.e. Group A (GRM) & Group B (ERM) were done by applying CHI-SQUARE TEST. P value ≤ 0.05 was taken as significant.

Results:

- Mean age of patients in this study was 41.05± 12.23 years in which 51 (36.4%) were 18-39 years and 89 (63.6%) were of 40-65 years of ageTable-1
- Among patients 49 (35%) were male and 91 (65%) were female patients Table-2
- Among 49 (35%) males, 24(24.5%) were in Group A treated by Gans repositioning maneuver (GRM) while 25 (25.5%) were in Group B treated by Epley' Maneuver. Similarly; among 91 (65%) female, 46 (25.3%) were in Group A while 45 (24.7%) were in Group B. Table-3
- Among 140 patients in each group, 74 (52.8%) in Group A and 66 (47.14%) in Group B suffered with Vertigo as major symptom. Additionally; 46 patients of each group suffered with nausea in which 19 (27.1%) belong to Group A while 27 (38.5%) belonged to Group B. Table-4
- Among 140 patients; 27 (38.3%) suffered with right sided ear PC-BPPV in which 13 (36.7%) patients of GRM group and 14 (41%)patients of ERM group. Similarly; 28 (42.2%) suffered with Left sided ear PC-BPPV in which 16 (50%) patients of GRM group and 12 (34.3%)patients of ERM group. Additionally; 16 (27.55%) suffered with bilateral PC-BPPV in which 6 (14%) patients of GRM group and 10 (27.1%) patients of ERM group. However; the results were statistically insignificant of having association with any ear with p-value = 0.324. Table-5
- The recurrence of symptoms observed in different months. In 1st month; 54 (49.9%) reported recurrence of vertigo and nausea in which 21 (19.4%) treated with GRM while 33 (30.5%) treated with ERM having non-significant results with p-value 0.568. In3rd month; 35 (49.5%) reported the recurrence of episodes with 12 (17.14%) managed by GRM and 23 (32.8%) by ERM having insignificant result with p-value 0.453. Furthermore, after 6th months of sessions, only 20 (28.5%) from 140 patients reported symptoms' recurrence in which 6 (8.5%) managed by GRM and 14 (20%) managed by ERM with a statistically significant results of p-value 0.029. Table -6
- The subjective and objective response rate about the success of Gans repositioning maneuver described as In the first month, among 70 patients; 21 (19.4%)and 19 (27.94%) reported subjective and objective improvement response respectively. Similarly, after 3rd month, 54 (77.14%) and 52 (75.3%) patients reported both subjective and objective improvement and after sixth month, 64(91.4%) and 66(94.2%) patients had subjective and objective improvement by treating through GRM.

Furthermore, there was the significant subjective and objective improvement was observed form first month to sixth month with p-value 0.028 and 0.023 respectively. Table-7

- The subjective and objective response rate about the success of Epley's maneuver described as In the first month, among 70 patients; 33 (47.14%) and 30(42.85%) reported subjective and objective improvement response respectively. Similarly, after 3rd month, 43 (61.42%) and 43 (61.42%) patients reported both subjective and objective improvement and after sixth month, 56(80%)and 58(82.8%) patients had subjective and objective improvement by treating throughEpley's maneuver. Furthermore, there was the significant subjective and objective improvement was observed form first month to sixth month with p-value 0.031 and 0.029 respectively. Table-8
- Group comparison of subjective response rate showed that after first month, 41 (58.57%) treated through GRM reported subjective improvement while 33 (47.14%)treated through ERM reported subjective improvementwith a non-significant result having p-value of 0.568. 54 (77.14%) and 43 (61.42%) patients from GRM and ERM group respectively reported subjective improvement after 3rd months. However, the results were statistically insignificant with p-value 0.453. Furthermore; after sixth moths of treatment; 64 (91.4%) and 56 (80%)patients from GRM and ERM group respectively reported subjective improvement with statistically significant having p-value 0.029. this showed that Gans repositioning maneuver was more effective in improving the symptoms among PC-BPPV. Table-9
- Group comparison of objective response rate showed that after first month, 42 (60%)treated through GRM reported subjective improvement while 30(42.85%)treated through ERM reported subjective improvementwith a non-significant result having p-value of 0.438. 52 (75.3%) and 43 (61.42%) patients from GRM and ERM group respectively reported subjective improvement after 3rd months. However, the results were statistically insignificant with p-value 0.283. Furthermore; after sixth moths of treatment; 66(94.2%) and 58(82.8%) patients from GRM and ERM group respectively reported subjective improvement with statistically significant having p-value 0.032. this showed that Gans repositioning maneuver was more effective in improving the symptoms among PC-BPPV. Table-10
- The success rate of PC-BPPV maneuver showed among 140 patients; 6 (8.5%) and 4 (5.8%)of GRM group A patient reported no subjective and objective improvement respectively;while 64(91.4%) and 66(94.2%) patients of GRM group A patient reported significant subjective and objective improvement respectively. Similarly; 14 (20%)and 12 (9.6%) of ERM group B patient reported no subjective and objective improvement respectively; while 56(80%) and 58(82.8%)patients of ERM group B patient reported significant subjective and objective improvement respectively.

