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Treatment of Benign Paroxysmalvertigo: Necessity of Post-Maneuver Prohibition

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TREATMENT OF BENIGN PAROXYSMALVERTIGO: NECESSITY OF POST-MANEUVER PATIENT PROHIBITION

BY

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ABSTRACT

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Benign paroxysmal positional vertigo (BPPV), characterized by a history of brief attacks of intense positional vertigo and rotary nystagmus, results from otoconial migration into the semicircular canals, making the sensory structures in the canal gravity sensitive. Treatment methods include positioning maneuvers, which return the otoconia back into the otolith, and typically include a variety of activity limitations for the subsequent 24-48 hours. Previous studies suggest BPPV treatment can be successful without any limitations of the patient post-therapy. The purpose of this study was to determine the necessity of post-maneuver restrictions on BPPV patients treated with the Canalith Repositioning Maneuver. Twenty participants were identified as having BPPV of the posterior canal and treated with the Canalith Repositioning Maneuver. During post-maneuver instruction, the ten participants assigned to the restricted group were provided with typical instructions. Ten participants assigned to the non-restricted group were given no post-maneuver restrictions. At the one-week post-treatment follow-up, all patients were free of vertigo and/or nystagmus. Results indicated that given two groups of subjects matched for age, gender, and symptoms, post-maneuver restrictions are not necessary for successful outcome using the CRM to treat posterior-canal BPPV.

INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is characterized by a history of brief attacks of intense positional vertigo and rotary nystagmus. It is reported to be the most common manifestation of vertigo in patients with vestibular disorders (Gans, 2000). Schuknecht (1962) was the first to describe the temporal bones of patients with BPPV symptoms. He reported the presence of calcium carbonate crystal deposits, (i.e. otoconia), adhering to the gelatinous cupula located in the ampulla of the posterior semicircular canal of symptomatic patients (Dornhoffer & Colvin, 2000). Over 90% of BPPV cases involve this canal (Gans, 2000). This is due to the anatomical position of the canal as inferior to the otolith organs, causing the posterior semicircular canal to serve as a reservoir for the debris. Today, this condition is known as cupulolithiasis, or BPPV of the cupula (Herdman & Tusa, 1996). Schuknecht (1969) theorized that the otoconia detach themselves from the otolith by spontaneous degeneration or head trauma. The particles then travel toward and attach to the cupula.

In addition to cupulolithiasis, Hall (1979) later postulated that the otoconia may not only adhere to the cupula, but may also become dislodged and present as freely floating debris in the posterior canal. The debris would make the canal sensitive to gravity. This condition is known canalithiasis (Fung & Hall, 1996). Cupulolithiasis is believed to account for only a small portion of all BPPV cases (5%), while canalithiasis is thought to be responsible for the majority (95%) (Gans, 2000).

Despite the potential for different pathological processes responsible for BPPV, all patients report a similar combination of symptoms. The most prevalent complaint is intense vertigo. The patient reports a sensation of spinning or falling associated with change in head position. Onset of this sensation is from one to ten seconds, and the symptoms will be transient, persisting less than one minute. The duration of symptoms may seem longer to the patient due to the extreme disorientation (Gans, 2000). The most common form of BPPV, posterior canal BPPV (PC-BPPV), will present with upward beating rotary torsional nystagmus that beats toward the undermost ear (Nunez, Cass, &Furman, 2000). There is also a fatigability of these symptoms for canalithiasis that is not found for cupulolithiasis (Hall, 1979). The patient will most likely be able to isolate the affected ear, as certain common head and body positions involving the affected ear will provoke symptoms. The patient may present with no other audiological symptoms or complaints, as BPPV can occur in isolation from other pathologies. However, BPPV may occur secondary to pre-existing conditions and must be separated from these through case history report and a complete diagnostic evaluation (Herdman, Blatt, & Schubert, 2000). In younger patients, BPPV is often associated with a history of Meniere's Disease, vestibular neuritis or labyrinthitis (Dornhoffer & Colvin, 2000).

