

# Effect of a Hybrid Maneuver in Treating Posterior Canal Benign Paroxysmal Positional Vertigo

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## Abstract

**Background:** Benign paroxysmal positional vertigo (BPPV) is the most common disorder of the vestibular system of the inner ear, which is a vital part of maintaining balance. Although the efficacy of the Epley maneuver—also known as the canalith repositioning maneuver (CRM)—is well established, data comparing CRM versus a hybrid treatment are lacking.

**Purpose:** The purpose of this study was to determine the effect of a hybrid treatment, the Gans repositioning maneuver (GRM) either with or without postmaneuver restrictions, compared with CRM on treatment of posterior canal BPPV (PC-BPPV).

**Research Design:** Study design was a randomized controlled trial.

**Study Sample:** A total of 45 patients (30 males and 15 females) with unilateral PC-BPPV were randomly allocated to one of three equal groups on the basis of the date of the first visit with matched assignment for gender: a GRMR group (GRM with postmaneuver restrictions), a GRM group, and a CRM group.

**Intervention:** Patients received weekly administration of the maneuver until resolution of symptoms. The Dix-Hallpike test was performed before treatment at every appointment, and finally after 1 mo from the last maneuver.

**Data Collection and Analysis:** Nystagmus duration and vertigo intensity were recorded. The supine roll test was performed in case the Dix-Hallpike test was negative to test otoconial migration. Data were analyzed with repeated-measures analysis of variance, paired *t*-tests with a Bonferroni correction, and the Spearman rank correlation coefficient.

**Results:** All patients showed improvement within the groups, and PC-BPPV symptoms were resolved by an average of 2, 1.7, and 1.6 maneuvers for GRMR, GRM, and CRM, respectively, with no statistical differences among the three groups ( $p > 0.05$ ). Only two patients had recurrence, and one patient had horizontal BPPV at 1 mo follow-up.

**Conclusion:** We demonstrated that the GRM as a new treatment is effective in treating PC-BPPV with no benefits to postmaneuver restrictions.

**Key Words:** Benign paroxysmal positional vertigo, canalith repositioning maneuver, nystagmus, vertigo

**Abbreviations:** BPPV = benign paroxysmal positional vertigo; CRM = canalith repositioning maneuver; GRM = Gans repositioning maneuver; GRMR = Gans repositioning maneuver with postmaneuver restrictions; SLM = Semont liberatory maneuver; VAS = visual analog scale

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## INTRODUCTION

Patients with benign paroxysmal positional vertigo (BPPV) usually complain of a sudden onset of vertigo with certain head positions that lasts for approximately 1–60 sec (Glasziou et al, 2013). The triggering positions include rolling over in bed into a lateral position, getting out of bed, looking up and back, and bending over. The vertigo may be associated with nausea. Patients usually have normal hearing, no spontaneous nystagmus, and normal results on neurologic evaluation (Johnson and Lalwani, 2008).

Most clinicians today recommend the use of the modified Epley maneuver, the canalith repositioning maneuver (CRM) (Babac and Arsović, 2012). This three-position maneuver eliminates the need for sedation and mastoid vibration (Wolf et al, 1999; Babac and Arsović, 2012). The Gans repositioning maneuver (GRM) is a relatively new treatment maneuver for BPPV, with few studies reported on its effectiveness (Roberts et al, 2006; Dispenza et al, 2012). GRM is a hybrid of the Semont liberatory maneuver (SLM) and the CRM and may give preference for use in patients with comorbid factors (such as vertebrobasilar insufficiency, cervical spondylosis, or limited range of motion of the hip or back) that contraindicate the use of these established maneuvers. The GRM incorporates the side-lying maneuver as its first position (Fig. 1). This is similar to the SLM and avoids hyperextension of the neck found with the CRM, the head of the patient is turned 45° away from the affected ear, and the patient is moved into a side-lying position on the involved side. The second position is a roll from the involved side to the uninvolved side. This mechanism is similar to the positioning used in the CRM. A liberatory headshake is then performed, as suggested by Semont et al (1988). Finally, the patient is returned to an upright, seated position (Roberts et al, 2006).

In addition, there are contradictory reviews on the need for involvement of postmaneuver restrictions as a part of the treatment protocol for BPPV (Fyrmpas et al, 2009; De Stefano et al, 2011; Papacharalampous et al, 2012), which are used in an effort to prevent the otoconial debris from returning to the semicircular canals after treatment. Cakır et al (2006) and McGinnis et al (2009) stated positive outcomes for these restrictions. On the other hand, DeBoodt (2003), Radtke et al (2004), Roberts et al (2005), and De Stefano et al (2011) reported that these restrictions are not necessary because they do not enhance the beneficial effect of the maneuver. Therefore, we compared the effectiveness of the GRM and CRM on treatment of BPPV of the posterior canal (PC-BPPV), in addition to investigating the contribution of postmaneuver restrictions on treatment.

