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# Comparison of outcomes of the Epley and Semont maneuvers in posterior canal BPPV: A randomized controlled trial

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## Abstract

**Objectives:** This study aims to compare the efficacy of the Epley and Semont maneuvers in relieving posterior canal benign paroxysmal positional vertigo (BPPV) arising in the in patients at the Outpatient Department of the Department of Otolaryngology, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand.

**Method:** In this prospective, randomized, comparative study, patients were assigned to receive one of the two treatment methods. First, BPPV was diagnosed with the Dix-Hallpike test. Then, each patient was treated by either the Epley or Semont maneuver. Immediately afterward, the efficacy of treatments was evaluated with the Dix-Hallpike test, and dizziness intensity was assessed with the visual analog scale (VAS).

**Results:** This study enrolled 80 patients with posterior canal BPPV, 40 of which underwent the Epley maneuver and the other 40 underwent the Semont maneuver. In the first week, The Epley maneuver cured 37 (92.5%) of the 40 patients, and the Semont maneuver cured 36 (90%) of the 40 patients. Statistical analysis revealed no significant difference in the efficacy of these treatments ($P = .251$). Regarding dizziness intensity, VAS scores decreased from 6.48 to 1.65 after the Epley maneuver and from 6.53 to 2.18 after the Semont maneuver. Statistical analysis revealed that the Epley maneuver was superior to the Semont maneuver ($P = .009$) in reducing dizziness intensity.

**Conclusions:** The Epley and Semont maneuvers had similar efficacy in curing posterior canal BPPV. Regarding the severity of dizziness after treatment, the Epley maneuver produced significantly better results than did the Semont maneuver.

**Level of Evidence:** II

KEYWORDS
benign paroxysmal positional vertigo (BPPV), Epley, posterior semicircular canal, Semont

## 1 | INTRODUCTION

Benign paroxysmal positional vertigo (BPPV), a common form of vertigo, is often triggered by a change in the posture of the head and affects the quality of life and daily activities of the patient. Every year, patients with BPPV seek help at the Outpatient Department of the Department of Otolaryngology, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok, Thailand. The disease mainly originates in the posterior semicircular canal.[1-6] The most popular treatments are the Epley and Semont maneuvers.[7,8] These two methods have been compared. However, available information concluding which treatment is better is insufficient.[9-11]In this study, the results of treatment with the Semont and Epley maneuvers performed in the posterior semicircular canal were compared in patients with BPPV who had been admitted to the Outpatient Department of the Department of Otolaryngology, Faculty of Medicine Vajira Hospital, Navamindradhiraj University.

## 2 | METHODS

This prospective, randomized controlled trial was conducted with patients in whom posterior semicircular canal BPPV was diagnosed and who were admitted to the Outpatient Department, Department of Otolaryngology, Faculty of Medicine Vajira Hospital, Navamindradhiraj University, between January 1, 2016 and January 1, 2017.

This study has been approved by the Research Ethics Review Committee for Research Involving Human Subjects, Faculty of Medicine Vajira Hospital.

The inclusion criteria were follows:

1. Age of 18 to 90 years
2. Ability to communicate
3. No previous treatment for BPPV
4. A diagnosis of BPPV arising in the posterior semicircular canal

The exclusion criteria were as follows:

1. Confirmed or suspected pregnancy
2. Other cause of vertigo, such as Meniere's disease
3. Confirmed or suspected Migraine
4. Symptoms indicating disorders of the central nervous system, such as seizures, unconsciousness, blurred vision, difficulty swallowing, difficulty speaking, and limb weakness
5. A disease or condition for which the Dix-Hallpike test, Epley maneuver, or Semont maneuver was contraindicated, such as degenerative disorders of the cervical or thoracic spine, detachment of the retina, or myocardial infarction
6. Underlying neurological or psychiatric disease
7. Disorders of the central nervous system found on physical examination
8. Dix-Hallpike test results that indicated horizontal or vertical nystagmus or BPPV arising in multiple semicircular canals

Patients were informed of the research, and those who agreed to participate in the study were enrolled. Each patient was randomly assigned to receive one of the two treatments. Information about age, gender, body mass index (BMI), comorbidities, surgical history, history of pregnancy, history of dizziness, average duration of episodes of vertigo, issues with posture, and previous treatment for any condition were collected. Then, the patient was asked to complete a questionnaire about the severity of vertigo. Using a visual analog scale (VAS), on which 0 represented no dizziness at all and 10 represented most severe dizziness, the patient circled the number that indicates the degree of vertigo being experienced.