The results showed Gans repositioning maneuver is more effective in treating PC-BPPV patients as compared to Eplye's maneuver with low recurrence rate and success rate.

Table 1: Distribution of PC-BPPV by Age:

Age	Frequency (%)	Mean± S.d
18-39	**51 (36.4%)**	**41.05± 12.23**
40-65	89 (63.6%)	

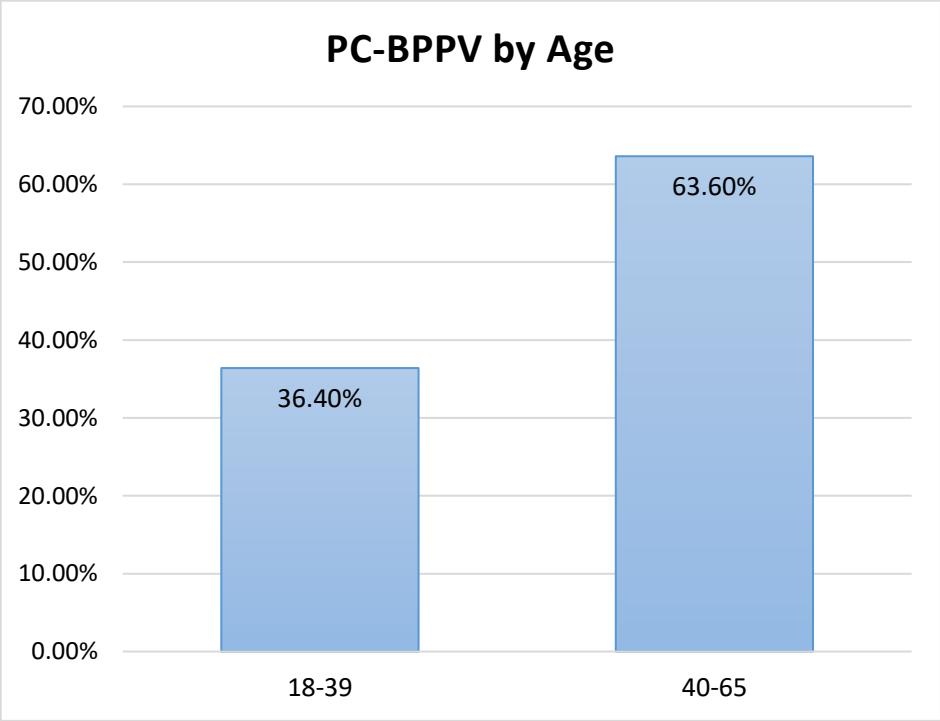

Figure 40: Bar Chart showing distribution of PC-BPPV by Age

Table 2: Distribution of PC-BPPV by Gender:

Gender	Frequency (%)
Male	**49 (35%)**
Female	91 (65%)