## METHODS

We recruited a convenience sample of patients who presented with BPPV to the outpatient clinic of the audiology and balance departments at teaching hospitals in Egypt, from September 2012 to July 2013. Patients with a diagnosis of unilateral BPPV of the posterior semicircular canal based on the Dix-Hallpike test (Kaplan et al, 2013) were enrolled in this study. The Dix-Hallpike test was considered positive if nystagmus was observed with a latency period of less than 15 sec and a duration of less than 60 sec as measured by videonystagmography (Version 2, 2009; Micromedical Technologies Inc., Chatham, IL) (Lin et al, 2012). The participants' ages ranged between 30–55 yr, and all participants had the ability to follow verbal instructions. Informed consent for participation was obtained from all participants before study inclusion. We excluded those who had symptoms lasting more than 2 mo, 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).

### Procedure

A total of 45 patients (30 males and 15 females) were eligible to participate. Patients were allocated to one of three equal groups with use of a randomized block design, with matching for gender on the basis of the date of the first visit. The groups included the GRM with and without restrictions and CRM with restrictions. Baseline characteristics, including age and gender, were recorded. Affected side, duration of illness, history of head trauma, previous recurrences, previous falls, frequency of vertigo per day, and change in physical activities were collected through a self-report questionnaire. Height and weight were measured, and body mass index was calculated.

All patients were examined by the same neurotologist. The Dix-Hallpike test was applied at the beginning of each appointment before the maneuver was applied, and the duration of nystagmus was recorded to the nearest second by a stop watch. Participants provided a subjective report of the 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. The VAS has been shown to be a reliable indicator of the degree of vertigo (Toupet et al, 2012). The supine roll test was performed to assess otoconial migration to the lateral semicircular canal (Lin et al, 2012; Bhattacharyya et al, 2008). The roll test was performed in the appointment at which the Dix-Hallpike test was first found to be negative and after 1 mo follow-up from the last performed maneuver.



**Figure 1.** GRM positioning sequence for right PC-BPPV. (A) Straightened position. (B) Head was turned 45° to the left. (C) Patient lay on his right side. (D) Patient rolled to the left side. (E). Liberatory head shake. (F) Patient returned to the seated position.

After the assessment, each patient received the specific treatment maneuver by the same physical therapist according to the group he or she was allocated. Group A (GRMR) received the GRM (Roberts et al, 2006) (Fig. 1) and postmaneuver restrictions.

The restrictions included wearing a soft cervical collar for the next 24 hr postmaneuver, sleeping semi-inclined at an angle of approximately 30° for the first two nights, and avoiding sleeping on the affected side for the next four nights (Roberts et al, 2005). Group B (GRM) received the GRM only. Group C (CRM) received the CRM (Parnes et al, 2003) (Fig. 2) and the same postmaneuver restrictions as Group A.

Regardless of the group, every patient received one treatment maneuver per appointment once a week. In case of persistence of symptoms, the maneuver was repeated each week until resolution of symptoms. Although participants in the GRMR and CRM groups were instructed to follow the postural restrictions, we did not monitor their adherence to these instructions. However, we asked the following questions to all participants in the two restricted groups: “Did postmaneuver restrictions cause any sense of discomfort?” “If yes what is it?”. This study was approved by the Research Ethical Committee of the Faculty of Physical Therapy, Cairo University, Egypt (P.T. REC/012/301).

### Statistical Analysis

We analyzed the data using SPSS statistical software version 19 (SPSS Inc., Chicago, IL). The characteristics

of the participants were calculated through descriptive statistical tests including means and standard deviations. Repeated-measures analyses of variance were used to compare the effectiveness of the treatment among the three groups. Paired *t*-tests were used to compare the effectiveness of treatment between pretreatment and posttreatment in each group, with a Bonferroni correction. The Spearman rank correlation coefficient was used to detect relationships between head trauma and the severity of illness, as reflected by the number of maneuvers needed to resolve the symptoms. Differences were considered significant if  $p \leq 0.05$ .

### RESULTS

All patients ( $n = 45$ , male/female ratio = 30/15) received treatment for PC-BPPV. Our patients were equally allocated with matching of gender into one of the following groups: GRMR, GRM, and CRM. There were no significant differences in the baseline characteristics among the three groups (Table 1).