There is no pharmacological treatment for BPPV, and vestibular suppressants only provide temporary relief from the associated nausea. Over the years, exercise protocols have been designed to ameliorate symptoms. However, many of these treatments did not take into consideration the canal that

was involved nor did they differentiate between canalithiasis and cupulolithiasis. It was not until the work of Epley (1980), of Semont (1988), and of Parnes and Price-Jones (1993), that these maneuvers were defined for a high success rate. The Semont Liberatory Maneuver (Semont, 1988) is a successful treatment method for cupulolithiasis or canalithiasis. It requires movement of the patient in mass; involving a series of briskly performed position changes and requiring a good degree of patient mobility. It is contraindicated for those patients with recent hip replacements or hip fractures (Gans, 2000).

The Canalith Repositioning Maneuver (CRM), as described by Epley (1980) and Parnes and Price-Jones (1993) is also a successful method of treating cupulolithiasis or canalithiasis. It is often more comfortable for patients and tends to be the preferred method of treatment. This maneuver requires only nominal movement of the patient, involving head movement 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 clinician and patient (Epley, 1992). However, some research suggests this method necessitates multiple maneuvers to cure symptoms, which is in contrast to the Semont Liberatory Maneuver (Nuti, Nati, & Passali, 2000). Nevertheless, Nunez, Cass and Furman (2000) report complete resolution of symptoms in over 91% of patients after only 1 or 2 treatment sessions of the CRM. Although some patients require multiple treatments for absolute relief of symptoms, both of these maneuvers have been found to have a success rate of greater than 90% after two treatments (Gans, 2000; Nunez, Cass, &Furman, 2000).

Part of the treatment protocol for BPPV includes post-maneuver prohibitions. An extensive variety of patient limitations is recommended and utilized to prevent the loose debris from returning to the semicircular canals following treatment. Such instructions may include remaining supine, keeping the head erect, sleeping at a 45º angle, refraining from lying on the pathologic side, and even wearing a cervical collar to prevent head movements (Nuti, Natu, & Passali, 2000). Frequently, patients are instructed to abide by these restrictions 24 - 48 hours or even up to a week following treatment. Though the intent of post-maneuver prohibitions seems valid, such extensive restrictions may not be feasible. In some instances, due to patient neck size, utilization of a cervical collar may not even be possible. Further, there is evidence that these limitations may not even be necessary.

Zucca, Valli, Valli, Perin, & Mira (1998) provided a new theory regarding resolution of BPPV symptoms. They postulated that dissolution of otoconia in endolymphatic fluid was a result of calcium ion content of the fluid. When studying the otolith debris of frogs, they found that, when calcium levels were high, it took longer for the calcium carbonate crystals to dissolve. Under normal circumstances, Zucca et al. (1998) discovered that the material would dissolve completely in the calcium deficient endolymph in less than 24 hours. This is corroborated by a study conducted by Nuti et al. (2000), who treated 52 BPPV patients using the Semont Liberatory Maneuver, giving no post-maneuver restrictions. All patients were free of symptoms, suggesting the otoconia debris did not re-enter the canals, regardless of patient activity or movement. This study

suggests that BPPV treatment can be successful without any limitations of the patient post-therapy. This is important because it would allow immediate resumption of normal daily life activities for a once debilitated patient.

Given that the Canalith Repositioning Maneuver is often the preferred method of treatment of BPPV (attributed to its comfort and ease of administration), it is of particular interest to establish if results similar to Nuti et al. (2000) would be found using this treatment method. Therefore, the purpose of this study was to determine the necessity of post-maneuver restrictions on BPPV patients treated with the Canalith Repositioning Maneuver. Specifically, this study addressed the question of whether treatment efficacy is affected in two groups of BPPV patients, one group given typical post-maneuver activity limitations and the other group given no restrictions.