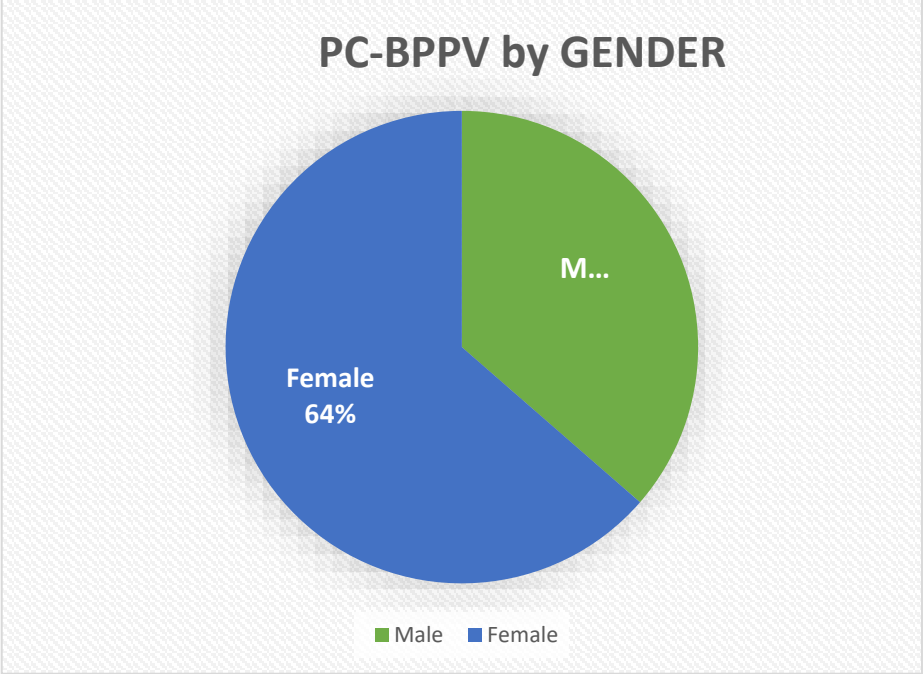

Figure 41:Pie chart showing distribution of PC-BPPV by Gender

Table 3: Distribution of Study Groups by Gender:

Sex	GRM (%)	ERM (%)	Total
Male	**24(24.5%)**	**25 (25.5%)**	**49 (35%)**
Female	**46 (25.3%)**	**45 (24.7%)**	91 (65%)

