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Original Article / *Özgün Makale*

The efficacy of Epley and Semont maneuvers in posterior semicircular canal benign paroxysmal positional vertigo treatment: A short-term comparative study

Posterior semisirküler kanal benign paroksismal pozisyonel vertigo tedavisinde Epley ve Semont manevralarının etkinliği: Kısa süreli karşılaştırmalı bir çalışma

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ABSTRACT

Objectives: This study aimed to compare the effectiveness of the Epley maneuver with the Semont maneuver in the treatment of posterior semicircular canal benign paroxysmal positional vertigo and observe differences in the resolution time of symptoms in the short-term follow-up.

Patients and Methods: Sixty patients with posterior semicircular canal benign paroxysmal positional vertigo (23 males, 37 females; median age: 44.9 years; range, 14 to 80 years) were included in the prospective randomized comparative study conducted in our clinic between April 2019 and October 2019. Diagnosis and treatment maneuvers were performed under videonystagmography examination. Participants were randomly selected after the diagnostic tests for the Epley maneuver and the Semont maneuver treatment groups.

Results: In the evaluation of vertigo with videonystagmography, 25 (83.3%) patients in the Epley maneuver group and 20 (66.6%) patients in the Semont maneuver group recovered in the one-week follow-up, and 28 (93.3%) patients in the Epley maneuver group and 24 (80%) patients in the Semont maneuver group recovered in the two-week follow-up. All patients in the Epley maneuver group recovered at the end of one month; four patients in the Semont maneuver group still had vertiginous symptoms (100% *vs.* 86.6%, p=0.04). There was a statistically significant difference between the Epley and Semont groups regarding visual analog scores at the one-week, two-week, and one-month follow-ups (p=0.002, p<0.001, p=0.001, respectively).

Conclusion: The Epley maneuver was significantly more effective than the Semont maneuver in resolving vertigo in the short-term treatment of posterior semicircular canal benign paroxysmal positional vertigo.

Keywords: Bening paroxysmal positional vertigo, Epley maneuver, Semont maneuver, videonystagmography.

ÖZ

Amaç: Bu çalışmada, posterior semisirküler kanal benign paroksismal pozisyonel vertigo tedavisinde Epley manevrasının Semont manevrası ile etkinliği karşılaştırıldı ve kısa dönem takipte semptomların iyileşme süresindeki farklılıklar gözlemlendi.

Hastalar ve Yöntemler: Nisan 2019 - Ekim 2019 tarihleri arasında kliniğimizde yapılan prospektif, randomize ve karşılaştırmalı bu çalışmaya posterior semisirküler kanal benign paroksismal pozisyonel vertigo tespit edilen 60 hasta (23 erkek, 37 kadın; medyan yaş: 44.9 yıl; dağılım, 14-80 yıl) dahil edildi. Videonistagmografi incelemesi altında tanı ve tedavi manevraları yapıldı. Katılımcılar, Epley manevrası ve Semont manevrası tedavi grupları için tanı testlerinden sonra rastgele seçildi.

Bulgular: Videonistagmografi ile vertigonun değerlendirilmesinde, birinci hafta kontrolünde Epley manevra grubunda 25 (%83.3) hasta ve Semont manevra grubunda 20 (%66.6) hasta; ikinci hafta kontrolünde Epley manevra grubunda 28 (%93.3) hasta ve Semont manevra grubunda 24 (%80) hasta iyileşti. Epley manevra grubundaki tüm hastalar bir ayın sonunda iyileşti, Semont manevra grubundaki dört hastada hala baş dönmesi semptomları vardı (%100'e karşın %86.6, p=0.04). Bir haftalık, iki haftalık ve bir aylık kontrolde görsel analog skorları açısından Epley ve Semont grupları arasında istatistiksel olarak anlamlı bir fark vardı (sırasıyla, p=0.002, p<0.001, p=0.001).

Sonuç: Epley manevrası, posterior semisirküler kanal benign paroksismal pozisyonel vertigonun kısa süreli tedavisinde vertigoyu tedavi etmede Semont manevrasından önemli ölçüde daha etkiliydi.

Anahtar sözcükler: Benign paroksismal pozisyonel vertigo, Epley manevrası, Semont manevrası, videonistagmografi.