METHODS

Participants

All participants were patients referred to The American Institute of Balance (AIB) in Seminole, Florida, for vestibular function testing. Participants were included in the study if they had a diagnosis of posterior canal BPPV. Diagnosis was made via case history reports and a positive, modified Dix-Hallpike test during the vestibular evaluation. The Dix-Hallpike test was considered positive if there was presence of paroxysmal, up-beating rotary nystagmus toward the affected ear upon administration of the maneuver. Other classic findings to identify BPPV also had to be present and included an onset latency following

positioning with associated subjective vertigo. Any patients with bilateral, horizontal, or anterior canal BPPV were excluded from the study.

Twenty patients meeting these criteria were assigned to one of two groups, the group receiving typical post-maneuver restrictions and the group receiving no restrictions. Subject groups were matched for age and gender. Specific details about the subject groups are shown in Table 1. The restricted group ranged in age from 30 – 88 years (mean: 67.6) and consisted of 6 women and 4 men. The non-restricted group ranged in age from 50 - 83 years (mean: 67.8) and also consisted of 6 women and 4 men. The involved ear was the right in most cases and the two groups were very similar on this parameter as well. Six participants in the restricted group had a history of prior episodes of BPPV, while four participants in the non-restricted group had this characteristic. It was extremely important that both groups have similar presentation of symptoms so that any differences in treatment outcome could be attributed to presence or absence of post-maneuver restrictions. For this reason, onset latency, duration and subjective intensity of nystagmus were analyzed for both groups of participants during treatment.

Table 1. Participant characteristics are shown for each group.

FACTOR	RESTRICTED GROUP	NON-RESTRICTED GROUP
Age	**67.6**	**67.8**
Male	**4**	**4**
Female	**6**	**6**
Affected Ear		
Right	**8**	**7**
Left	**2**	**3**
Prior BPPV Episode	**6**	**4**

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 dual 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.

