Epley repositioning maneuver versus Gans repositioning maneuver on postural instability in elderly patients with benign paroxysmal positional vertigo

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Received 6 November 2016
Accepted 9 December 2016

The Egyptian Journal of Otolaryngology
2017, 33:518–522

Introduction
Patients with benign paroxysmal positional vertigo (BPPV), especially the elderly, often experience a greater incidence of falls and postural instability. The Epley repositioning maneuver has been proven to be effective in improving the postural control, whereas Gans repositioning maneuver (GRM) is still lacking data.

Objective
The objective of this study was to compare between the effectiveness of GRM and Epley repositioning maneuver in improving postural stability in elderly patients with posterior canal BPPV.

Patients and methods
In this randomized controlled trial, patients were randomly assigned into two groups. Group A (study group) was assessed by side-lying test and treated by GRM, whereas group B (control group) was evaluated by Dix–Hallpike test and treated by the Epley repositioning maneuver. Postural stability was estimated by computerized dynamic posturography.

Results
Patients in both groups showed improvement within the groups in equilibrium scores subtest 4, 5, 6 ($P<0.05$), whereas there was no significant difference between groups ($P>0.05$) regarding equilibrium scores.

Conclusion
GRM is as effective as the Epley repositioning maneuver in improving postural stability in elderly patients with posterior canal BPPV.

Keywords:
aged, benign paroxysmal positional vertigo, equilibrium, postural balance

Egypt J Otolaryngol 33:518–522

1012-5574

Background

Postural control is considered one of the most important functions of the vestibular system. Vestibular system informs the central nervous system with head position and motion. Central nervous system integrates this information with other sensory inputs to determine the entire body position and movement, whereas the motor pathways control the static position of head and body [1].

Vestibular lesion disturbs the alignment of head and body in relation to gravity. If this lesion is unilateral, it will lead to lateral head flexion to the affected side. If the lesion is bilateral, the head will move forward. This change in body alignment will increase tension and pain in muscles [2].

Benign paroxysmal positional vertigo (BPPV) is considered the main cause of peripheral vertigo. The symptoms' severity varies from positional vertigo as mild degree to continuous vertigo provoked by head movement and lasts for long periods as severe degree [3]. Patients may complain of imbalance, falling, nystagmus, and equilibrium disturbances due to vestibular deficits. These symptoms commonly occur with aging [4,5].

BPPV is caused by displacement of loose calcium carbonate crystals, known as otoconia, from their usual position within the utricle to one of the three semicircular canals [4]. The posterior canal is the most commonly affected because of its anatomical position beneath the utricle and is more affected by gravity in both upright and lying positions [6]. Involved canals become more sensitive to changing head position in space. Symptoms may not only include vertigo, dizziness, and nystagmus when the patient moves into the provoke position, but also an increase in the postural sways during and between the vertigo attacks [7].

Observation of the reversal phase direction of nystagmus can be used to figure out which canal is affected. Upbeating nystagmus with the superior pole of the eyes moving toward the affected side is a characteristic of involved posterior canal benign paroxysmal positional vertigo (PC-BPPV) [2,8].

Existing treatment maneuvers for vertigo (PC-BPPV) include Semont liberatory maneuver (SLM) and Epley maneuver [9]. Both maneuvers SLM and Epley have provided a remarkable impact on a majority of patients [10]. BPPV is common in old age; these patients have comorbid factors such as vertebrobasilar insufficiency, cervical spondylosis, back problems, as well as obesity. These factors must be considered during both assessment and treatment [11]. Side-lying test is used as a valid alternative for assessing BPPV instead of Dix–Hallpike test (DHT) as a diagnostic test in patients with comorbid factors [12]. Hyperextension of the neck for Epley maneuver and brisk lateral motion for SLM are contraindicated for such patients. A hybrid approach namely Gans repositioning maneuver (GRM) was created to deal with those patients. The GRM incorporates the side-lying maneuver as its first position. This is similar to the SLM and avoids hyperextension of the neck presented in the Epley maneuver. The head of the patient is turned 45° away from the affected ear, and the patient is directed to side-lying position on the involved side. The second position is a roll from the involved side to the uninvolved side. A liberatory head shake is then performed as recommended by Semont *et al.* [13]. Finally, the patient is moved to a seated position [8].