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Benign paroxysmal positional vertigo (BPPV) is the most common cause of peripheral vertigo. It accounts for approximately 24% of all cases of peripheral vestibular disorders.[1] Benign paroxysmal positional vertigo was first described by Barany in 1921, and the diagnostic maneuver was proposed by Dix and Hallpike in 1952.[2,3] Benign paroxysmal positional vertigo is characterized by recurrent brief attacks of rotational vertigo associated with head position changes, particularly when turning the neck, getting up, lying down, or rolling over in bed.[4] This symptoms are thought to occur when degenerative debris from otoconia move from the utricle into semicircular canals. Otoconia displacement affects endolymphatic fluid movement, which leads to stimulation of ampullary receptors, resulting in vertiginous symptoms.

The etiology of BPPV is controversial, and more than 50% of all reported cases are idiopathic in nature.[5] Head trauma, prolonged bed rest secondary to inner ear disorders, such as stapes surgery, and vestibular neuronitis are the other etiologic factors of BPPV.[6,7]

Determination of the affected canal in BPPV is critical for the treatment, and the Dix-Hallpike test is the gold standard for evaluating posterior and anterior semicircular canal BPPV. If the lateral canal is affected, the best maneuver is the Roll test. Posterior semicircular canal (PSC) involvement is the most frequent in BPPV, accounting for 80 to 90% of cases.[2,4]

Several effective repositioning maneuvers exist to manage PSC-BPPV. Epley and Semont described the methods, although their positions and movements are different, move the otoconial debris around the long arm of the posterior canal, along the common crus, and back to the utricle.[8,9]

Both of these maneuvers relieve the symptoms in 60 to 80% of patients after the first maneuver.[2,3] Since vertigo affects the patients' quality of life, the primary purpose of these maneuvers is to maintain their ability without symptoms and allow them to return to routine daily life as soon as possible.

The aim of this study was to compare the effectiveness of the Epley maneuver with the Semont maneuver in the treatment of PSC-BPPV and observe differences in the resolution time of BPPV in the short-term follow-up.

PATIENTS AND METHODS

The prospective randomized comparative study was performed at Istinye University School of Medicine, Medical Faculty, Department of Otorhinolaryngology and Head and Neck Surgery between April 2020 and October 2020 with the approval of the Istinye University School of Medicine Ethics Committee following the National Health and Medical Research guidelines and in accordance with the Declaration of Helsinki (2/2020.K-043). Sixty patients with PSC-BPPV (23 males, 37 females; median age: 44.9 years; range, 14 to 80 years) referred to our center between March 2020 and June 2020 were included in the study. The participants were volunteers. They were informed about the procedures and written informed consent was obtained before participating in the study.

In the detailed anamnesis of the patients, presentation of vertigo, predisposing factors, previous episodes of vertigo, duration, accompanying hearing loss, tinnitus, feeling of fullness in the ear were questioned. In addition, patients who had neurological symptoms, such as facial paralysis, headache, loss of power, slurred speech, and syncope, visual symptoms, such as double vision, floating objects in front of the eye, and visual field constriction, and a history of systemic diseases, drug use, and trauma were recorded. The otological and neurological examination findings of the patients included in the study were within normal limits. All patients underwent a complete otoneurologic examination, including otoscopy, tympanometry, and pure tone audiometry.

The diagnosis was based on clinical and videonystagmography (VNG) examinations under Dix-Hallpike and Roll maneuver while testing the involved side. Patients who had lateral or anterior semicircular canal BPPV, multiple semicircular canal involvement, neurologic or psychiatric disease, other forms of peripheral vertigo, and unilateral hearing loss were excluded from this study.

Patients were asked to evaluate the severity of vertigo symptoms subjectively with a visual analog score (VAS) (1, no complaints; 5, severe). Diagnosis and treatment maneuvers were performed under VNG examination. Patients were randomly selected after the diagnostic tests for the Epley-repositioning maneuver (ERM) and Semont-repositioning maneuver (SRM) treatment groups (Figure 1, 2). In addition, steps of the Semont maneuver were shown to each patient, and the patients were asked to perform it at home for the first three days.

The post-treatment evaluation was scheduled for one week after the first treatment, and control tests were planned for one and four weeks after the first treatment. Successful treatment was defined as an absence of vertigo attack, having a VAS of 1, and a negative Dix-Hallpike test. Patients in both groups still positive for the Dix-Hallpike test were treated with Epley and Semont maneuvers.

