

# Treatment of Benign Paroxysmal Positional Vertigo: Necessity of Postmaneuver Patient Restrictions

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## Abstract

Benign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo, resulting from migration of otoconia into the semicircular canals. Several treatment methods involving positioning maneuvers that return the otoconia to the utricle have been described. Following treatment, most patients are provided with a variety of activity restrictions. Previous studies suggest that, overall, BPPV treatment may be successful without these restrictions. The purpose of this study was to determine the necessity of postmaneuver restrictions using an experimental and control group with participants matched for age, gender, involved ear, and symptoms. A canalith repositioning maneuver was used to treat the BPPV. During postmaneuver instruction, the 21 participants assigned to the restricted group were provided with typical activity restrictions. Twenty-one participants assigned to the nonrestricted group were given no postmaneuver restrictions. Only one participant in the restricted group and two participants in the nonrestricted group were not clear at the one-week follow-up appointment. Results indicated that postmaneuver restrictions do not improve treatment efficacy.

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

**Abbreviations:** BPPV = benign paroxysmal positional vertigo; CRM = canalith repositioning maneuver; SLM = Semont liberatory maneuver

## Sumario

El vértigo posicional paroxístico benigno (BPPV) es la causa más común de vértigo, producido por la migración de las otoconias a los canales semicirculares. Se han descrito varios métodos de tratamiento, que involucran maniobras de re-posicionamiento que buscan devolver las otoconias al utrículo. Después del tratamiento, la mayoría de los pacientes reciben instrucción sobre una variedad de restricciones en su actividad. Existen estudios previos que sugieren, globalmente, que el tratamiento del BPPV puede tener éxito sin estas restricciones. El propósito de este estudio fue determinar la necesidad de estas restricciones post-tratamiento, utilizando un grupo experimental y uno control, con participantes agrupados por edad, género, oído involucrado y síntomas. Se utilizó una maniobra de re-posicionamiento canalicular para tratar el BPPV. En la instrucción post-maniobra, los 21 participantes del grupo con restricciones, fueron instruidos sobre las típicas restricciones de actividad.

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Los veintidós participantes del grupo sin restricciones no recibieron instrucciones restrictivas posteriores a la maniobra. Sólo un participante en el grupo restringido y dos participantes en el grupo no restringido no estaban recuperados en la cita de seguimiento una semana después. Los resultados indican que las restricciones posteriores a la maniobra no mejoran la eficacia del tratamiento.

**Palabras Clave:** Vértigo posicional paroxístico benigno, maniobra de reposición canalicular, otoconia

**Abreviaturas:** BPPV = vértigo posicional paroxístico benigno; CRM = maniobra de reposición canalicular; SLM = maniobra liberadora de Semont

**B**enign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo in patients with vestibular disorders (Bath et al, 2000; Gans, 2000). This pathology is characterized by brief episodes of intense positional vertigo and rotary nystagmus. The symptoms are caused by an abnormal interaction of the semicircular canal cupula and displaced otoconia from the utricle. The presence of the displaced otoconia causes the involved canal to become sensitive to changes in head position in the plane of the involved canal. Although BPPV has been reported in all three semicircular canals, approximately 90% of BPPV cases involve the posterior canal, given its location inferior to the utricle (Gans, 2000; Korres et al, 2002).

There is no pharmacological treatment for BPPV. Fortunately, treatment maneuvers have been developed and are used with a high rate of success (Semont et al, 1988; Epley, 1992). The Semont liberatory maneuver (SLM) requires movement of the patient en bloc. This involves a series of briskly performed position changes and requires a good degree of patient mobility (Semont et al, 1988). Unfortunately, the SLM is contraindicated for patients with orthopedic issues such as recent hip replacements or hip fractures (Gans, 2000).

The canalith repositioning maneuver (CRM), modified from Epley (1992), is also a successful method of treating BPPV. This maneuver requires only limited movement of

the patient including head rotation and rolling to one side. Consequently, any physical limitations of the patient are less likely a factor in this treatment method, providing maximum comfort for the patient (Epley, 1992). For this reason, the CRM and its variations tend to be a preferred method of treatment for clinicians. Although some patients require multiple treatments for absolute relief of BPPV symptoms, both the SLM and the CRM have been found to have a success rate of 80% after one treatment and greater than 90% after two treatments (Gans, 2000; Nunez et al, 2000).