The postural stability and impacts of physical treatment in BPPV patients are evaluated by posturography; it is considered as an evaluative method for BPPV patients. These patients suffer from impaired balance. Treatment with the Epley maneuver improves both static and dynamic stability [14,15]. Postural sways in such patients were found to be significantly higher than that in healthy participants, whereas they decreased after the physical treatment [16].

Rare comparative studies dealt with the effect of GRM versus different repositioning maneuvers on postural stability. Therefore, the rationale of the current study is to compare the effect of both Epley and Gans maneuvers in resolving the episodic vertigo with improvement in postural stability in patients with PC-BPPV.

Patients and methods

A convenient sample of 30 patients (12 male and 18 female) with a diagnosis of unilateral PC-BPPV due to canalithiasis, as indicated by DHT or side-lying test, were presented to outpatient clinic of Hearing and Speech Institute, Cairo, Egypt, from June 2013 to January 2014. This study was approved by the local Research Ethical Committee (number P.T.REC/012/001245). Patients from both sexes participated in the study after signing institutionally approved consent form preceding data collection. The mean age of group A was 52.2±5.2 years and that of group B was 51.6±6.7 years, respectively. Patients were included in the study if they had vertigo originating from changes in the head position related to gravity. Symptoms of vertigo and nystagmus lasting from seconds to minutes with upbeating and torsional nystagmus referred from the same physician of the outpatient clinic of Hearing and Speech Institute.

Participants who had anterior or horizontal semicircular canal involvement were excluded, or if BPPV was due to cupulolithiasis, or if vertigo was associated with central lesion multiple sclerosis, ataxia, migraine headache, or posterior inferior cerebellar artery syndrome. The patients were randomly assigned into two equal groups. The randomization was done by a computer-generated number table. Group A (study group) was assessed by side-lying test and treated by GRM. Group B (Control group) was assessed by DHT and treated by the Epley maneuver as a conventional treatment [17].

Videonystagmography was used to record, analyze, and magnify the shape and direction of any degree of nystagmus by using Frenzel glasses supported by video imaging technology to identify which canal is involved in BPPV [18].

Computerized dynamic posturography device (Equitest, version 8.6.0; Neurocom International Inc., Clackamas, Oregon, USA) for measuring postural stability through posturography test protocols generated a sequence of standardized motions in the support of platform to challenge the patient's posture in an orderly and reproducible way. The platform is contained within an enclosure, which could also be used to generate apparent visual surround motions [19]. The evaluation was performed by computerized dynamic posturography (CPD) before treatment intervention and after complete remission of BPPV symptoms regardless of the number of sessions by using six different subtests of Sensory Organization Test (SOT) to measure the degrees of anteroposterior sway. The different conditions of SOT are as follows – SOT1: the eyes were opened, while the force platform and visual surroundings were fixed; SOT2: same as condition 1, but the patient's eyes were closed; SOT3: the platform was fixed while the visual surroundings kept moving (sway referenced); SOT4: the visual surrounding was fixed, the eyes were open, and the platform was kept moving; SOT5: the visual surrounding was fixed, the eyes were closed, and the platform was kept moving; and SOT6: the eyes were open while the platform and visual surrounding were kept moving. Composite equilibrium score is calculated depending on the six SOT tests, which reflects the overall coordination ability of the visual, vestibular, and somatosensory system [20].