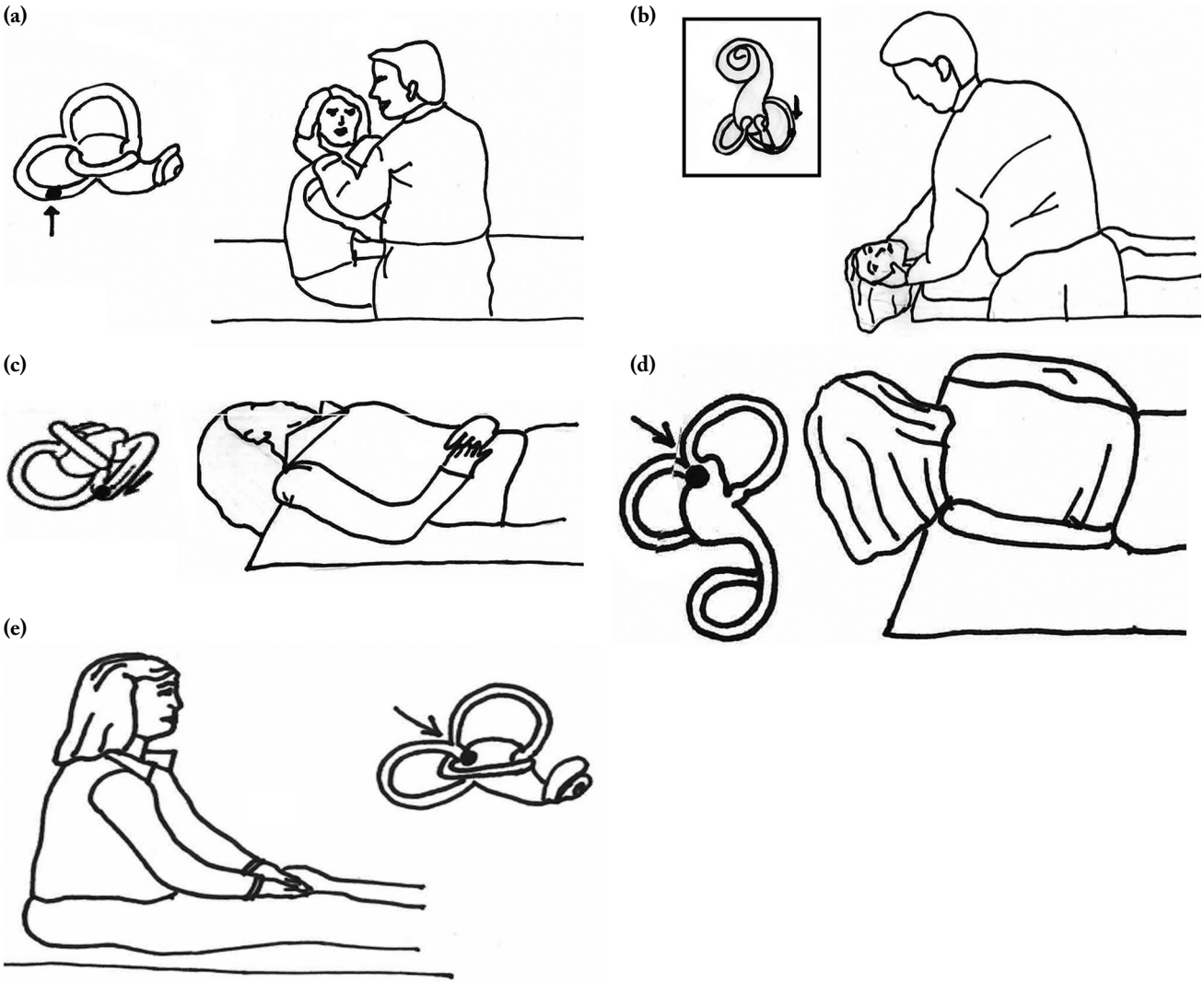

Figure 1. Epley maneuver: **(a)** The patient is seated with the head turned 45 degrees to the affected side (right side in this case); **(b)** the patient's neck is tilted back in slight extension; **(c)** the head is turned 90 degrees to the healthy side; **(d)** the entire body is rotated 90 degrees until the patient is laying on the healthy side, while keeping the head position against the trunk; **(e)** the patient is raised to the initial position and then the head is turned towards the front. Each position in maintained for 1 min or until induced nystagmus has been extinguished.