Part of the treatment protocol for BPPV traditionally includes postmaneuver restrictions. An extensive variety of restrictions is recommended and used by many individual labs in an effort to prevent the otoconial debris from returning to the semicircular canals following treatment (Nuti et al, 2000; Cohen and Kimball, 2004). These restrictions include avoidance of quick head movements, keeping the head erect, sleeping at a 45° angle, refraining from lying on the pathologic side, and even wearing a cervical collar to prevent certain head movements (Lynn et al, 1995). In various clinics, patients are instructed to abide by these restrictions 24 to 48 hours or even up to a week following treatment. Though the intent of postmaneuver prohibitions seems reasonable, such extensive restrictions may not be feasible. In some instances, due to patient

neck size, utilization of a cervical collar may not be possible. Cohen and Kimball (2004) point out that patients with significant cardiac, respiratory, or orthopedic problems (i.e., scoliosis) may be unable to sleep upright. Furthermore, there is evidence that these limitations may not even be necessary (Massoud and Ireland, 1996; Nuti et al, 2000; Marciano and Marcelli, 2002; Cohen and Kimball, 2004). Details on the previous studies investigating postmaneuver restrictions are provided in Table 1.

Massoud and Ireland (1996) investigated the effects of postmaneuver instructions on treatment efficacy using the SLM and a modification of the CRM based on Epley (1992) and Parnes and Price-Jones (1993). Ninety-six participants were randomly assigned to one of four possible groups, two treatment (SLM or CRM) groups with postmaneuver restrictions or two treatment (SLM or CRM) groups without postmaneuver restrictions. The groups were equivalent in terms of age, gender, and duration of symptoms. No measure of intensity of symptoms was provided. Both treatments were equally successful, and there was no effect of postmaneuver restrictions. Since no measure of the intensity of participant symptoms was provided, it is impossible to determine the interaction of this variable with treatment success.

A similar finding to Massoud and Ireland (1996) was reported by Nuti et al (2000).

Fifty of their 56 (89%) patients were successfully treated using the SLM with no postmaneuver restrictions. However, the study lacked a matched, restricted control group.

Marciano and Marcelli (2002) found no difference in the treatment outcomes of restricted versus nonrestricted groups of participants. The authors state that the two groups were homogeneous for the factors of number, gender, and age; however, the reader is only provided with this information for 810 initial patients diagnosed with BPPV. The reader is not provided with this information for the 200 subjects who actually completed the study. Further, there was no attempt to quantify the intensity of the symptoms of the participant groups.

Cohen and Kimball (2004) attempted to provide more control over factors not considered by previous investigations. The authors randomly assigned 76 participants to receive treatment only (Epley), augmented treatment only (Epley with additional head rotation), and treatment (Epley) with restrictions. The authors asked each participant to rate the intensity of their vertigo immediately after testing by Dix-Hallpike maneuver. Although information regarding total number of participants, age, and gender is provided prior to grouping, none of this data is available to the reader for the three groups. The authors reported no clinically meaningful differences among the

**Table 1. Characteristics of Previous Studies and the Current Study Investigating the Necessity of Postmaneuver Activity Restrictions on Treatment Outcome**

Study	Treatment	Restrictions Tested	Control Group
Massoud and Ireland (1996)	SLM and CRM	1. Sleep in sitting position 2. Sleep on uninvolved side (all participants instructed to avoid quick head movements)	Yes
Nuti et al (2000)	SLM	No restrictions provided	No
Marciano and Marcelli (2002)	Modified Epley (CRM), SLM for some participants	1. Sleep in semi-sitting position 2. No forward or backward head movements	Yes
Cohen and Kimball (2004)	Epley or Augmented Epley	1. Sleep on uninvolved side 2. Sleep propped on pillows 3. Keep head upright while sleeping	Yes
Current Study	CRM	1. Avoid bending over or any inverting of the head 2. Sleep semi-inclined at an angle of approximately 30° 3. Avoid sleeping on the affected side	Yes