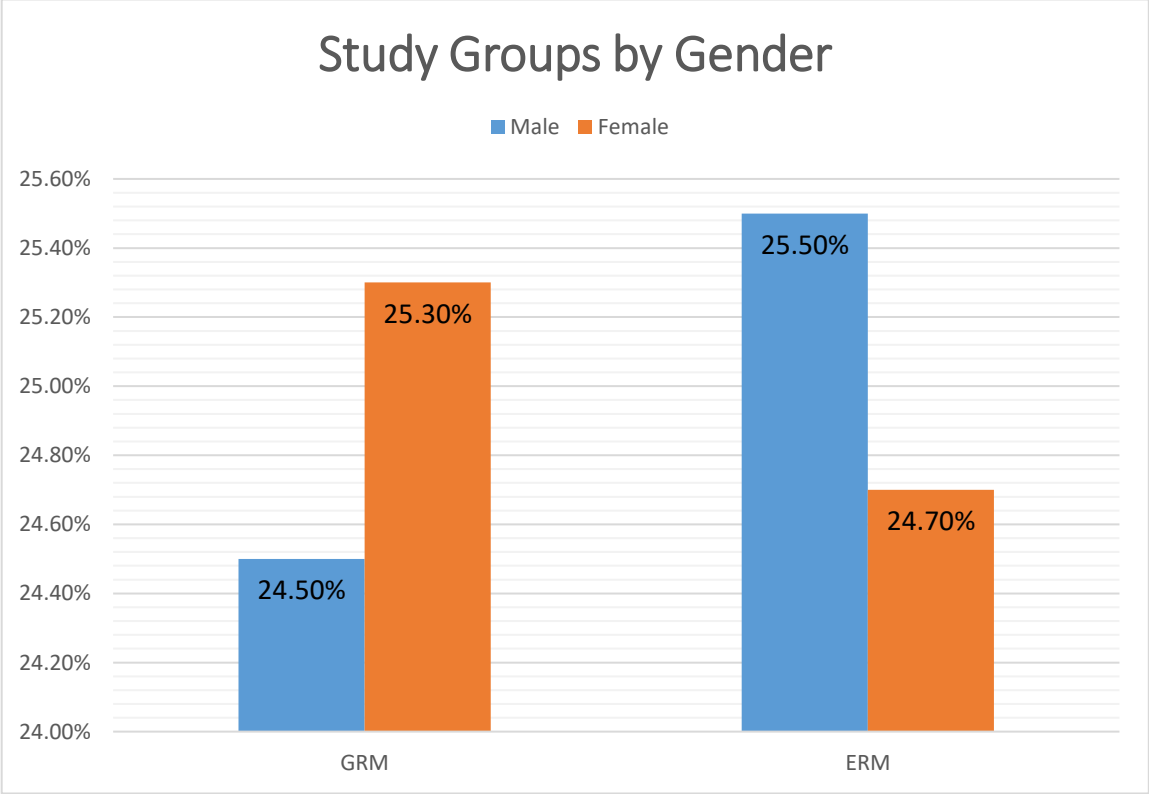

Figure 42: Bar Chart showing distribution of Study Groups by Gender

Table 4: Distribution of Study Groups by Symptoms:

Symptoms	GRM (%)	ERM (%)	Total
Vertigo	74 (52.8%)	66 (47.14%)	140 (100%)
Nausea	19 (27.1%)	27 (38.5%)	46 (65.3%)

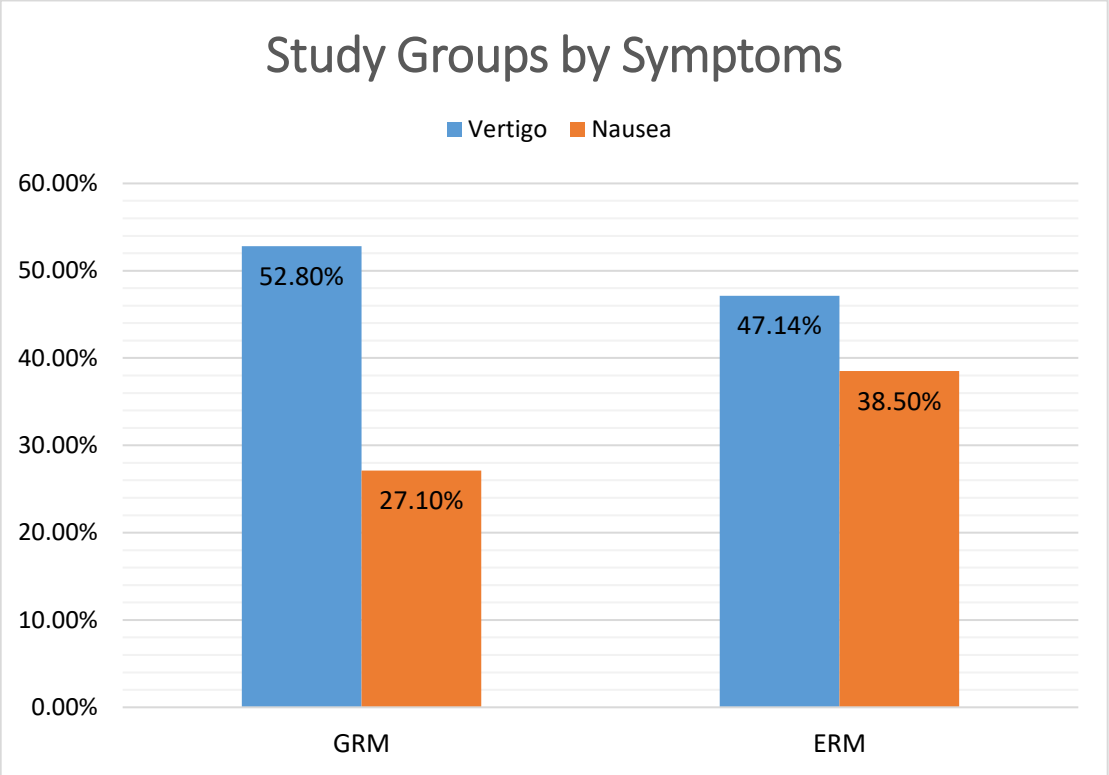

Figure43: Bar Chart showing distribution of Study Groups by Symptoms

Table 5: Distribution of Study Group by Affected Ear:

Ear Side	GRM (%)	ERM (%)	Total	P-value
Right	13 (36.7%)	14 (41%)	27 (38.3%)	0.324
Left	16 (50.0%)	12 (34.3%)	28 (42.2%)	
Bilateral	6 (14%)	10 (27.1%)	16 (27.55%)	

