Efficacy of Postural Restriction in Treating Benign Paroxysmal Positional Vertigo

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Objective: To investigate the efficacy of postural restriction after canalith repositioning in treating benign paroxysmal positional vertigo (BPPV).

Design: Prospective trial of patients with postural restriction vs those without postural restriction after treatment.

Patients: Patients with classic BPPV and with BPPV without nystagmus were treated using the modified Epley canalith repositioning procedure. Patients were randomly separated into 2 groups. The first group was instructed to wear a cervical collar and to maintain an upright head position for 2 days. The second group had no motion restriction. After 5 days, the patients were followed up and evaluated using the Dix-Hallpike test.

Results: In the first group, 56 of 62 ears healed after the first maneuver, and the remaining ears healed after the second. In the second group, 45 of 57 ears healed after the first maneuver, 6 after the second, and 5 (with subsequent postural restriction) after the third (1 ear did not improve). Five patients in the first group and 3 patients in the second group had BPPV without nystagmus; all of these patients healed after a single maneuver. The difference between the 2 groups in the number of maneuvers required for treatment was statistically significant (P < .05). The number of patients who required a third maneuver was significantly higher in the second group (P < .05).

Conclusions: Postural restriction enhances the therapeutic effect of canalith repositioning in the treatment of posterior semicircular canal BPPV. The long-term efficacy of postural restriction in preventing BPPV recurrence has not been demonstrated.


IN 1921, BARANY1 FIRST DESCRIBED benign paroxysmal positional vertigo (BPPV), which is the most common cause of dizziness and occurs due to head motion, resulting in temporary vertigo. The posterior semicircular canal (SCC) is usually affected. Dix and Hallpike2 described the condition as the presence of a temporary vertigo attack (5-30 seconds) at the end of a latency period. The diagnosis is confirmed by the presence of vertical upbeat and rotatory-type nystagmus toward the lower ear, nystagmus developing in the opposite direction, and vertigo when brought back to the seated position. Resolution of vertigo and nystagmus is typical with resumption of the positioning maneuver.3,4

There are 2 main hypotheses to explain the development of BPPV. In the first, Schuknecht5 advocates the cupulolithiasis theory, which is based on the attachment of otolithic debris to the cupula in the crista ampullaris. In the second, Hall et al6 propose the canalithiasis theory, which is based on the presence of free-floating debris in the canal. Both theories support the presence of foreign particles in the SCC as a cause of vertigo. It has also been speculated that these particles are otooliths of calcium carbonate originating from the macula of the utricle.7 It is not known how these particles detach from the utricle.

The liberating maneuver by Semont et al8 and the canalith repositioning procedure (CRP) by Epley9 yield high success rates, even after single maneuvers. However, the success rates are variable based on different techniques, including different waiting periods in the positions, the use of mastoid oscillation during the maneuvers, repeated maneuvers during a single treatment session, and reverse migration of some particles. An important component of the treatment protocol is the application of postural restriction following the CRP to prevent the return of these particles into the SCC. However, some authors argue that postural restriction is irrelevant to treatment success and is a patient burden.10,11

In this study, the variables affecting the success of treatment in patients who un-
derwent the modified Epley CRP were evaluated. The effects of postural restriction on treatment success were prospectively investigated.

**METHODS**

Ear, nose, and throat and neurologic examinations were performed on patients who were initially seen with vertigo symptoms. Audiometric tests were conducted when indicated. The Dix-Hallpike test was performed on patients wearing Frenzel glasses. Among patients with vertigo and vertical upbeatting and torsional nystagmus toward the lower ear, those who had vertigo and nystagmus in the opposite direction while seated were diagnosed as having classic BPPV. Patients with rotatory vertigo after the Dix-Hallpike maneuver but who did not have nystagmus underwent a second Dix-Hallpike maneuver 2 hours later. Patients with classic vertigo that was ipsilateral, had similar characteristics and latency, and was accompanied by typical agitation were followed up in a separate group of patients with BPPV without nystagmus.