three groups for intensity of vertigo, age, etiology of sinus disease, cold or influenza, trauma, and tobacco use. Interestingly, the authors observed what they described as “weakly significantly better responses” ( $p = 0.05$ ) for the augmented Epley group (no restrictions) than for the group that received restrictions for posturography measures. Specifically, the group with no restrictions exhibited better posturography performance than the group with restrictions. This result suggests a negative consequence of using restrictions, an effect that has not previously been reported and one that Cohen and Kimball (2004) did not support in the discussion of their findings.

It is important to determine conclusively if postmaneuver restrictions affect treatment outcome. If restrictions are unnecessary, patients may be allowed immediate resumption of normal daily activities. Most studies suggest that these restrictions do not improve treatment outcome; however, some of these reports provide little control over certain factors that may influence the results of the study such as age, gender, intensity of symptoms, and so forth. In contrast, one study suggested a disadvantage for the use of restrictions (Cohen and Kimball, 2004). Therefore, the purpose of this study was to determine the necessity of postmaneuver restrictions on BPPV patients treated with the CRM. Specifically, treatment efficacy was assessed in two closely matched groups of BPPV patients, one group given typical postmaneuver activity restrictions and the other group given no restrictions.

## METHOD

### Participants

All participants were patients referred to the American Institute of Balance (AIB) in Seminole, Florida, for vestibular and equilibrium evaluation. Informed consent was obtained from each patient prior to inclusion in the study. Participants were included in the study if they had a diagnosis of unilateral posterior canal BPPV. Diagnosis was made with a positive result on the modified Dix-Hallpike test during vestibular evaluation. In the modified Dix-Hallpike, the examiner is positioned standing behind the patient, rather than to the side as is done in

the traditional Dix-Hallpike. The examiner turns the head of the patient slightly toward the test ear and supports the patient's neck and back. This allows the examiner to sit while the patient is lowered into the provoking supine position with the neck of the patient slightly hyperextended and supported while their head is off the examination table. In this position, the examiner has a clear view of the eyes of the patient. This modification to the traditional Dix-Hallpike test results in enhanced ease of performance of the maneuver for both the patient and the examiner. See Roberts et al (2005) for a description of this modification.

The result was considered positive if there was a paroxysmal, up-beating rotary nystagmus toward the affected ear upon administration of the maneuver, along with an onset latency and associated subjective vertigo. An up-beating, rotary nystagmus is expected in cases of posterior canal BPPV given the connection of the canal to the superior oblique and inferior rectus extraocular muscles (Honrubia and Hoffman, 1997). The nystagmus will beat toward the involved ear, which is the ear being tested with the modified Dix-Hallpike maneuver. Patients with bilateral, horizontal, or anterior canal BPPV were excluded from the study.

Forty-two patients meeting these criteria were randomly assigned to one of two groups, the group receiving typical postmaneuver restrictions or the group receiving no restrictions. Special care was taken to ensure that the two groups were equivalent on several parameters (age, gender, involved ear, etc.). In some instances, it was necessary to exclude patients from the study who were willing to participate to avoid compromising the equivalence of the two groups. Specific details about the groups are shown in Table 2. The restricted group ranged in age from 30 to 88 years (mean: 67.9) and consisted of 14 women and 7 men. The nonrestricted group ranged in age from 40 to 83 years (mean: 64.5) and also consisted of 14 women and 7 men. The involved ear was the right for 14 participants in each group. Twelve participants in the restricted group had a history of prior episodes of BPPV, while eight participants in the nonrestricted group had this characteristic.

It was extremely important for both groups to have similar presentation of symptoms so that any differences in treatment outcome could be attributed to

presence or absence of postmaneuver restrictions. For this reason, onset latency, duration, and subjective intensity of nystagmus were analyzed for both groups of participants during treatment.