In addition, each participant rated the effect of dizziness using Dizziness Handicap Inventory-Thai version.[12] This was adapted from the Dizziness Handicap Inventory (DHI) of Jacobson et al.[13] The total score could range from 0 to 100, and the degree of severity was determined as follows:

- A score of 0 to 39 indicated that BPPV mildly affected the activities of daily living.
- A score of 40 to 69 indicated that BPPV moderately affected the activities of daily living.
- A score of 70 to 100 indicated that BPPV strongly affected the activities of daily living.

Then, the auditory and nervous systems were examined with a pneumatic otoscope, a tuning fork (Weber and Rinne tests), oculomotor tests, head thrust test, saccade test, Romberg's test, Tandem gait test, a test for dysdiadochokinesia, the finger-to-nose test, and the Dix-Hallpike test with Frenzel goggles. The diagnosis of BPPV was confirmed, and the affected side was recorded, as well as the presence of nystagmus (characteristic, latency, and duration).

After the diagnosis of posterior semicircular canal BPPV was confirmed, the Epley maneuver was performed. For the Epley maneuver, the patient sat on the examination bed, the examiner stood behind the patient, and the assistant stood at the patient's right side. The patient turned 45° toward the affected side, lay down, and lowered the head 20°. After 60 seconds, with the patient's head still lowered, the physician turned the patient's head to the opposite side, 45° from midline. After another 60 seconds, the patient's head and body were rotated until the patient's head was positioned 135° from the supine position. After another 60 seconds, the patient sat up on the edge of the bed, still facing the unaffected side.

For the Semont maneuver, the patient performed all actions, and the physician only closely supervised and observed the symptoms. The patient sat on the examination bed with feet hanging beside the bed, turned the head 45° toward the unaffected side, and then quickly lay down on the affected side and held it for 30 seconds or until nystagmus disappeared. The patient then quickly rose, lay down on the unaffected side, turned to face downward, and held this position for

30 seconds, after which the patient rose to sit on the side of the bed with the feet hanging, as before the examination.

After both treatments, the Dix-Hallpike test was performed. Then, the patient was asked to complete the VAS for how much they feel dizzy immediately after treatment. After 1 week from the first treatment, the Dix-Hallpike test was repeated.

Post Treatment complications, such as canal conversion and canalith jam were aware.

The quantitative data (age, BMI, and severity of vertigo), the DHI before treatments, latency and duration of nystagmus were calculated either as means and SDs or as medians and interquartile ranges. Statistical correlation was tested with an independent *t* test or the Mann-Whitney *U* test; the results were considered statistically significant when $P < .05$. The results of the Dix-Hallpike test before and after treatment were calculated as percentages. The relationship between test results was statistically evaluated with either a chi-square test or the Fisher's exact test; the results were considered statistically significant when $P < .05$. DHI before and after treatment were calculated either as means and SDs or as medians and interquartile ranges. The correlation was statistically tested with either a paired *t* test or the Wilcoxon signed-rank test; the results were considered statistically significant when $P < .05$. IBM SPSS version 22 for Windows (SPSS Inc., Chicago, Illinois) was used to analyze all data.