The mean numbers of maneuvers required to resolve symptoms of PC-BPPV in the GRMR, GRM, and CRM groups were 2, 1.7, and 1.6, respectively, with no statistical differences among the three groups (Fig. 3).

Postmaneuver restrictions did not influence nystagmus duration or VAS scores (Figs. 4 and 5). When patients in the restricted groups were asked about expressing any serious sense of discomfort, 25 of 30 participants



**Figure 2.** CRM for right PC-BPPV. (A) Straightened position. (B) Hanging Dix-Hallpike position. (C) Head was turned 90° to the opposite Dix-Hallpike position. (D) The patient was asked to roll another 90°. (E) Patient in sitting-up position.

in both groups answered “yes” in the first two nights only. Of the 25 participants in each group, 20 had both sleep disturbance and restrictions in activities of daily living, and 5 participants had sleep disturbance only.

In testing the effect of the treatment after 1 mo and the incidence of recurrence of symptoms, we used the

Dix-Hallpike test. Only two patients in the entire group had recurrence of symptoms: one patient in the GRM group and one patient in the CRM group. These findings do not affect the total recurrence rates and the effectiveness of the maneuvers used. In the GRMR group, only 1 (6.6%) of 15 patients had nystagmus and

**Table 1. Baseline Characteristics of the Patients by Groups (n = 45)\***

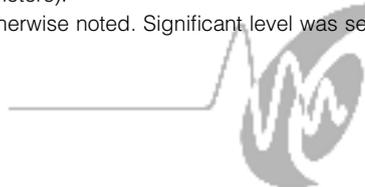
Characteristics	Groups			p
	Group A (GRMR) n = 15	Group B (GRM Only) n = 15	Group C (CRMR) n = 15	
Age (y)	43.7 (7.8)	44.1 (8)	42.3 (8.1)	0.81
Gender (M/F) n	10/5	10/5	10/5	—
BMI (kg/m <sup>2</sup> )	27.9 (2.7)	29.6 (4.3)	27.7 (3.4)	0.27
Affected Side (right/left) n	8/7	7/8	6/9	—
Duration of Illness (days)	17.6 (15.7)	15 (14.1)	17.9 (14)	0.84
Nystagmus Latency (sec)	2.1 (2.4)	1.6 (1.3)	1.4 (1.1)	0.56
Nystagmus Duration (sec)	23.1 (15.4)	25.5 (15.9)	25.5 (17)	0.89
Vertigo Intensity (VAS) <sup>†</sup>	9 (1.3)	8.3 (1.7)	8.4 (1.7)	0.48
Incidence of Head Trauma n/(%) <sup>‡</sup>	6/15 (40)	7/15 (46.7)	5/15 (33.3)	0.75

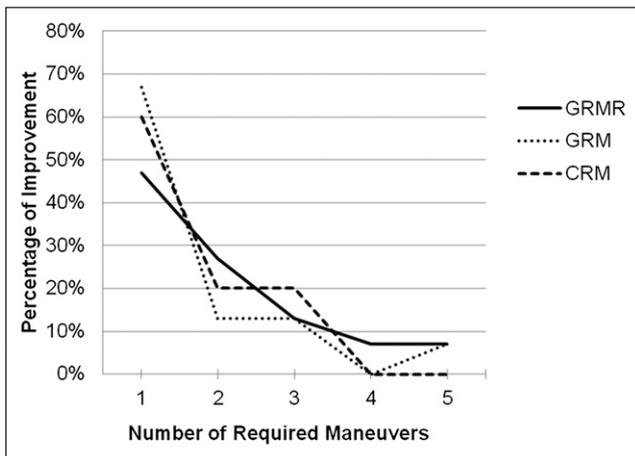
*Note:* All three groups showed significant relief of nystagmus symptoms and vertigo ( $p < 0.001$ ), as shown in Figures 4 and 5. BMI = body mass index (weight in kilograms/height in square meters).

\*Data are presented as mean (SD) unless otherwise noted. Significant level was set at  $p \leq 0.05$ .

<sup>†</sup>Scale of 0–10.

<sup>‡</sup>Percentage of patients in each group.