### Instrumentation

Patient eye movement during diagnosis or confirmation of BPPV was recorded via Synapsys video goggles, comprised of a modified Bolle mask fitted with binocular infrared recording cameras. Recordings were transmitted via a Black and White Quad Processor, high resolution and real time, and recorded by a General Electric VHS Advances Video System, Model 13TVR72. Clinician and patient movement were also recorded via scenic camera JVC Videomovie compact VHS recorder, Model GR-AX808.

### Procedures

All participants were identified or confirmed as having BPPV following the standard assessment protocol at AIB, or by one of its affiliated otolaryngologists. A modified Dix-Hallpike was administered to all patients prior to treatment. Once the presence of posterior canal BPPV was confirmed, the patient returned within one week for treatment with the CRM. Experienced audiologists performed all treatments and follow-up assessments.

The CRM employed in the current study was similar to that utilized by Fung and Hall (1996) and described by Gans and Harrington-Gans (2002). See Figure 1 for a schematic of each position. In Position 1 of the CRM, the participant's symptoms were provoked. If symptoms did not provoke, the patient was excluded from the study. This position was identical to the modified Dix-Hallpike test. The patient was positioned supine, with the neck hyperextended and the

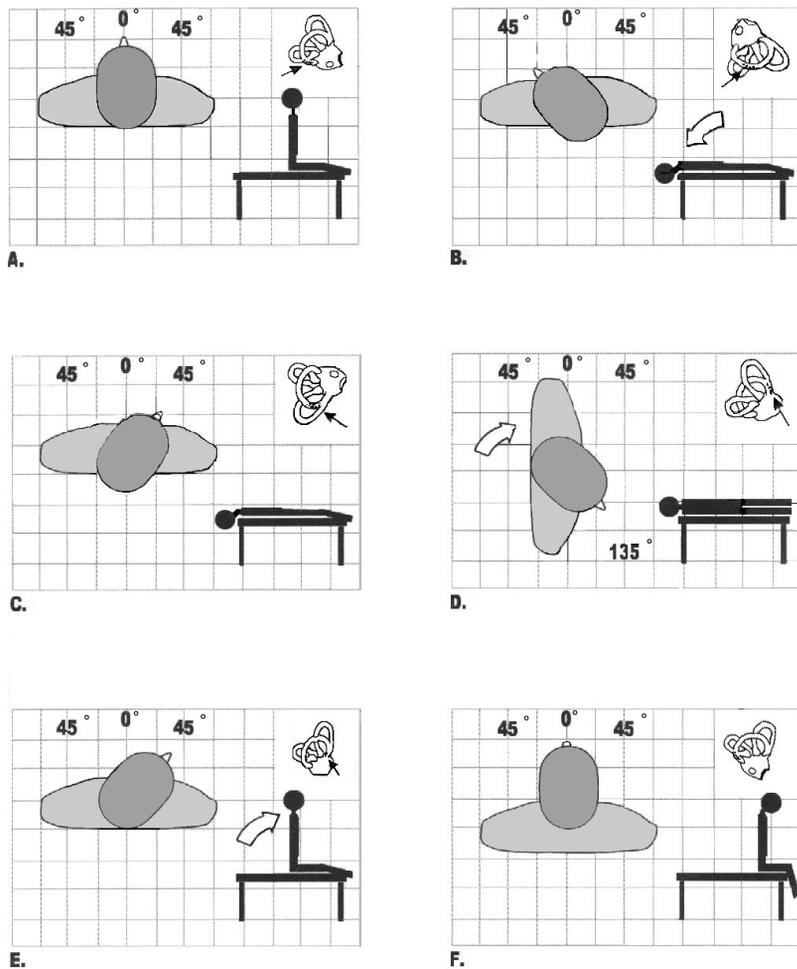
affected ear down while the clinician supported the head and neck. The patient was kept in that position for three minutes to allow the otoconia to move distal to the ampulla. In Position 2, the head was rotated toward the opposite ear with the involved ear remaining positioned upward for three minutes. This allowed the otoconia material to settle at the common crus. In the third position, the patient was rolled onto the uninvolved side and kept in this position for three minutes. Finally, the patient was seated upright. Following treatment with the CRM, the patient was rechecked with modified Dix-Hallpike positioning. This was performed to differentially diagnose canalithiasis versus cupulolithiasis variants of BPPV based on fatigability of symptoms, as well as to test for successful clearance of the debris.