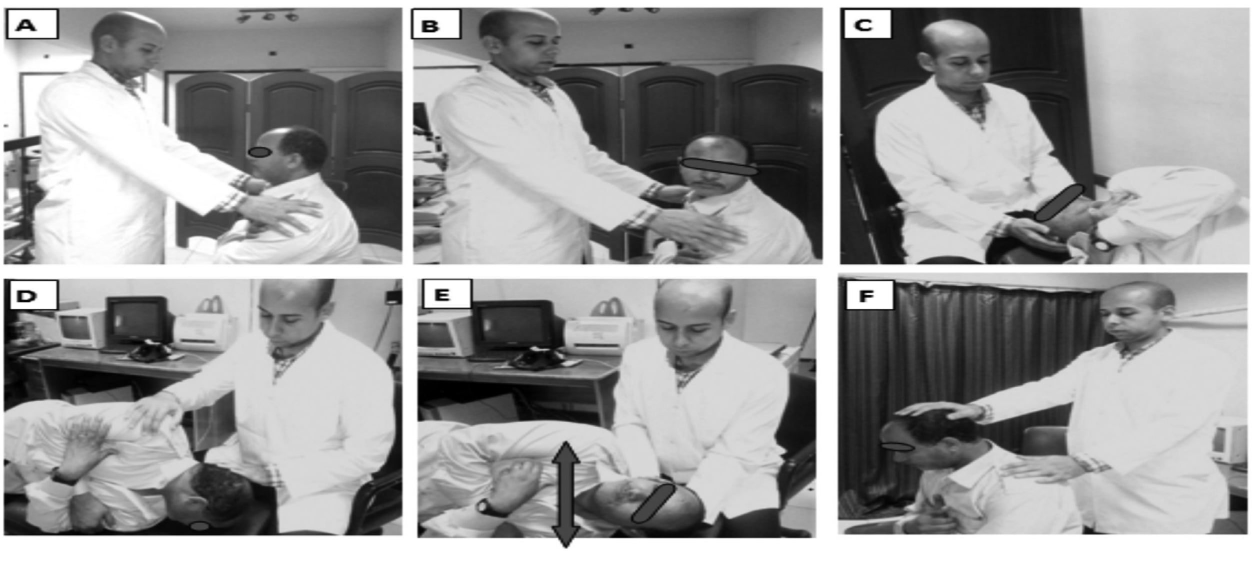
Scores ranged from 0 to 100, where 0 represents loss of balance and 100 represents perfect stability, taking into consideration that all patients receive only one session per appointment [21,22]. SOT protocol comprises 18 trials of the six sensory conditions, with three repetitive trials for each condition, and each trial lasts 10 s. The patient was instructed to ignore any surface or visual surround motion and to remain steady and upright as possible. The patient wore a parachute-type safety harness connected to an overhead bar to be protected from the risk of fall. Then the patient was motivated to do his best performance to assure its sensitivity [23].

After the assessment, each patient received the specific treatment maneuver by the same therapist according to his/her allocation. Group A received the GRM presented in six steps as described by Roberts *et al.* [8] (Fig. 1), whereas group B received the Epley maneuver as described by Radtke *et al.* [17]. All patients were asked to follow postmaneuver instructions. These instructions incorporated staying in upright position for 20 min after the session, wearing a soft collar, avoiding vertical head motion for 24 h, sleeping supine with head elevated to 30° for the first night following the session, sleeping on the unaffected side for the first three nights after session, and avoiding brisk head motion for three to five nights [8]. To be sure that the maneuver was successful with each position change either with GRM or CRM, the direction of the nystagmus should be the same with each position change. A reversal or change in the type of the nystagmus suggested that the otoconia moved back again toward the cupula or into another canal [2]. Patients were re-evaluated 7 days after the treatment session. Success was defined by the absence of nystagmus and positional vertigo during DHT or side-lying test. During re-evaluation, if there was a complete remission of BPPV symptoms – that is, disappearance of vertigo and nystagmus – posture stability should be reassessed again using the computerized dynamic posturography device to evaluate the six conditions of SOT.

Statistical analysis

We analyzed the data using SPSS statistical software, version 18 (SPSS Inc., Chicago, Illinois, USA). Before final analysis, data were screened for normality assumption and for the presence of extreme scores.

Figure 1



Gans maneuver for right posterior canal-benign paroxysmal positional vertigo. (a) Patient sitting at the edge of the bed. (b) Head was turned 45° to the unaffected ear 'left side'. (c) The patient lies on the right side. (d) Rolling to the unaffected side with nose facing the ground. (e) Liberatory head shake two to three times. (f) Patient returns to the sitting position with chin toward the chest.

This exploration was done as a prerequisite for parametric calculation of the analysis of difference. The current test involved two independent variables. The first variable was the tested group, which had two levels (groups A and B). The second was the treatment period with two levels (pre and post). The equilibrium scores (SOT) were the dependent variables. Accordingly, 2×2 mixed design multivariate analysis of variance was used to compare the tested variables of interest at different tested groups and training periods. Multivariate analysis of variance was conducted with the initial α level set at 0.05.