Fifteen to 20 minutes after the Dix-Hallpike test, patients underwent the modified Epley CRP. During the maneuver, the patient’s head was leaning off the examination table and was rotated 45° toward the affected ear. The patient was placed in a supine position with the neck forcibly extended, keeping the extension slightly less than maximal. The head was supported by the examiners (B.O.C, I.E., and Z.A.C), and the patient’s eyes were open. Three minutes later, the head was rotated 90° toward the other side. Care was taken during this rotation to keep the patient’s head in extension and to prevent even the slightest flexion. After waiting 3 more minutes in this position, the whole body was turned 90° toward the opposite side, and the patient reclined on his or her shoulder. The patient’s head was kept motionless during this rotation. Three minutes later, the patient was placed in a seated position and was brought to 20° to 30° flexion without disturbing the 45° position. Three minutes later, the head was brought into the normal position, and after waiting 3 minutes in this position, the test was completed.

The patients were randomly separated into 2 groups. In the first group, the patients were instructed to wear a cervical collar for 2 days and to keep the neck immobile. These patients were also instructed to elevate their heads in bed using 2 to 3 pillows for 2 days and to refrain from turning toward the affected ear. The patients were followed up after 5 days and were evaluated using the Dix-Hallpike test. The maneuver was repeated in patients who were found to have nystagmus and vertigo.

In the second group, the patients had no motion restriction after the maneuvers and were encouraged to perform all kinds of movements. At follow-up, the patients were questioned regarding their movements and activities and were excluded from the analysis if they had refrained from turning to the affected side during sleep, performed head elevation, avoided sudden head movements or steadied their heads as if wearing a cervical collar, or stayed at home and rested instead of performing daily activities. A second maneuver was performed in patients who demonstrated vertigo and nystagmus on the Dix-Hallpike test. Patients with vertigo and nystagmus at the third visit were instructed to maintain postural restriction after receiving the modified Epley CRP. These patients were followed up 5 days later.

Patients were also interviewed via telephone and were evaluated for early and late recurrence of BPPV. Pharmacologic agents were not used, except for 1 patient in each group. Statistical analysis was performed using χ² and Fisher exact tests.

**RESULTS**

One hundred twenty patients, 66 women and 54 men, diagnosed as having posterior BPPV were included in the study. The first group was instructed to maintain postural restriction and included 61 patients. The second group had no postural restriction and included 59 patients. During the follow-up examinations after the first Epley CRPs, 3 patients in the second group were found to be subconsciously performing postural restriction and were excluded from the analysis; the remaining 56 patients were evaluated. The mean age in the first group was 49 years (age range, 23-78 years). The mean age in the second group was 48 years (age range, 24-82 years). The mean durations of vertigo symptoms were 28.4 days (range, 1-300 days) in the first group and 30.1 days (range, 1-200 days) in the second group. One patient in each group had bilateral posterior SCC involvement. In the first group, 1 patient had posterolateral SCC BPPV, and the posterior canal was treated first. Five patients in the first group and 3 patients in the second group had BPPV without nystagmus. Overall, 61 patients and 62 ears in the first group and 56 patients and 57 ears in the second group (117 patients and 119 ears total) were evaluated.

In the first group, 48 of 54 patients with unilateral BPPV healed after the first maneuver, and the remaining 6 patients healed after the second maneuver (Figure 1). One patient with bilateral involvement underwent maneuvers on both sides, starting with the more severe side, and both sides healed after the first maneuvers. Five patients without nystagmus healed after a single maneuver. The Epley maneuver was performed on the patient with posterolateral BPPV on the right side, with healing...
after the first maneuver. In the second group, 40 of 52 patients with unilateral BPPV healed after the first maneuver, and 6 patients healed after the second maneuver (Figure 2). In the remaining 6 patients, postural restriction was prescribed following the Epley maneuver. Of these, 5 were noted to be healed at the follow-up examination, while vertigo and nystagmus had persisted in a 66-year-old woman for 15 days (nystagmus duration, 18 seconds, with a 1-second latency period). She had no predisposing factor for BPPV. The Semont salvage maneuver was performed, with no improvement. Another patient with bilateral BPPV had complete healing on both sides after single maneuvers. In 3 patients without nystagmus, symptoms disappeared after single maneuvers.