During recheck using the modified Dix-Hallpike, only one participant, who was assigned to the nonrestricted group, continued to have symptoms following the initial treatment. This participant was retreated using the CRM as described above with the one exception, that the time interval that the patient remained in each position was reduced to only one minute. The remaining 41 subjects were without vertigo or nystagmus during the recheck immediately following the treatment.

During postmaneuver instruction, the restricted group was provided a standard cervical collar, along with written and verbal instructions including the following: (1) avoid bending over or any inverting of the head for the next 24 hours (the collar was used to aid in compliance of this restriction); (2) sleep semi-inclined at an angle of approximately 30° the first night; and (3) avoid sleeping on the affected side for the next three to four nights. This information is provided for comparison to the previous studies in Table 1. The nonrestricted group was given no postmaneuver restrictions.

**Table 2. Participant Characteristics for Each Group**

Factor	Restricted Group	Nonrestricted Group
Age	67.9	64.5
Male	7	7
Female	14	14
<b>Affected Ear</b>		
Right	14	14
Left	7	7
Prior BPPV Episode	12	8



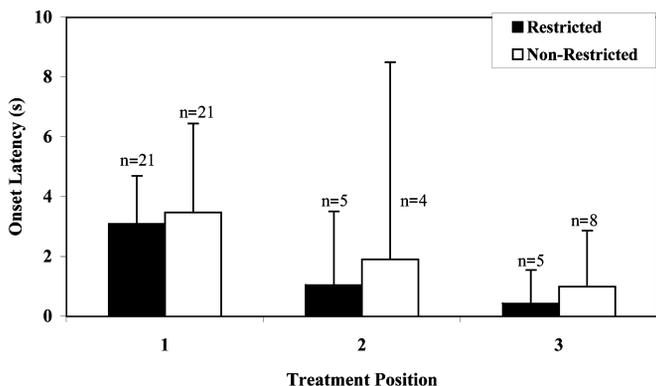
**Figure 1.** Canalith repositioning maneuver positioning sequence is shown for hypothetical left posterior canal benign paroxysmal positional vertigo. (A) Patient is in primary position seated and facing forward. (B) Position 1: Body reclined and head placed over end of table, extended, and rotated 45° to left. Otolith debris moves to center of posterior canal. (C) Position 2: Head rotated 90° to right (45° right of center) and kept well extended. Otolith debris moves to common crus. (D) Position 3: Head and body rotated 90° to right onto right shoulder (head 135° right of supine). Otolith debris traverses common crus. (E) Patient is returned to primary position. Body brought to seated position with head maintained at 45° right of center. Otolith debris enters utricle. (F) Head turned forward to center position with chin down at about 20°. (Adapted with permission from Gans, 1996.)

All patients returned one week following the initial treatment, and the modified Dix-Hallpike was re-administered with participant report provided. Participants were also tested in the side-lying position to check for horizontal canal migration of otoconial debris. During the side-lying procedure, the patient is laid on his or her side, with the head parallel to the ground. It is then that symptoms associated with horizontal canal BPPV become provoked. Symptoms of horizontal canal BPPV include intense vertigo and horizontal nystagmus in the direction of the affected ear. Checking

for this is necessary as migration of otoconia debris to the horizontal canal can occur during treatment for posterior canal BPPV. It is also possible that horizontal canal BPPV is present and masked by symptoms of the posterior canal BPPV in some cases.

If no symptoms were present or provoked, the patient no longer needed to be seen. If symptoms persisted, the maneuver was to be repeated and the participant, regardless of group, was to be provided with postmaneuver restrictions and seen again in one week.

During each position of the treatment,



**Figure 2.** Nystagmus onset latency during the three treatment positions is shown for each group. Error bars represent standard error of the mean.

latency to onset and symptom duration was measured. Participants also provided a subjective report of the intensity of their vertigo using a scale from 0 to 10. A rating of 0 indicated no subjective vertigo, and a rating of 10 indicated the greatest magnitude of vertigo. The examiner, via video-oculography, also determined presence or absence of nystagmus.