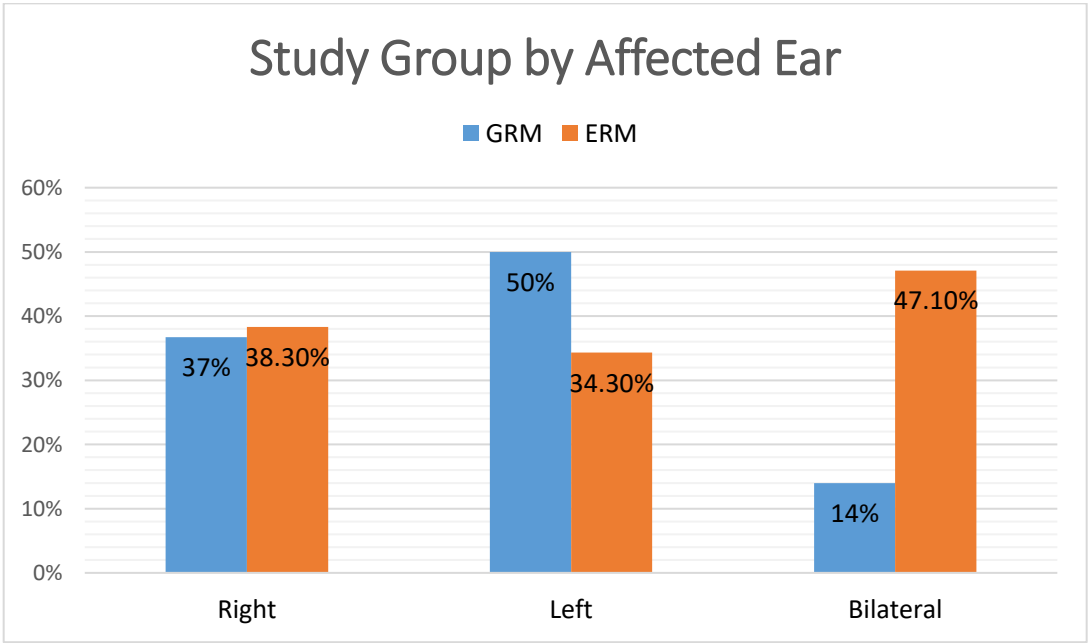

Table 6: Distribution of Study Groups by Symptoms' Recurrence:

Follow Up	GRM (%)	ERM (%)	Total	P-value
First Month	21 (19.4%)	33 (30.5%)	54 (49.9%)	0.568
Third Month	12 (17.14%)	23 (32.8%)	35 (49.5%)	0.453
Sixth Month	6 (8.5%)	14 (20%)	20 (28.5%)	0.029