All subjects were instructed to avoid taking vestibular suppressant medications before their first visit and during the week before the control visit. Postural restriction was counseled after canalith repositioning for one week.

Statistical analysis

Data analysis was performed using IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). All data were expressed as mean ± standard deviation (SD). Descriptive data were expressed in mean and SD, median (min-max), or number and frequency. Prior to evaluation with Student's t-test, variables were checked for normal distribution and equal variance with Shapiro-Wilk test. The Mann-Whitney U test was used to compare results from each period. Repeated measures analysis of variance (Mauchly's test of sphericity) was performed to evaluate the differences in results between two groups over the first, second, and fourth week periods. A p value of <0.05 was considered significant.

RESULTS

Fifty-eight of the study population had canalolithiasis, and two had cupulolithiasis. The patients were divided into two groups randomly. Patients ages were

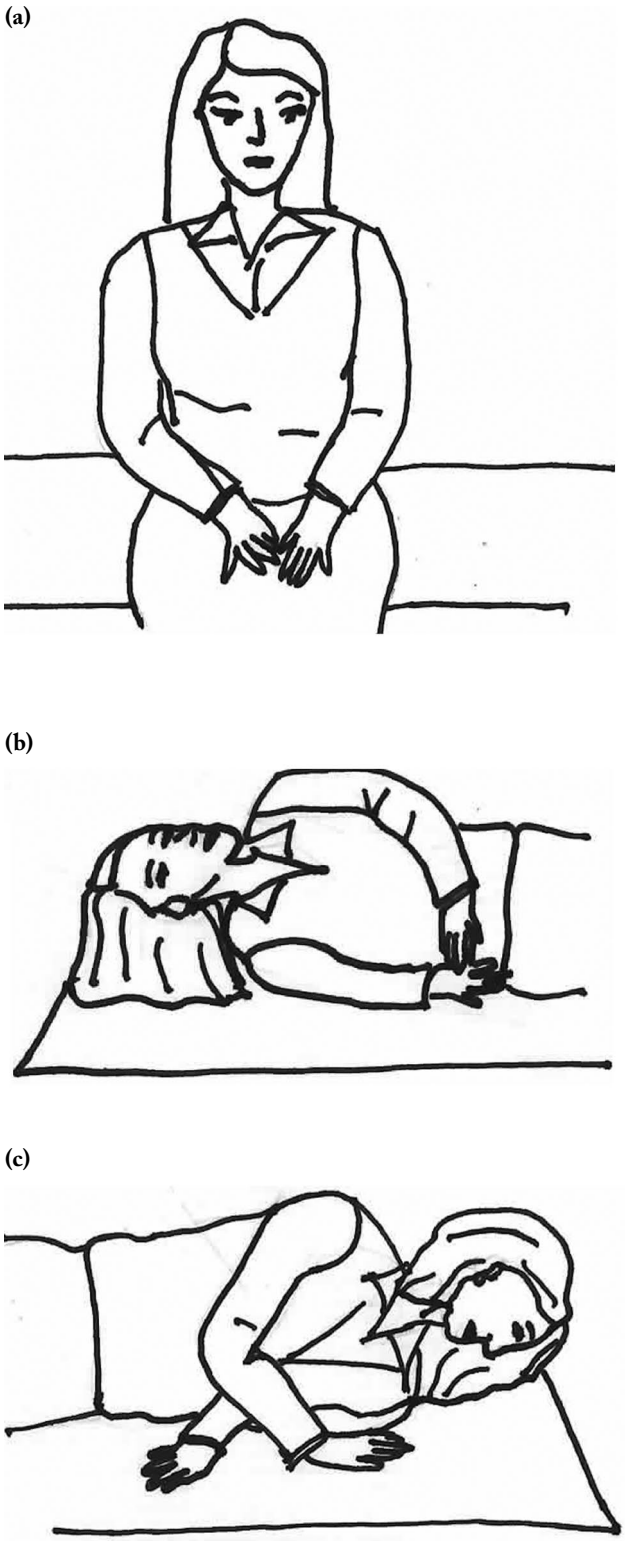

Figure 2. Semont maneuver: **(a)** the patient is seated with the head turned 45 degrees to the healthy side (left in this case); **(b)** the patient is quickly moved to lie on the affected side; **(c)** the patient is suddenly turned 180 degrees to lay on the unaffected side while maintaining the position of the head relative to the trunk. Each position is maintained for 2 min.