## 3 | RESULTS

Of the 80 participants, 40 underwent the Semont maneuver and 40 underwent the Epley maneuver. The general basic characteristics of patients are listed in Table 1. The mean age of patients receiving the Semont maneuver was 61.73 years (range, 27-79 years) and that of patients receiving the Epley maneuver was 60.43 years (range, 22-84 years); for both groups, the mean age was 61.07 years. Both groups had more female than male participants. The right side was

**TABLE 1** Characteristics of participants

| General characteristics | Semont maneuver (n = 40) | Epley maneuver (n = 40) | *P* value |
|---|---|---|---|
| *Age (mean ± SD)* | 61.73 ± 11.28 | 60.43 ± 13.93 | .648[a] |
| *Gender (percentage)* | | | |
| • Male | 12 (30) | 11 (27.5) | .805[b] |
| • Female | 28 (70) | 29 (72.5) | .812[b] |
| *Underlying disease (percentage)* | | | |
| • No | 20 (50) | 22 (55) | .654[b] |
| • Yes | 20 (50) | 18 (45) | .614[b] |
| -Diabetes | 4 (20) | 6 (33) | .499[b] |
| -High blood pressure | 12 (60) | 9 (50) | .446[b] |
| -Hyperlipidemia | 13 (65) | 13 (72) | 1.0[c] |
| -Asthma | 2 (10) | 2 (11) | 1.1[c] |
| *BMI (median [IQR])* | 23 (3.5) | 22.35 (3.4) | .343[d] |
| *Side of symptoms (percentage)* | | | |
| • Left | 17 (42.5) | 18 (45) | .654[b] |
| • Right | 23 (57.5) | 22 (55) | .640[b] |
| *Duration of symptoms before patients came to the hospital (percentage)* | | | |
| • <1 week | 18 (45) | 17 (42.5) | .822[b] |
| • 1 week to 1 month | 17 (42.5) | 19 (47.5) | .653[b] |
| • >1 month | 5 (12.5) | 4 (10) | 1.03[c] |
| *Duration of vertigo before patients came to the hospital (percentage)* | | | |
| • <1 minute | 14 (35) | 12 (30) | .633[b] |
| • 1-20 minutes | 20 (50) | 23 (57.5) | .501[b] |
| • >20 minutes | 6 (15) | 5 (12.5) | .745[b] |
| *Effects of dizziness, per Dizziness Handicap Inventory (median [IQR])* | 28 (13) | 28 (16) | .735[d] |
| *Severity of vertigo before treatment, per VAS (median [IQR])* | 6 (1) | 6 (3) | .825[d] |

Abbreviations: BMI, body mass index; IQR, interquartile range; SD, standard deviation; VAS, visual analog scale.
[a]Independent *t* test.
[b]Chi-square test.
[c]Fisher's exact test.
[d]Mann-Whitney *U* test.

more commonly affected than the left side in both groups. Approximately half the patients in both groups had underlying diseases such as hyperlipidemia, hypertension, and diabetes in most cases. Most of the patients in both groups had had symptoms of BPPV for less than 1 week; others had had symptoms for 1 week to 1 month. In most patients in both groups, episodes of vertigo lasted for 1 to 20 minutes. DHI scores were found to reflect mild effects of dizziness on daily living (median, 28 points). VAS scores decreased from 6.48 to 1.65 after the Epley maneuver and from 6.53 to 2.18 after the Semont maneuver. There were no significant differences between groups in age, gender, underlying disease, BMI (mean BMI, 23.29), affected side, duration of symptoms before arrival at the hospital, duration of vertigo before arrival at the hospital, effects of dizziness according to the DHI, or the severity of vertigo before treatment according to the VAS.

The results of the physical examination with the Dix-Hallpike test (Table 2) did not significantly differ between groups with regard to average latency and average duration of nystagmus. The results of the Dix-Hallpike test after treatment and the severity of dizziness as rated on the VAS are listed in Tables 3 and 4.

After treatment with the Semont maneuver, only eight patients had nystagmus, but for most, the duration was shorter and the dizziness was less severe, according to VAS scores, than before treatment. Only one patient who had nystagmus after treatment had the same visual analog score before and after treatment. At 1 week after the Semont maneuver, Four patients still showed positive Dix-Hallpike test. Then, they were treated by the Epley maneuver and showed negative Dix-Hallpike test in another week.

After treatment with the Epley maneuver, only four patients had nystagmus. For two, the duration was shorter and dizziness was less severe, according to VAS scores, than before treatment. VAS scores of the other two patients did not change after treatment. At 1 week after the Epley maneuver, three patients still showed positive Dix-Hallpike test. Then, they were treated by the Epley maneuver and showed negative Dix-Hallpike test in another week.