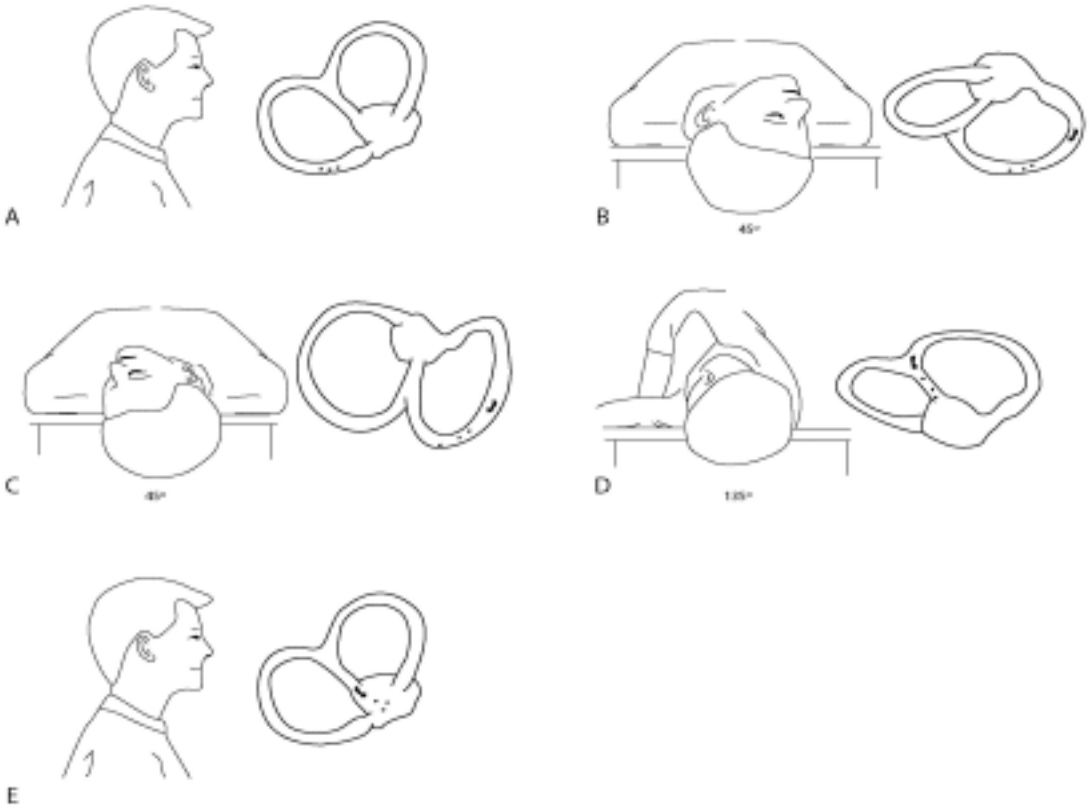
Procedures

All participants were identified or confirmed as having BPPV following the standard assessment protocol at AIB, or by its affiliated ENT physicians. This protocol included case history, audiological and VNG testing. A modified Dix-Hallpike was administered for all patients prior to treatment. Once the presence of PC-BPPV was confirmed, the patient returned within one week for treatment with the Canalith Repositioning Maneuver. All treatments were performed by one of two experienced audiologists, regardless of experimental group.

The Canalith Repositioning Maneuver was similar to that utilized by Fung and Hall (1996) and described by Gans (2002). See Figure 1 for a schematic of each position. In position one of the CRM, the participant's symptoms and vertigo were provoked. This position was identical to that of the positioning of the patient during the Dix- Hallpike test. The patient was positioned supine, with the neck hyper-extended and the affected ear down. 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 two, the head was rotated toward the opposite ear with the head 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 his/her side for three minutes during

Figure 1



patient was seated upright. Following treatment with the CRM, the patient was rechecked with a Dix-Hallpike. This was performed to differentially diagnose the presence of canalithiasis versus cupulolithiasis based on fatigability of symptoms, as well as to test for successful clearance of the debris.

During post-maneuver 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; 2) sleep semi-inclined at an angle of approximately 30º the first night; and 3) avoid sleeping on the affected side for the next three to four nights. The non-restricted group was given no post-maneuver restrictions.

All patients returned one week following the initial treatment and the modified Dix-Hallpike was re-administered and patient report provided. Patients were also tested in the side-lying position to check for horizontal canal migration of the otoconia 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 (HC-BPPV) present. Symptoms of HC-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 frequently occurs during treatment for PC-BPPV. It is also possible that horizontal canal BPPV is present and masked by symptoms of the PC-BPPV in some cases.

If no symptoms were present or evoked, the patient no longer needed to be seen. If symptoms persisted, the maneuver was repeated and the participant, regardless of group, was given post-maneuver restrictions and seen again in one week.

Patients also provided a subjective report to complete the Provoked Vertigo Test (Smith-Wheelock, Shepard, & Telian, 1991) during each position of

the treatment, and then again at follow-up during re-check. The Provoked Vertigo Test, which was adapted from the University of Michigan Vestibular Testing Center Habituation training flow sheet, was used to assess symptom duration and intensity of subjective 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 so significant difference in age between the two groups [$F(1,18)=0.001$, $p=0.97$]. The data from subjective report used to complete the Provoked Vertigo Test were averaged and examined for trends using the factors of nystagmus onset latency, nystagmus duration, and intensity rating. This analysis was necessary to ensure that both participant groups had similar presentation of symptoms before and during treatment. In that way, any group differences observed at the follow-up appointment should be attributed to post-maneuver restrictions given that was the only factor on which the subjects differed. Data were collected on these factors for each of the three positions of the CRP 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 s (average = 3.3). Data for the unrestricted group ranged from 0 to 9 s (average = 3.4). For position two, only three subjects experienced nystagmus, and each of these were in the restricted group. Average onset was 1.1 s, while