Table 1
Demographic, ethiopathogenetic, and side distribution of the groups

	Epley (n=30)		Semont (n=30)	
Groups	n	Mean±SD	n	Mean±SD
Age (year)		42.8±18.7		47.1±14.3
Sex				
Male	11		11	
Female	18		19	
Canalolithiazis	29		29	
Cupulolithiazis	1		1	
Side of disease				
Right	16		19	
Left	14		11	

SD: Standard deviation.

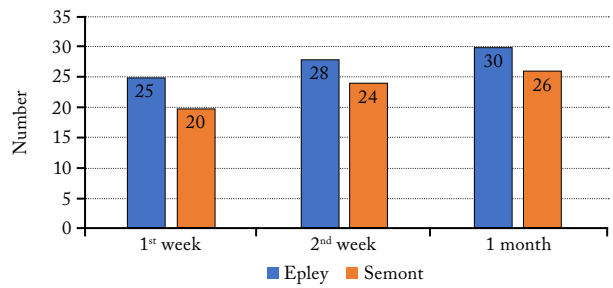

Figure 3. Comparison chart of Epley and Semont maneuvers according to the post-treatment recovery period.

between 14 and 80 years, and the median age was 44.9 (Epley: 42.8±18.7; Semont: 47.1±14.0; p=0.325). There was no significant difference between the two groups, and no relationship was found between age, sex, and length of disturbance on response to maneuvers. The duration of symptoms varied between two days and one month. The left PSC was affected in 25 patients, while the right PSC was affected in 35 patients. All patients of the series matched the inclusion criteria stated above (Table 1).

In the one-week follow-up, 25 of 30 patients (83.3%) in the ERM group were free of positional vertigo and nystagmus elicited by VNG compared with 20 of 30 patients (66.6%) in the SRM group (p=0.02). In the two-week follow-up, 28 (93.3%) patients in the ERM group and 24 (80%) patients in the SRM group recovered (p=0.02). Although all patients in the ERM group recovered at the end of one month, four patients in the SRM group still presented symptoms (100% vs. 86.6%, p=0.04) (Figure 3).

Before the treatment, there was no statistically significant difference between Epley and Semont groups concerning VAS (p=0.060). After treatment, there was a statistically significant difference between Epley and Semont groups regarding VAS at the one-week, two-week, and one-month follow-up (p=0.002, p<0.001, p=0.001, respectively).

DISCUSSION

The etiology of BPPV is challenging to determine, and the condition is defined as idiopathic in 60% of cases. Head trauma is the most detected cause, and vestibular neuronitis, prolonged bed rest, and ear surgeries are other causes. In our study, an etiologic factor was identified in 15 (25%) patients, and 75% of the cases were considered idiopathic.[6,7]

Two different mechanisms have been proposed in the etiopathogenesis of BPPV; the first and the most common is known as canalithiasis, in which degenerative otoconia particules of the utricle circulate freely within the endolymph of the semicircular canals; the second mechanism, cupulolithiasis, suggets that these same degenerative remnants do not circulate in the ducts but adhere to the cupula of the posterior canal, making it more sensitive to gravity.[10,11] These two variants of BPPV have different characteristics of the nystagmus elicited by the provoking maneuvers. Nystagmus of canalolithiasis is brief (lasting less than a minute), paroxysmal, and it is preceded by a latency of few seconds. Conversely, nystagmus of cupulolithiasis has no latency or a brief one and lasts more than a minute; however, the main difficulty is to achieve a successful repositioning of the debris and resolution of the symptoms. In our study, 96.6% (n=58) of patients had canalolithiasis.

Prevalence of BPPV is more common in patients older than 50 years. This is explained by age-related degenerative changes causing otoconial debris, that float freely and enter the semicircular canals and triggered BPPV.[12] The median age of the patients in our study was 44.9 years, consistent with previous reports. Females are approximately 1.6 to 2 times more likely to experience BPPV than males. The female-to-male ratio of 1.6/1 in our study is similar to previous reports.