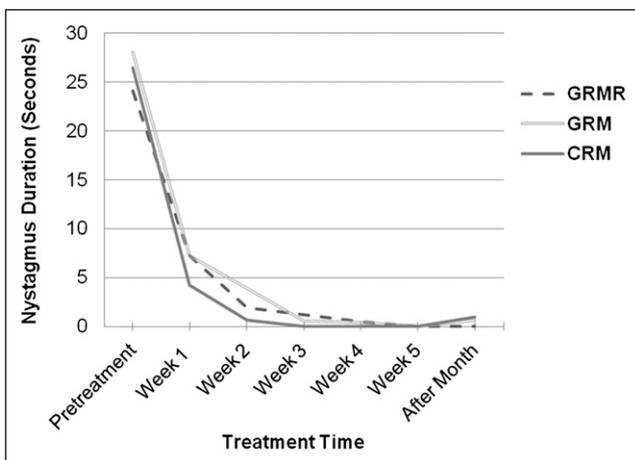


**Figure 3.** Percentage of patients cleared of PC-BPPV over the number of maneuvers.

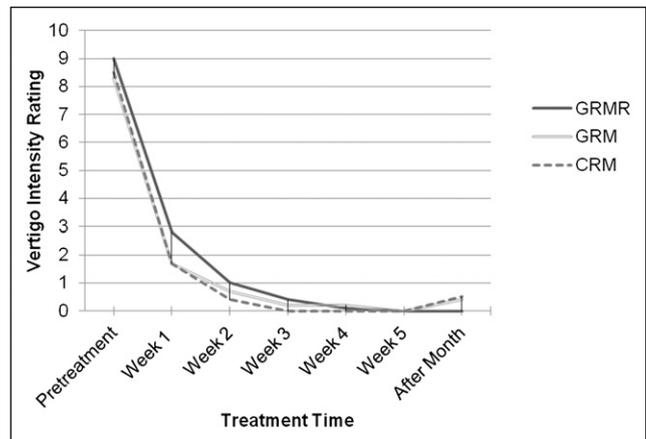
vertigo during the roll test, whereas the Dix-Hallpike test result was negative. That patient received only one maneuver, after which the posterior semicircular canal was free, but symptoms of horizontal semicircular canal appeared after 1 mo follow-up. In both GRM and CRM groups, no incidence of otoconial migration was detected, as the roll test result was negative in all patients. Although 18 patients (40%) had a history of head trauma related to the onset of BPPV, Spearman correlation revealed a low direct correlation between a history of head trauma and the number of treatment maneuvers needed to resolve PC-BPPV ( $r = 0.315$ ,  $p = 0.035$ ).

### DISCUSSION

The demographic and baseline characteristics of the 45 patients enrolled in our study showed no influence on the results. Only two studies have been reported on GRM. These studies were either a one-



**Figure 4.** Marginal means of nystagmus duration by treatment for GRMR, GRM, and CRM.



**Figure 5.** Marginal means of vertigo intensity rating scores (VAS) by treatment for GRMR, GRM, and CRM.

group prospective study (Roberts et al, 2006) or a comparative study with the SLM and CRM (Dispenza et al, 2012). Both studies used the postural restrictions. It was the first time, in our study, that GRM, either with or without postmaneuver postural restrictions, was compared with a well-established CRM. Our findings revealed that both maneuvers had a significant improvement in treating PC-BPPV. In addition, there were no significant effects of postural restrictions on the rate of resolution of symptoms in terms of nystagmus duration and vertigo intensity. Also, the long-term effect of both maneuvers after 1 mo was similar with low rates of recurrence and otoconial migration.

In the current study, the average numbers of maneuvers used to resolve PC-BPPV appeared to be consistent with those of Roberts et al (2006) and Dispenza et al (2012), although the number of patients in the current study was smaller compared with these studies. Participants in our study received a single maneuver during each appointment, which was repeated every week until the symptoms resolved. This result differs from that of Dispenza et al (2012) and Macias et al (2000), who repeated the repositioning maneuver in the same session in case of no response, depending on the repeated test. These repetitions did not affect the rate of success compared with our work or with other studies (Wolf et al, 1999; Gans and Harrington-Gans, 2002; Roberts et al, 2006; Hunt et al, 2012; Babac and Arsović, 2012; Prokopakis et al, 2013). Therefore, patients with orthopedic problems (neck, back, and hip disorders), who cannot tolerate repetition of the maneuver in one session because of limitation of body movements, may be able to repeat the maneuver in more than one session to resolve the symptoms.