In the first group, 56 of 62 ears healed after the first maneuver, and the remaining ears healed after the second maneuver (Table). In the second group, 45 of 57 ears healed after the first maneuver, 6 after the second maneuver, and 5 (with subsequent postural restriction) after the third maneuver. The difference between the 2 groups in the number of maneuvers required for treatment was statistically significant ($P<.05$, $\chi^2$ test). In addition, the number of patients who required a third maneuver was significantly higher in the second group ($P<.05$, Fisher exact test).

The follow-up period ranged from 6 to 20 months. Telephone interviews were conducted with 53 of 61 patients with postural restriction, and 10 patients (18.9%) were found to have recurrences. Telephone interviews were conducted with 45 of 56 patients without postural restriction, and 9 patients (20.0%) were found to have recurrences. The difference in recurrence rates was not significant ($P>.05$, $\chi^2$ test).

### Table. Number of Maneuvers Among 119 Ears in Patients With and Without Postural Restriction*

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Postural Restriction</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>With 1 maneuver</td>
<td>56 (90.3)</td>
<td>45 (78.9)</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>With 2 maneuvers</td>
<td>6 (9.7)</td>
<td>6 (10.5)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>With 3 maneuvers (with subsequent postural restriction)</td>
<td>0</td>
<td>5 (8.8)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>1 (1.8)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>57</td>
<td>119</td>
<td></td>
</tr>
</tbody>
</table>

*Data are given as number (percentage) unless otherwise indicated.

Benign paroxysmal positional vertigo is a common peripheral vestibular disorder that may resolve spontaneously or may persist for months or years, with significant effects on a patient’s social life. Because of its persistence, the term benign may be inappropriate. The maneuvers by Semont et al and by Epley effectively treat BPPV. However, studies demonstrate a wide range of results, with 44% to 100% of patients obtaining resolution of positional vertigo using these maneuvers. These variable results can be explained by the different techniques used in the studies. For example, Epley recommends repeated maneuvers during single treatment sessions. Other authors perform the maneuver only once per session. We used a single maneuver per session to avoid patient fatigability and to minimize reentry of otocional debris into the posterior SCC.

Position durations during the CRP also varied. In a study by Epley, the duration was based on nystagmus time, with a typical pause of 6 to 13 seconds in each position. In the study by Moon et al, patients paused 1 minute in each position after the resolution of nystagmus. Ruckenstein maintained each position for 2 minutes. Harvey et al kept patients in the first position after disappearance of nystagmus and turned the head 15° to 20° in the opposite direction, with 30 seconds in each position. In other studies, the patient paused 4 minutes in the first position (the Dix–Hallpike position), with the head turned slowly (during 1 minute) to the opposite Dix–Hallpike position; after 4 minutes, the patient slowly sat up. Pollak et al maintained their patients 1 to 2 minutes in each position. Tirelli et al recommended during the CRP that patients remain in various positions for 3 to 4 minutes. In our study, we changed head positions after waiting 3 minutes in each position to allow time for the detachment of particles that may have adhered to the posterior canal wall and cupula and to enable complete motion in the channel without residue.

Another application believed to be effective in the treatment of BPPV that differs among authors is the use of mastoid oscillation during the CRP, as recommended by Epley. The application increased in popularity after Li.

Figure 2. Number of maneuvers among 56 patients without postural restriction after canalith repositioning. BPPV indicates benign paroxysmal positional vertigo.
described the use of an oscillator placed on the mastoid process. Hamid27 suggested that mechanical vibration is helpful in resistant cases of BPPV. Other authors believe that the use of mastoid oscillation does not affect treatment success and do not recommend it.18,24 In our study, we attained high success rates during BPPV treatment without using mastoid oscillation.

These studies demonstrate personalized techniques during the CRP, with variable success rates. Significant differences in the technique of the CRP include (1) positioning and pause duration in each position, (2) the use of mastoid oscillation, and (3) postmaneuver postural restriction. All of these variables independently affect treatment success. While some authors9,14,17,20,22,25,26 favor the use of postural restriction after the maneuvers to avoid dumping of canaliths into the canal, others10-13 find this unnecessary and uncomfortable for the patients. Epley9,20 recommended that patients remain in a head-upright position for 48 hours after the procedure and suggested that recurrence within days to weeks is likely due to suboptimal technique or a patient’s poor adherence to postprocedural instructions.20 In several other studies,14,17,20 investigators recommended that patients remain in a head-upright position for 48 hours; in other studies,25,26 patients were instructed to refrain from laying flat or from engaging in vigorous physical exercise for at least 24 hours. In other studies,16,17,22 patients were instructed to refrain from lying on the affected side for at least 1 week. Other authors advocate that patients use cervical collars for 2 days.17,18,22 These differences demonstrate significant variation among authors in the literature concerning the application of postural restriction.