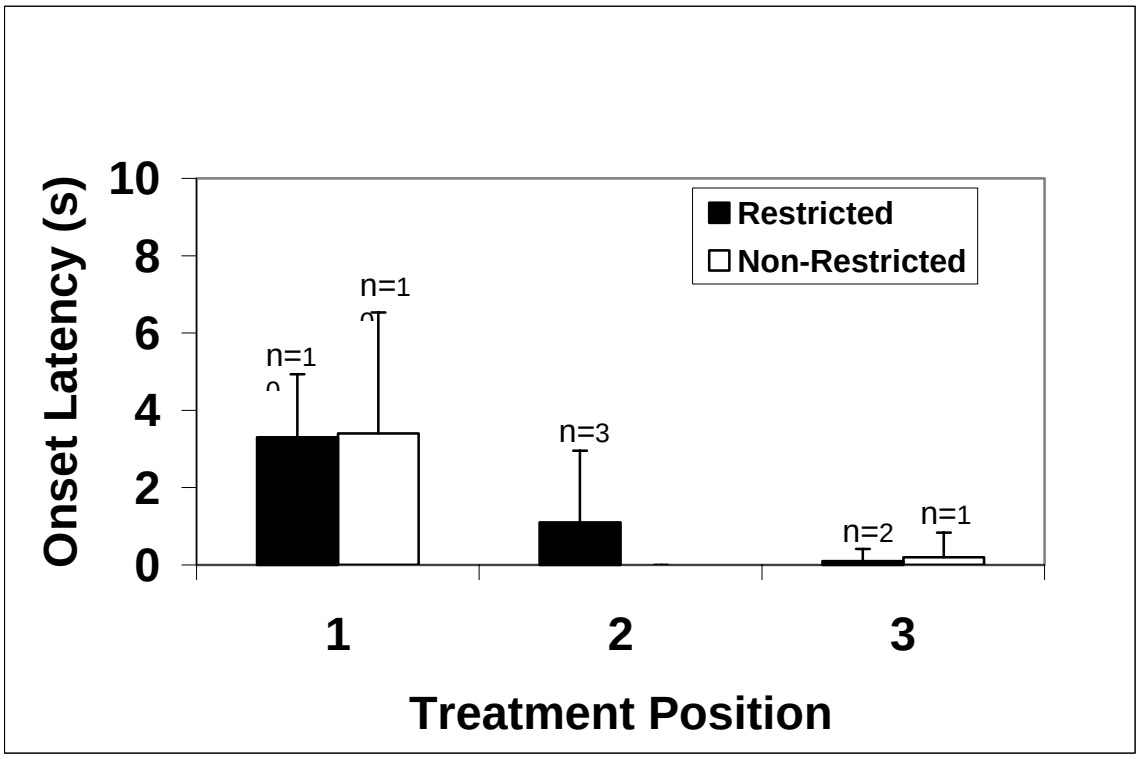


Figure 2. Nystagmus onset latency during the three treatment positions is shown for each group.