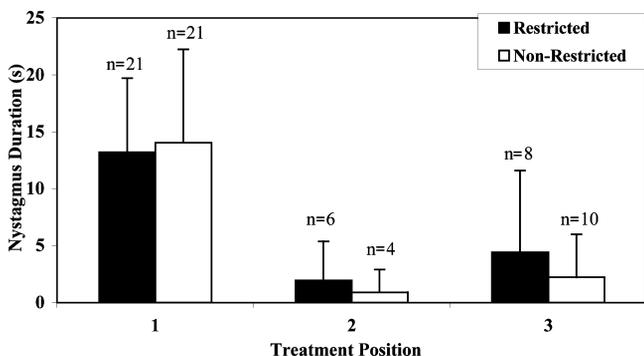
**RESULTS**

**A** one-way Analysis-of-Variance (ANOVA) with the factor group indicated no significant difference in age between the two groups ( $F[1,40] = 0.661, p = 0.42$ ). The data from the factors of nystagmus onset latency, nystagmus duration, and intensity rating were averaged and examined for trends. This

analysis was necessary to ensure that both participant groups had similar presentation of symptoms during treatment. In that way, any group differences observed at the follow-up appointment would be attributed to postmaneuver restrictions since that was the only factor on which the participants differed. Data were collected on these factors for each of the three positions of the CRM treatment.

Onset latency of nystagmus is shown for both groups as a function of treatment position in Figure 2. All patients in this study presented with nystagmus in position one of the maneuver. Onset latency for the restricted group ranged from 1 to 9 sec (average = 3.5 sec). Data for the unrestricted group ranged from 1 to 9 sec (average = 3.1 sec). For Position 2, four participants in the nonrestricted group experienced nystagmus (average = 1.9 sec), and five participants in the restricted group experienced nystagmus (average = 1.1 sec). For Position 3, eight participants in the nonrestricted group and five in the restricted group experienced nystagmus. Onset latencies averaged 1 sec for the nonrestricted group and 0.43 sec for the restricted group.

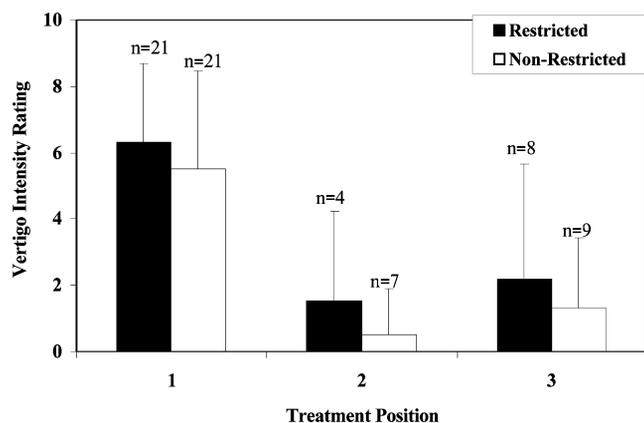
These data were analyzed with a two-way ANOVA with one between factor (group) and one within factor (position). Results indicated a significant effect of position ( $F[2,80] = 6.57, p < 0.01$ ). There was no effect of group ( $F[1,40] = 1.08, p = 0.30$ ) and no interaction ( $F[2,80] = 0.05, p = 0.95$ ). Tukey Honest Significant Difference (HSD) post hoc analysis indicated that onset latency of Position 1 was significantly longer than for Position 2 or Position 3 ( $p < 0.05$ ), but there was no difference in onset latency between Position 2 and Position 3 ( $p > 0.05$ ). These results indicated that onset latency of nystagmus decreased from the first position to the second, but no further decrease was observed.



**Figure 3.** Nystagmus duration during the three treatment positions is shown for each group. Error bars represent standard error of the mean.

Duration of nystagmus is shown for each group and each position in Figure 3. Duration of nystagmus for the restricted group ranged from 2 to 27 sec (average = 13.2 sec). Data for the nonrestricted group ranged from 3 to 39 sec (average = 14.1 sec). For Position 2, average duration was 2 sec for the restricted group and 0.9 sec for the nonrestricted group. For Position 3, average duration was 4.4 sec for the restricted group and 2.2 sec for the nonrestricted group.