Although canalith repositioning is currently accepted as the primary treatment of PSC-BPPV, symptoms tend to resolve only in some patients. The underlying mechanism for the resolution is not completely known. Most of the studies reported that the self-remission of PSC-BPPV usually occurs within weeks or months.[11] As postulated by other authors, to minimize the confounding effect of spontaneous remission and highlight the efficacy of the maneuver, we decided to perform a short-term follow-up.[12]

The Epley maneuver has become a mainstay of therapy in recent years due to its ease of use, noninvasive nature, and apparent effectiveness at relieving vertigo. The Semont maneuver involves taking the subject from the seated position and quickly lowering them into a side-lying position on the affected side. After resolution of the vertigo and nystagmus, the patient is quickly raised and lowered to the opposite side-lying position. Once vertigo and nystagmus have ceased, the patient is raised back to the seated position. For those patients who have limited neck mobility or are of excessive size, modified Epley and Semont maneuvers or sometimes combined postural restriction may be applied. Although both procedures appear efficacious for the therapeutic schemes of BPPV, the question of which maneuver is better for PC-BPPV patients remains unanswered. Some clinical studies give contradictory results as to which procedure better resolves vertigo and produces a negative Dix-Hallpike test.

A few studies to date have compared the effectiveness of the Epley and Semont maneuvers in patients with PSC-BPPV. A network meta-analysis found that SRM has a comparable efficacy with ERM in PSC-BPPV regarding short-term effects, such as one-week recovery rate.[13] In a meta-analysis by Zhang et al.,[14] the efficacy of SRM, ERM, and Brandt-Daroff exercise was examined, but it was not ascertained which approach has the best effect. Lee et al.[15] compared the recovery rate of ERM and SRM at the end of one week and reported them at 94.4% and 79%, respectively. Soto et al.[16] SRM and ERM had a similar recovery rate in the short-term (one week) use (74% *vs.* 71%), but for the long-term use, ERM had a higher recovery rate than SRM (93% *vs.* 77%). Babac et al.[17] reported that the recovery rate of four modified SRMs and four modified ERMs were 96.5% and 92.4%, respectively. In our current study, ERM showed a high resolution rate of nystagmus and vertigo at the one-week follow-up after treatment, and the resolution rate was significantly higher than SRM (83.3% *vs.* 66.6%, p=0.02). When the patients were re-evaluated after two weeks, the recovery rates were significantly higher in ERM than in SRM (93.3% *vs.* 80%, p=0.02).

Levrat et al.[18] reported that the effectiveness of SRM has been extensively investigated, and the results have demonstrated that SRM has a high recovery rate of 90.3% after a maximum of four treatments.

The recurrence was also found in the Semont group but not seen in the Epley group, which is intended to

move the otoliths from the PSC into the vestibule. This finding suggests that the transition of otoliths into the common crus by the Semont maneuver is not always successful despite the rapid change of side-lying positions. In our study, all patients who were treated with ERM recovered completely at the end of one month; however, in the Semont group, vertiginous symptoms continued in four patients (100% *vs.* 86.6%), and this difference was found statistically significant (p=0.04).

Side effects are uncommon, although accidental canal switch is beginning to be recognized as a complication of canalith repositioning maneuvers. The opening to the horizontal canal is adjacent to the opening of the posterior and anterior canals, which is a risk for debris re-entry. White et al.,[19] in a retrospective study, found the rate of posterior-horizontal switch with the ERM to be 6.2%. Brocchetti et al.[20] found conversion rate with SRM to be 4.6%. In our study, two of 30 SRM cases converted from posterior to horizontal, whereas no conversions occurred in the ERM group.

This study has several limitations. A relatively small number of patients was included, and a substitute CRM replacing the Epley or Semont maneuver, a sham maneuver, and Brandt-Daroff exercise were not executed.

In conclusion, BPPV is a common disease in clinical practice. Benign and often self-limiting BPPV can have a considerable impact on quality of life. The Epley maneuver was significantly more effective than the Semont maneuver in resolving vertigo for the short-term treatment of PSC-BPPV. However, further studies with a larger sample size and a longer follow-up period are needed.

Declaration of conflicting interests

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