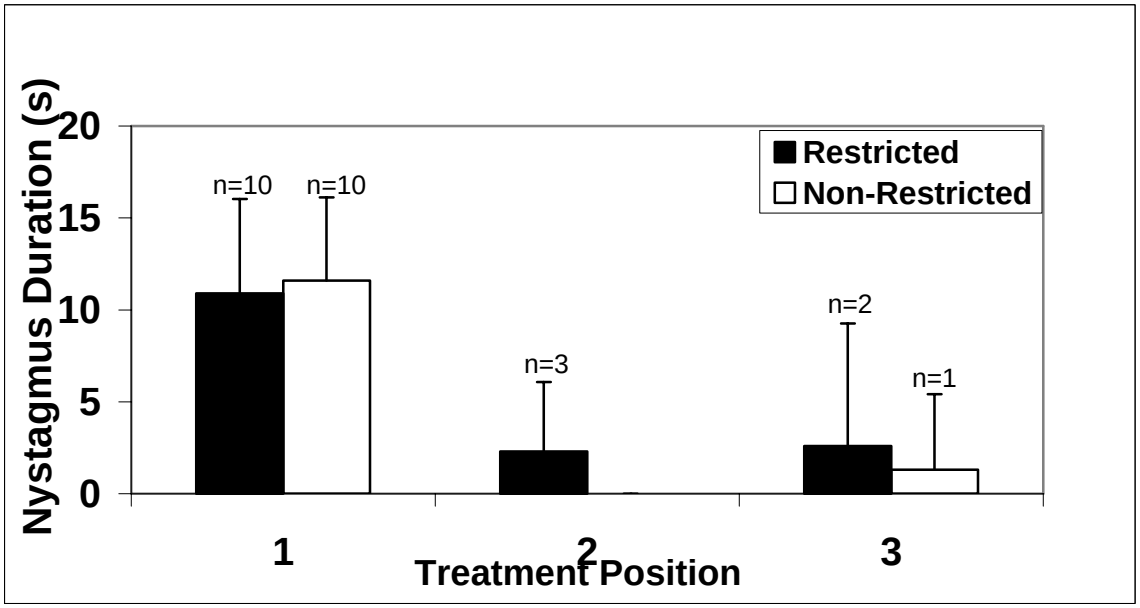


Figure 3. Nystagmus duration during the three treatment positions is shown for each group.

the unrestricted group had no nystagmus present. For position three, only two patients in the restricted group and one in the non-restricted group experienced nystagmus. Onset latencies of 0.2 s were obtained for both groups.

These data were analyzed with a two-way ANOVA with one between subjects factor (group) and one within subjects factor (position). Results indicated a significant effect of position [$F(2,17)=13.69$, $p<0.001$]. There was no effect of group [$F(1,18)=0.50$, $p=0.49$] and no interaction [$F(2,17)=1.71$, $p=0.21$]. Post-hoc testing (Tukey) 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.

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 19 s (average = 10.9). Data for the unrestricted group ranged from 5 to 19 s (average = 11.6). For position two, of the three subjects in the restricted group who experienced nystagmus, average duration was 2.3 s. Again, the unrestricted group had no nystagmus present. For position three, only two participants in the restricted group and the one participant in the non-restricted group experienced nystagmus. Average duration was 2.6 s for the restricted group with a 1.3 s duration for the subject in the non-restricted group.

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

a significant effect of position [$F(2,17)=54.03$, $p< 0.001$]. There was no effect of group [$F(1,18)=0.52$, $p=0.48$] and no interaction [$F(2,17)=1.04$, $p=0.38$]. Post-hoc testing (Tukey) indicated that the duration of the nystagmus elicited with Position 1 was significantly longer than the nystagmus durations elicited by Positions 2 or 3 ($p<0.05$), 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. A rating of 0 indicated no subjective vertigo and a rating of 10 indicated the greatest magnitude of vertigo. These intensity ratings are summarized as a function of treatment position in Figure 4 for both groups. Intensity ratings in position one for the restricted group ranged from 1 to 10 (average = 6.7). Ratings for the unrestricted group ranged from 3 to 10 (average = 5.5). For position two, the restricted group subjectively rated the intensity of vertigo from 0 to 8 (average 2.3). None of the participants in the unrestricted group experienced vertigo for this position. For position three, the restricted group ratings ranged from 0 to 8 (average1.5) and for the non-restricted group 0 to 7 (average 1.4).