These data were also analyzed with a two-way ANOVA with one between factor (group) and one within factor (position).



**Figure 4.** Vertigo intensity rating is shown during the three treatment positions for each group. Error bars represent standard error of the mean.

Results indicated a significant effect of position ( $F[2,80] = 74.90, p < 0.001$ ). There was no effect of group ( $F[1,40] = 0.42, p = 0.52$ ) and no interaction ( $F[2,80] = 1.03, p = 0.36$ ). Post hoc testing (Tukey HSD) indicated that the duration of the nystagmus elicited with Position 1 was significantly longer than the nystagmus durations elicited by Positions 2 or 3 ( $p < 0.001$ ), but there was no difference in duration between Position 2 and Position 3 ( $p > 0.05$ ). These results indicated that duration of nystagmus decreased from the first position to the second, but no further decrease was observed.

Finally, each subject was asked to rate the intensity of the vertigo during each position of treatment from 0 to 10. These intensity ratings are summarized as a function of treatment position in Figure 4 for both groups. Intensity ratings in Position 1 for the restricted group ranged from 2 to 10 (average = 6.3). Ratings for the nonrestricted group ranged from 1 to 10 (average = 5.5). For Position 2, average subjective rating of intensity was 1.5 for the restricted group and 0.5 for the nonrestricted group. For Position 3, the restricted group ratings averaged 2.2 and the nonrestricted group ratings averaged 1.2.

As for onset latency and duration of nystagmus, the intensity rating data were also analyzed with a two-way ANOVA with one between factor (group) and one within factor (position). Results indicated a significant effect of position ( $F[2,80] = 49.89, p < .001$ ). There was no effect of group ( $F[1,40] = 3.29, p = 0.08$ ) and no interaction ( $F[2,80] = 0.03, p = 0.97$ ). Post hoc testing (Tukey

HSD) indicated that the intensity of the nystagmus elicited with Position 1 was significantly greater than the intensity of the nystagmus elicited by Positions 2 or 3 ( $p < 0.001$ ), but there was no difference between Position 2 and Position 3 ( $p > 0.05$ ). These results indicated that the intensity of the nystagmus decreased from the first position to the second, but no further decrease was observed.

The data regarding onset latency, nystagmus duration, and nystagmus intensity indicate that both groups were equivalent on these factors during treatment. The groups were also equivalent in terms of gender, age, and involved ear, and similar in prior occurrence of BPPV. Any subsequent differences should have been attributable to the use of restrictions.

At the one-week posttreatment follow-up, all participants were checked with the modified Dix-Hallpike. Only one participant in the restricted group and two participants in the nonrestricted group had symptoms of posterior canal BPPV when placed in this provoking position. All remaining participants were free of vertigo and/or nystagmus associated with posterior canal BPPV. This indicated that the otoconia debris was successfully removed from the posterior canal in most cases regardless of group. To determine if the two groups of participants differed significantly in treatment outcome, a chi-square analysis ( $\chi^2$ ) was performed. Results indicated there was no significant difference between the groups in terms of treatment outcome ( $\chi^2 = 0.36, p > 0.05$ ).

Two of the participants in the restricted group continued to report vertigo symptoms at the follow-up appointment. Side-lying positional testing indicated horizontal canal BPPV for both of these participants. One participant was male and presented with a right horizontal canal BPPV, and the second was a female participant with left horizontal canal BPPV. It is believed that the male participant experienced a horizontal canal migration during treatment of the posterior-canal BPPV. During Position 1, the participant raised his head, which presumably allowed the otoconia to migrate into the right horizontal canal. In the second case, it was suspected that the horizontal canal BPPV was present before initial treatment but was masked by the severity of the posterior canal nystagmus.