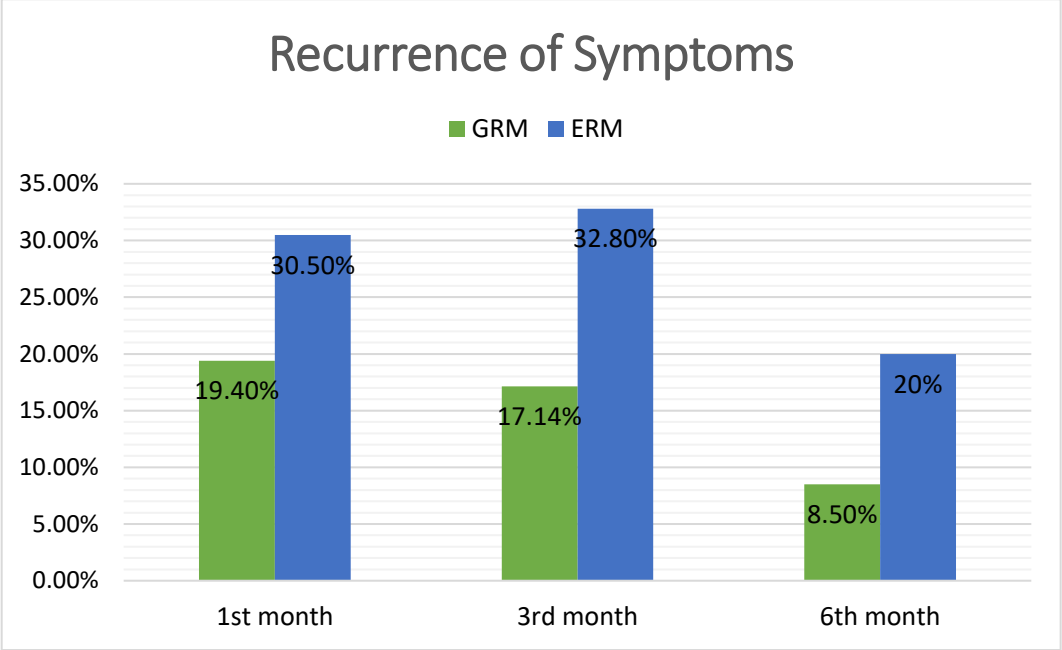

Figure 45: Bar Chart showing distribution of Study Groups by Symptoms' Recurrence

Table 7: Response Rate of GRM in PC-BPPV patients:

Response Rate	1st month (%)	3rdmonth (%)	6th month (%)	P-value
Subjective Response	41 (58.57%)	54 (77.14%)	64(91.4%)	0.028
Objective Response	42 (60%)	52 (74.3%)	66 (94.2%)	0.023

Table 8: Response Rate of ERM in PC-BPPV patients:

Response Rate	1st month (%)	3rdmonth (%)	6th month (%)	P-value
Subjective Response	33 (47.14%)	43 (61.42%)	56(80%)	0.031
Objective Response	30(42.85%)	43 (61.42%)	58(82.8%)	0.029

Table 9: Comparison of Study Groups by Subjective Response Rate:

Follow Up	GRM (%)	ERM (%)	P-value
First Month	41 (58.57%)	33 (47.14%)	0.568
Third Month	54 (77.14%)	43 (61.42%)	0.453
Sixth Month	64 (91.4%)	56 (80%)	0.029

Table 10: Comparison of Study Groups by Objective Response Rate:

Follow Up	GRM (%)	ERM (%)	P-value
First Month	42 (60%)	30(42.85%)	0.438
Third Month	52 (75.3%)	43 (61.42%)	0.283
Sixth Month	66(94.2%)	58(82.8%)	0.032

Table 11: Comparison of Study Groups by Chance of Success Rate:

Success Rate	GRM		ERM		p-value
	Present	Absent	Present	Absent	
Subjective response last session	6 (8.5%)	**64 (91.4%)**	14 (20%)	**56 (80%)**	0.012
Objective response last session	4 (5.8%)	**66 (94.2%)**	12 (9.6%)	**58 (82.8%)**	0.020