Controlled studies10-12 of the efficacy of postural restriction have not shown that it significantly increases the success rate of the maneuver. Massoud and Ireland13 found it unnecessary to require postural restriction, but they recommended that patients avoid sudden head movements. Our success with postural restriction suggests its beneficial effect on patient outcomes. In our group of patients with postural restriction, 56 of 62 ears healed after the first maneuver, and the remaining ears healed after the second maneuver. In our group of patients without postural restriction, 45 of 57 ears healed after the first maneuver, and 6 ears healed after the second maneuver. In the remaining 6 ears, postural restriction was applied after the CRP, with only 1 patient demonstrating persisting vertigo and nystagmus. The difference between the 2 groups in the number of maneuvers required for treatment was statistically significant. In 2 studies12,13 in which postural restriction did not affect the success of the CRP, the authors recommended avoidance of sudden head movements, thus proposing motion restriction among patients without motion restriction. In our study, we believe that the unlimited motion allowed among patients in the group without postural restriction led to the lower success rates.

Most patients with long-standing vertigo develop stiffness in the neck and modify their activities to avoid sudden head turns and refrain from laying on the affected (ear) side. We believe that time is required for otoithic debris to adhere to the receptor organ macula. In patients who do not have vertigo and nystagmus after the CRP, dizziness and lightheadedness, especially after sudden linear movements, continue for 2 to 3 days as a result of particles that reach the utricle but do not assume the original position in the macula.

Our study did not reveal any significant difference between the study groups for recurrence of BPPV. During the follow-up period of 6 to 20 months, recurrence rates among patients with and without postural restriction were 18.9% and 20.0%, respectively (P > .05). These rates were 12.5% and 9.1% in the study by Moon et al,12 who also did not find a difference between study groups during a follow-up period of 3 months. Other studies10,12 also did not show any effect of postural restriction on recurrence. Epley9 demonstrated a 30% recurrence rate during a follow-up period of up to 30 months. In another study,26 the recurrence rate was 26.8%, with a mean follow-up of 15.9 months and a 15% recurrence rate per year. The results of our study were in concordance with the literature.

In our study, 8 patients with subjective symptoms of vertigo but without clinical evidence of positional typical nystagmus were diagnosed as having BPPV without nystagmus and were followed up in a separate group; all of these patients healed after a single maneuver. In some studies,21,27 BPPV was diagnosed without the presence of nystagmus, the objective sign of BPPV, and successful results were obtained with the repositioning maneuver. Haynes et al27 found rates of 63% and 23% for complete and partial recovery, respectively, and Tirelli et al21 found rates of 60.5% and 32.5%, respectively. One patient in our study who reported only symptoms of vertigo demonstrated nystagmus during the Dix-Hallpike maneuver that was absent during the CRP. This is probably because, despite the deposition of particles causing vertigo in the canal, they did not reach the critical mass that causes nystagmus, resulting in a milder clinical picture.

Numerous variables affect the treatment success among patients with posterior SCC BPPV. According to Epley,20 the most common problem is particles that fail to traverse the apex of the canal, occurring most frequently when the head is not extended sufficiently in the first and second positions. As long as the patient does not have neck-related complaints, we believe that forced extension of the neck with the head supported (as opposed to slight extension) will ease the detachment of particles from the cupula and channel wall, aided by the increased effect of gravity. This movement will also prevent reverse migration caused by insufficient extension during passage from the first position to the second position. We attribute our high success rates (approaching 99%) to the achievement of sufficient extension and to our waiting time of 3 minutes.

In conclusion, postural restriction enhances the therapeutic effect of the CRP in the treatment of posterior SCC BPPV and should be applied in resistant cases. The CRP should be performed even among patients diagnosed as having BPPV without nystagmus. The long-term efficacy of postural restriction in preventing BPPV recurrence has not been demonstrated.

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REFERENCES