## DISCUSSION

All participants involved with this study exhibited typical onset latencies during the treatment positions (Gans, 2000). These were longer for the first position, and there was no difference in onset latency between the second and third positions. Duration of nystagmus for the participants in this study was in agreement with prior studies and averaged 6.13 sec (Gans, 2000). Further, duration of nystagmus was longest during Position 1 and decreased significantly by the second position. Intensity of the symptoms was also considered. This was rated as strongest for position one and decreased significantly for the second position. There was no difference in intensity for Positions 2 and 3.

Given the similarity of the groups on several factors (age, gender, involved ear, and prior history of BPPV), along with the fact that there was no difference between the two groups on any of the symptom characteristics assessed during treatment, outcome at the follow-up appointment would be expected to be influenced only by the postmaneuver restrictions or lack of restrictions. The presence or absence of symptoms after modified Dix-Hallpike positioning at follow-up was assessed. Only three participants (one in the restricted group and two in the nonrestricted group) continued to present with posterior canal BPPV at the one-week posttreatment follow-up appointment. This indicated an overall success rate of 92.8% collapsed on group. Statistical analysis revealed no difference in treatment outcome between the two groups leading to an interpretation that postmaneuver restrictions do not add to the success of the treatment. This finding is in agreement with previous work for adaptations of the CRM (Massoud and Ireland, 1996; Marciano and Marcelli, 2002; Cohen and Kimball, 2004) and also the SLM (Massoud and Ireland, 1996; Nuti et al, 2000).

It is noteworthy that two patients presented with symptoms of horizontal canal BPPV at the follow-up appointment. Both participants were in the group that received restrictions. One participant's horizontal canal BPPV was most likely attributable to migration of otoconia debris during the treatment maneuver. This is certainly a possibility that all patients are informed of

prior to treatment. The second participant is thought to have had the horizontal canal BPPV, but the characteristic horizontal nystagmus was masked by the stronger rotary-torsional nystagmus of the posterior canal BPPV. Once the posterior canal BPPV was cleared, the nystagmus of the horizontal canal BPPV became apparent. If any of the participants in the group with no restrictions had presented with horizontal canal BPPV at follow-up, it may have been possible to relate the result to a lack of restrictions. It is unlikely that the use of restrictions caused the horizontal canal involvement.

As there was no effect of postmaneuver treatment restrictions, this may indicate that the success of the treatment is explained by dissolution of otoconia debris in the endolymphatic fluid of the utricle. As reported by Zucca et al (1998), otoconial debris of the frog is able to dissolve in typically calcium deficient endolymph over a period of 20 hours. As long as calcium levels are normal, dissolution time should be rapid. This would result in amelioration of physiological symptoms. In other words, if the debris dissolves when returned to the endolymph of the utricle, it cannot be redeposited into the canals. This occurs regardless of the presence or absence of postmaneuver restrictions. The results observed in the current study appear to be consistent with the results of Zucca et al (1998).

## SUMMARY AND CONCLUSIONS

Several studies have indicated that the use of postmaneuver activity restrictions is unnecessary to improve outcome efficacy for treatment of BPPV (e.g., Massoud and Ireland, 1996; Nuti et al, 2000; Marciano and Marcelli, 2002). Unfortunately, these studies either did not use a control group (Nuti et al, 2000) or did not define potential differences between their experimental group and control group (Massoud and Ireland, 1996; Marciano and Marcelli, 2002). The one study that did attempt to control most of the potentially confounding variables found a possible disadvantage as measured by posturography for using postmaneuver restrictions (Cohen and Kimball, 2004). The purpose of this investigation was to control factors such as gender, age, and symptoms in an effort to determine if postmaneuver restrictions are necessary for BPPV treatment success. A

group of participants given restrictions served as the control group, and a group without restrictions was the experimental group. Participants of both groups received treatment with the CRM.

Several factors were analyzed to ensure homogeneity of the two participant groups. These included age, gender, history of recurrent BPPV, and involved ear. To determine if the two groups were similar in terms of symptoms, latency of nystagmus onset, nystagmus duration, and intensity rating were all assessed for each treatment position. The results of the current study suggest postmaneuver restrictions are not necessary for successful outcome using the CRM to treat posterior-canal BPPV. The significance of this finding is that patients may return to normal daily activities immediately following treatment.

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