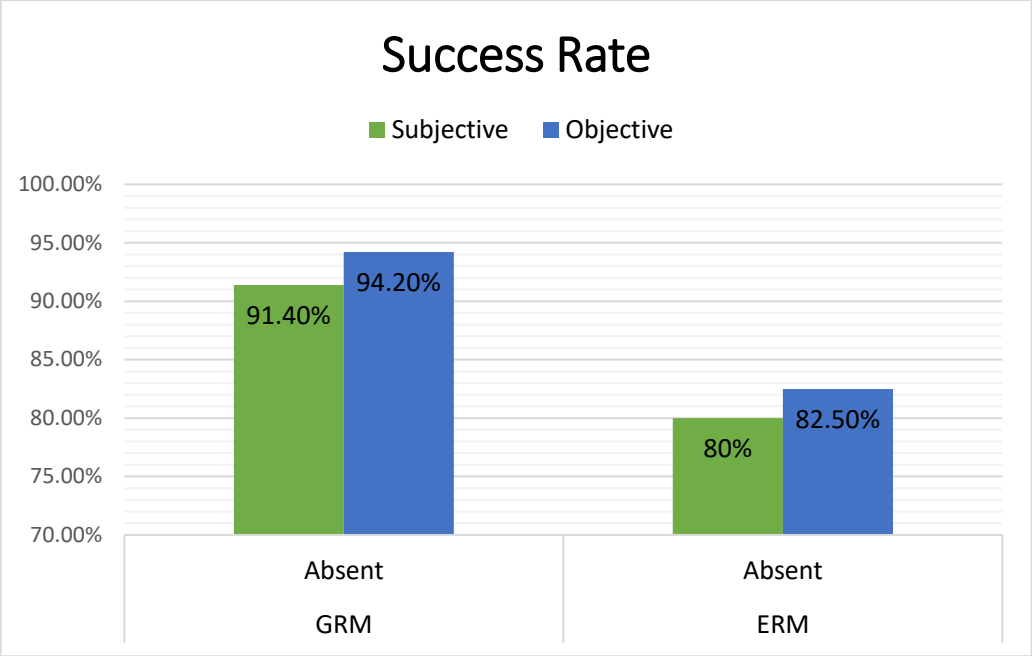

Figure 46: Bar graph representing the success rate in Study Groups

Discussion:

Gans repositioning maneuver and Eplye's maneuver both has been demonstrated effective in treating PC-BPPV in 80 to 91% of cases without using any medications and surgical procedures. The recurrence of the BPPV among 20% is a significant issue in spite of the significant improvement in BPPV. However,higher success rate with low recurrence rate is achieved through the GRM. Effective brisk change in position is considered as one of the major factor of higher recurrence rate in Epley'smaneuver (27).

The head extension with sudden positional changes leads to structural damages to bone especially in older and orthopedic patients. This ultimately lead to the limitation of the body to maintain or achieve the required position for desired time (3). Being difficult to achieved and maintained; GRM provide a better alternative position as it cause the significant reversibility of symptoms with no cervical pain due to the effective protection to the cervical structure(2). Resolution of vertigo and nausea in more than 70% of patients after 1 month of treatment with GRM maneuver confirms its effectiveness in treating BPPV. Similarly; Muragodet. al reported >70% resolution of symptoms after 1 month of GRM treatment(29). The higher resolutions of symptoms by GRM is depending on the usage of different mechanical things including towels or pillows that help in achieving required position and movements for longer period. This leads to the complete removal of debris from the canals back to utricle and repositioned the canaliths in inner ear(74).

Being effective and traditional maneuver; Epley's maneuver showed 14 (20%)and 12 (9.6%) no subjective and objective improvement in symptoms while 6 (8.5%) and 4 (5.8%) reported no subjective and objective improvement in symptoms after GRM maneuver. Despite of head movements and positional changes; inadequate training of physician to perform Epley's maneuver also affect the response and success rate of traditional maneuver. Finnegan et al. (75) reported that in 2017, 28% male and 17% female BPPV patientswere not treated appropriately due to having inadequate skills and training in applying Epley's maneuver that worsen their condition. Carter et al. reported that GRM is a smoother protocol that is painless for PC-BPPV patients to achieved by using bed rolling technique which is absent in Epley's maneuver (74).

Similarly, Omar et al. conducted a comparative study for determining the effectiveness of Epley's maneuver and Gans repositioning in treating BPPV among elder population. The results of showed no statistical significant difference in techniques in treating symptoms. However, Study concluded that GRM is an effective alternative hybrid technique in treating the older population above 50 years suffering with multiple orthopedic conditions including cervical and postural abnormalities with better response rate. Additionally; being easy to apply, marinating for longer time, limited to no head extension, limited sessions and higher success rate with low recurrence rate made GRM more superior than Eplye's maneuver(1) . The results highly supported current study results.

Paul et al. also reported that the repetition of Epley's maneuver lead to the cervical pain, numbness and weakness of upper limbs which is the main reason failure in treating and resolution of PPC-BPPV symptoms (11). Zainun et al. reported that Epley's maneuver is statistically more significant maneuver in rapidly treating subjective vertigo and psychological improvement after one month with percentage of100%. Additionally; GRM produced an effective subjective improvement with 95.5% after two sessions having low recurrence rate. This increase recurrence rate in Epley's maneuver with longer period of recovery rate depends upon the inappropriate application of technique in patients (76).

Conclusion:

Epleymaneuver and Gansrepositioning maneuver both are effective in treating vertigo and nausea among patients of Posterior canal Benign Paroxysmal Positional Vertigo. However, GRM has better subjective and objective response with lower recurrence rate.

This concludes that although Gans repositioning maneuver (GRM) is a safe and more effective particle-repositioning maneuver for the treatment of vertigo in patients with posterior SCC-BPPV than Epley's Repositioning Maneuver (ERM), having fewer recurrences and less complication

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