As for onset latency and duration of nystagmus, the intensity rating data were also analyzed with a two-way ANOVA with one between subjects factor

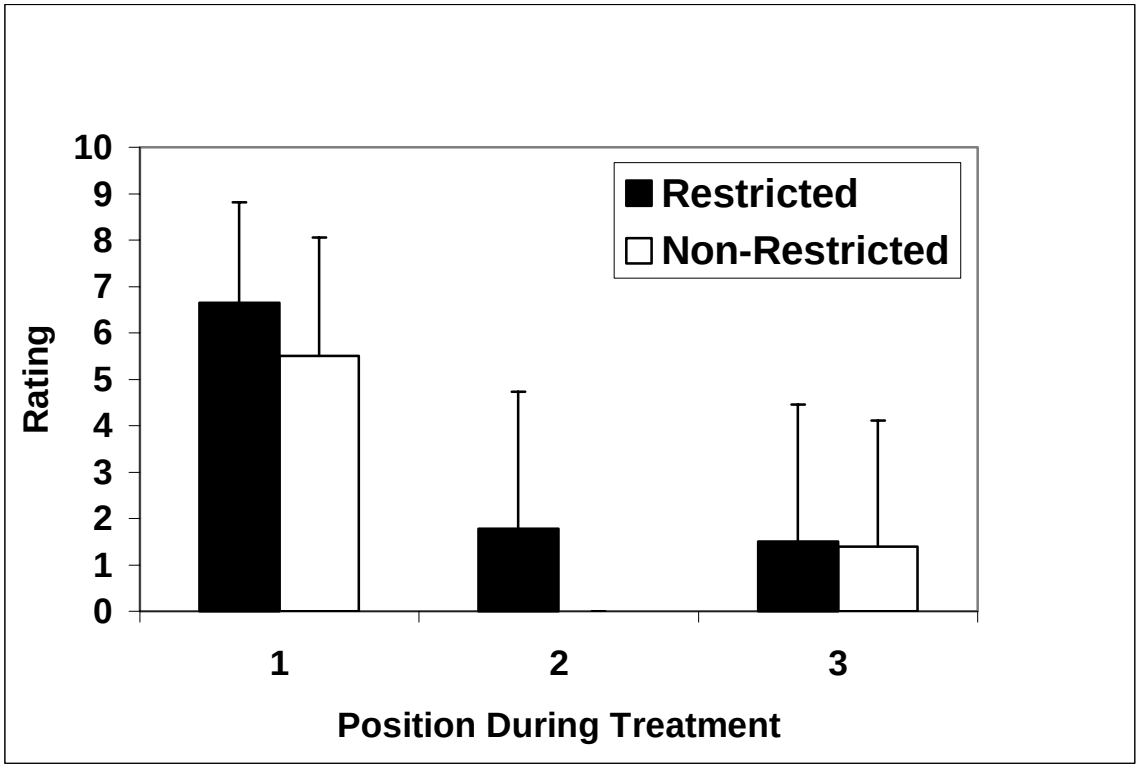


Figure 4. Nystagmus intensity rating is shown during the three treatment positions for each group.

(group) and one within subjects factor (position). Results indicated a significant effect of position [$F(2,17)=44.72$, $p < .001$]. There was no effect of group [$F(1,18)=2.53$, $p=0.13$] and no interaction [$F(2,17)=0.45$, $p=0.65$]. Post-hoc testing (Tukey) 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 ($p<0.05$), 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 following treatment. The groups were also equivalent in terms of gender and age. Any subsequent differences should be attributable to the use of restrictions.

Following each treatment, all patients were immediately rechecked using the modified Dix-Hallpike to assure the treatment was effective in clearing all debris from the posterior canal. Only one participant, who was assigned to the non-restricted group, continued to have symptoms following the initial treatment. This participant was re-treated 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 19 subjects were without vertigo or nystagmus during the re-check immediately following the treatment.