One of the purposes of the current study was to detect the effectiveness of postmaneuver restrictions on the treatment of BPPV with the newly developed GRM. This aim was not addressed in the two previous studies

that used the GRM (Roberts et al, 2006; Dispenza et al, 2012). The results of our study are not surprising, as they are more or less in accordance with the current literature. Our findings agree with most of the previous studies (DeBoodt, 2003; Radtke et al, 2004; Roberts et al, 2005; Fyrmipas et al, 2009; De Stefano et al, 2011; Papacharalampous et al, 2012; Toupet et al, 2012) that investigated the efficacy of postural restrictions on the success rate of CRM and reported that these restrictions do not influence resolution of BPPV. In addition, most of the patients in the restricted groups expressed a serious sense of discomfort. Postural restrictions may cause patients to feel discomfort, and important physical activities such as driving, shopping, or exercising can be quite difficult (Hunt et al, 2012). Moreover, restrictions may cause sleep disorders because of the awkward sleeping position. Thus, our findings showed that patients may be advised to return to normal physical activities immediately after treatment.

That there was no effect of postmaneuver treatment restrictions may indicate that the success of the treatment is consistent with dissolution of otoconia in the utricle. Otoconial debris is able to dissolve in the calcium-deficient endolymph across time (Zucca et al, 1998). As long as calcium levels are normal, time to dissolution should be rapid and result in amelioration of pathological symptoms. In other words, if the debris dissolves once returned to the utricle, it cannot be redeposited into the canals. This mechanism occurs regardless of the presence or absence of postmaneuver restrictions (DeBoodt, 2003).

Only 3 (6.6%) of the 45 patients who participated in this study needed more than three maneuvers in order to treat PC-BPPV: 2 patients in Group A and 1 patient in Group B. The three patients were similar regarding which side was affected (right ear), and all had a history of head trauma related to onset of the symptoms. Despite 40% (18/45) of the total number of patients having a history of head trauma, the percentage of improvement in the three groups was not affected by the episodes of head trauma, although the three patients (who had recurrence) revealed a history of head trauma. We believe this can partially be attributed to the small sample size. However, several studies (Gordon et al, 2004; Kansu et al, 2010; Helminski et al, 2010; Prokopakis et al, 2013) reported that patients who had a history of head or neck trauma are more difficult to treat than those with idiopathic BPPV, and also had a greater tendency of symptom recurrence. In our opinion, more studies are needed to investigate the nature and severity of head trauma on the onset of BPPV.

We identified no significant difference in recurrence rates between patients who followed postural restriction (Groups A and C) and those who were advised to behave normally (Group B) after 1 mo of clearance of symptoms. Only two patients (4.4%) had recurrence of the previous

symptoms. This low rate of recurrence is not surprising, as the follow-up period was not as long as other studies that ranged from 3 mo up to 15 yr (Prokopakis et al, 2013).

Only one patient (2.2%) in our study had otoconial migration to the horizontal semicircular canal. Bhattacharyya et al (2008) explained that conversion between the posterior and the horizontal semicircular canals could result from one of two probabilities: (1) The first is that the patient originally presented with PC-BPPV only, and it converted after treatment to horizontal canal (otoconial migration), thus supporting the theory of canalithiasis in that the particles are free floating in the canal not adherent to the cupula as in the cupulolithiasis theory. (2) The second is that the patient might originally have two semicircular canals (posterior and horizontal) involved. Involvement of the horizontal canal became evident at the time of reassessment, while the posterior canal was appropriately treated.

According to our results, we might attribute resolution of the pathological symptoms in response to the applied maneuvers to the repositioning of otoconial debris inside the utricle, making them entrapped again inside the utricle and/or otoconial debris dissolution in such a way that nystagmus or vertigo could not be elicited (DeBoodt, 2003; De Stefano et al, 2011; Toupet et al, 2012).

## STUDY LIMITATIONS

One of the limitations of our study was the small sample size ( $n = 45$ ) compared with other studies (Prokopakis et al, 2013), although the number of participants was equally distributed among all groups. A second limitation was that this study was completed at a single outpatient clinic. These potentially limit the degree to which the findings from this study can be generalized to a larger population of patients diagnosed with BPPV. Despite the previous limitations, the results of this study demonstrated that positive treatment outcomes were achieved for patients with PC-BPPV when a repositioning maneuver—either CPR or GRM—was used.

## CONCLUSIONS

Results of the current study provides class II evidence (i.e., the study was a clinical randomized trial, not a systematic review of randomized trials with a small sample size) that the efficacy of both Gans and Epley repositioning maneuvers in treating PC-BPPV were obvious without superiority of one maneuver to the other. However, the postmaneuver restrictions added no further benefits for treatment efficacy. Patients could be advised to return to their normal physical activities immediately after administration of repositioning maneuvers. The incidence of recurrence of PC-BPPV was low; however, patients who have a traumatic onset of BPPV

with worse symptoms may need more repeated maneuvers than those who have idiopathic BPPV.

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