Results

Thirty patients with unilateral PC-BPPV were assigned randomly into two groups of equal number. Fifteen patients included in group A (nine female and six male) were treated by Gans maneuver; their mean age was 52.2±5.25 years. Fifteen patients included in group B (nine female and six male) were treated by the Epley maneuver; their mean age was 51.6±6.76 years. There were no statistically significant differences ($P>0.05$) between patients in both groups concerning age. Statistical analysis revealed that there was a significant difference within the same group in pre and post assessment ($F=15.685$, $P=0.001$), whereas there was no significant difference between the two groups in pre assessment ($F=1.086$, $P=0.429$) and post assessment ($F=1.086$, $P=0.428$). Table 1 represents the mean and SD of the six subtests of SOT levels and composite score in both groups with different measuring periods. Multiple pairwise comparison tests revealed that there was a significant increase in equilibrium scores in the post-treatment condition compared with the pretreatment condition in both groups in SOT5 and SOT6, whereas it was significant in SOT4 only in the study group ($P<0.05$). With regard to the difference between subject effects, multiple pairwise comparisons revealed that there were no significant differences ($P>0.05$) in group A compared with group B regarding equilibrium scores. There were significant differences in the composite score before and after treatment in both groups (experimental and control group) ($P<0.05$), but there were no significant differences between the pretreatment and post-treatment scores between groups ($P>0.05$).

Discussion

The GRM is considered a new treatment for PC-BPPV. It is a hybrid of SLM and CRM, and might be preferably used with patients who suffer from neck, back, hip, and mobility issues that contraindicated the use of these established maneuvers. The GRM is similar to SLM in assuming the side-lying as its first position and avoids hyperextension of the neck found with the CRM or its modifications. Rare studies assessed the effectiveness of GRM [8,24]. The purpose of this study was to investigate the efficacy of GRM in improving postural stability and if it would be comparable to the results of the Epley maneuver, as it is considered as the most common repositioning treatment used.

Our results revealed that there is no significant difference between group A treated with GRM and group B treated with Epley's maneuver in resolving postural instability and remission of BPPV symptoms. These findings agreed with those of Dispenza *et al.* [24], who compared the efficacy in resolution of signs and symptoms of PC-BPPV patients using different repositioning maneuvers, the SLM, Epley, and GRM, and found that there are no significant differences in their efficacy ($P=0.23$) between the three groups [25].

Clinically, Epley's maneuver requires that the head of the patient be maintained in each position at least 30–180 s, which may be difficult for obese patients and elderly who developed comorbid factors such as cervical spondylosis, limited neck ROM, vertebrobasilar insufficiency, and so forth to assume these positions. However, GRM has the advantages of being as effective as the Epley maneuver, such as simplicity in application, less number of sessions needed to cure the patients, with higher percentage of success and low recurrence rate [26].

The results of the current study showed that there was no significant difference in the posturography scores before and after application of Gans maneuver on the less challenging conditions SOT 1, 2, and 3. However, there was a significant difference and improvement in postural stability and reduction of body sway after

Table 1 Descriptive statistics for the Sensory Organization Test subtests and composite equilibrium score in preassessment and postassessment for groups A and B

SOT subtests	Group A (N=15)		Group B (N=15)	
	Pre	Post	Pre	Post
SOT1	94.6	92.6	93.2	92.3
SOT2	91.5	93.3	90	90.9
SOT3	90.6	93	87.4	91.7
SOT4	74.4	85.4*	77.3	85.8
SOT5	42	70.5*	35.5	69.5*
SOT6	33.9	57.3*	24.9	56.1*
CS	0.76	0.44*	0.75	0.42*

CS, composite equilibrium score; SOT, Sensory Organization Test. *$P<0.05$, significant difference within group compared with baseline. $^{\Delta}P<0.05$, significant difference between groups.

treatment, which was evident not only in SOT 4, 5, and 6, but also in composite score if it is compared with the pretreatment scores. Similar results were obtained by previous researchers [27–29]. They revealed these results to vestibular dysfunction.

Black and Nashner found an increase in postural sway in patients with BPPV during posturography testing on SOT conditions 3, 4, and 6. Difference in results may be related to patients' selection and characteristics. These studies include patients with combination of vestibular neuritis and BPPV or with history of head trauma, and vascular dysfunction, both of which were excluded from our study [30].

Hilton and Pender [31], assessed the effectiveness of the Epley maneuver for PC-BPPV and concluded that there was a high recurrence rate of BPPV after the Epley treatment (36%), whereas Roberts *et al.* [8], found that 80.2% of the participants in his study were cleared after one treatment with GRM and 95.5% of them were cleared after two treatments and that the recurrence rate was 5%.

Declaration of consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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