At the one-week post-treatment follow-up, all patients were free of vertigo and/or nystagmus when checked with the modified Dix-Hallpike. This demonstrated that the otoconia debris was successfully removed from the posterior canal in all cases. However, side-lying positional testing indicated HC-BPPV in two subjects who had been assigned to the restricted group. One subject was a male and presented with a right horizontal canal BPPV and the second, a female subject with left horizontal canal BPPV. It is believed that the male subject experienced a horizontal canal migration during treatment of the posterior-canal BPPV. During position one, the participant raised his head, which presumably allowed the otoconia to migrate to 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

The Canalith Repositioning Maneuver has been used for many years as a method of successfully treating cupulolithiasis and canalithiasis (Cohen & Jerabek, 1999). There are many variations and forms of this treatment, although each is based on the same underlying principle of moving the otolithic debris from the posterior semicircular canal to the utricle. Many clinicians employ post-maneuver restrictions following this treatment to ensure that the debris does not re-enter the canal. There is evidence that these restrictions are unnecessary for the Semont Liberatory Maneuver (Nuti, Nati, & Passali, 2000). The purpose of this investigation was to determine if such restrictions are necessary for the CRM treatment procedure.

Several factors were analyzed to ensure homogeneity of the two participant groups. Latency of nystagmus onset, nystagmus duration, and nystagmus intensity were all assessed for each treatment position. One classic characteristic of BPPV is the presence of an onset latency of nystagmus of less than ten seconds after moving into the position before the nystagmus starts. The subjects involved in this study exhibited typical onset latencies during the treatment positions.

Duration of nystagmus associated with BPPV is no longer than 30 seconds. Duration data from the subjects in this study were in agreement with

prior studies and averaged 3.35 sec. Further, duration of nystagmus was longest during position one and decreased significantly by the second position.

Finally, intensity of the vertigo was considered. This was rated as strongest for position one and decreased significantly for the second position. There was no difference in intensity of vertigo for positions two and three.

Given the similarity of the groups in terms of age and gender along with the fact that there was no difference between the two groups on any of the factors assessed during treatment, outcome following either post-maneuver restrictions or no restrictions should be the one influencing factor on results at follow-up. The presence of absence of symptoms was the factor that would determine the necessity of post-maneuver restrictions. When each subject returned for follow-up and went through the diagnostic positioning, no subject presented with either nystagmus or subjective vertigo. This indicated successful treatment. Further, since none of the subjects from either group experienced BPPV symptoms during the diagnostic evaluation at the follow-up, it was interpreted that post-maneuver restrictions do not add to the success of the treatment. This finding is in agreement with the work of Nuti et al. (2000) in treating BPPV with the Semont Liberatory Maneuver.

Nuti et al. (2000) studied the outcomes of 52 patients with BPPV who were treated with the SLM, all given no post-maneuver restrictions. All patients were checked following treatment and forty-seven of the 52 subjects (94%) were free of symptoms. The authors interpreted this result as indicative of successful treatment using the SLM without activity limitations. The results of the current

study indicate that treatment is also successful for the CRM without the use of activity limitations.

As there was no effect of post-maneuver treatment restrictions, this may indicate that the success of the treatment is consistent with dissolution of otoconia in the utricle. As reported by Zucca et al. (1998) otoconia debris is able to dissolve in the calcium deficient endolymph over time As long as calcium levels are normal, dissolution time should be rapid and result in amelioration of physiological symptoms. In other words, if the debris dissolves once returned to the utricle, it cannot be re-deposited into the canals. This occurs regardless of the presence or absence of post-maneuver restrictions. The results observed in the current study appear to be consistent with the results of Zucca et al 1998).

The CRM has been utilized for many years as an effective form of treatment for posterior canal BPPV. The results reported here support the efficacy of this treatment. All subjects were clear of symptoms one week post-treatment, which is slightly higher than the 90% reported in other studies.

SUMMARY AND CONCLUSIONS

The current study addressed the necessity of post-maneuver restrictions for BPPV patients treated with the Canalith Repositioning Maneuver. The primary focus was whether treatment efficacy was affected in two groups of BPPV patients, one group given typical post-maneuver activity limitations and the other group given no restrictions. Results indicated that given two groups of subjects matched for age, gender, and symptoms, post-maneuver 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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