The two groups exhibited no significant difference in post-treatment VAS scores for dizziness. A comparison of the positive and negative Dix-Hallpike test results of the two groups indicated no statistical difference ($P = .210$). However, a comparison of the results of the questionnaires to measure the severity of dizziness after treatment revealed that patients who received the Epley maneuver reported significantly less dizziness than did those who received the Semont maneuver ($P = .009$).

No complications such as canalith jam and canal conversion occurred in this study. Both treatments did not have cervical limitations.

**TABLE 2** Results of physical examination according to Dix-Hallpike test

| Nystagmus | Semont maneuver (n = 40) | Epley maneuver (n = 40) | *P* value |
|---|---|---|---|
| Average latency (median [IQR]) | 5.8 seconds (5) | 6.1 seconds (5) | .839[a] |
| Average duration (median [IQR]) | 7.5 seconds (5) | 6.3 seconds (5) | .463[a] |

Abbreviation: IQR, interquartile range.
[a]Mann-Whitney *U* test.

**TABLE 3** Comparison of treatment results after the Semont and Epley maneuvers

| Test results | Semont maneuver (n = 40) | Epley maneuver (n = 40) | *P* value |
|---|---|---|---|
| *Dix-Hallpike test (first visit)* | | | |
| • Negative (percentage) | 32 (80) | 36 (90) | .210[a] |
| • Positive (percentage) | 8 (20) | 4 (10) | .196[a] |
| *VAS for dizziness (median [IQR])* | 2 (2) | 1 (2) | .009[b] |
| *Dix-Hallpike test (a week post-treatment)* | | | |
| • Negative (percentage) | 36 (90) | 37 (92.5) | .251[a] |
| • Positive (percentage) | 4 (10) | 3 (7.5) | .290[a] |

Abbreviations: IQR, interquartile range; VAS, visual analog scale.
[a] Fisher's exact test. [b] Mann–Whitney U test.

**TABLE 4** Pretreatment and post-treatment VAS scores after Semont and Epley maneuvers

| | VAS score (median [IQR]) | | |
|---|---|---|---|
| Treatment | Before treatment | After treatment (first visit) | *P* value |
| Semont maneuver | 6 (1) | 2 (2) | <.001[a] |
| Epley maneuver | 6 (3) | 1 (2) | <.001[a] |

Abbreviation: VAS, visual analog scale.
[a]Wilcoxon signed-rank test.

## 4 | DISCUSSION

According to the immediate success rate of the Epley maneuver (90%), this was different from the result of Munoz et al (34%).[14] Success rate of Epley maneuver at 1 week (92.5%) was similar to the results from RCT have been reported by Yimtae et al, Liang et al, and Xie et al (success rate 88%, 98%, and 93%, respectively) but different from the result of a RCT of Mazoor et al, Amor-Dorado et al, and Froehling et al (success rate 73%, 80%, and 67%, respectively).[11,14-19] Success rate of the Semont maneuver at 1 week was 90%, This was similar to the double-blind RCT of Chen et al (85% at Fourth day).[20] but different from the result of Mazoor et al (70%).[11] The different result may be caused by the different clinical setting of the study (primary care setting showed lower success rate than specialty-setting), different severity of BPPV before treatment, duration of BPPV before treatment, and criteria of success (negative Dix-Hallpike test vs symptom free with negative Dix-Hallpike test).

Our study findings correspond to the Cochrane review in 2014 and Clinical Practice Guideline: BPPV (update 2017) and found that the results of the Epley maneuver did not differ from those of the Semont maneuver.[9,21]

The results of the VAS were significantly better in the Epley maneuver group compared with the Semont maneuver group. Contrast with the study of Toupet et al that showed patients with Epley maneuvers had a higher score for dizziness on day 3 after maneuver and no different score on day 5.[22] It can be hypothesized that the patients responded differently because in our study the physician performed the Epley maneuver, whereas the patient performed the Semont maneuver, and the physician provided only advice and close supervision that made some patients feel confident in treatment and may feel less dizzy. Another reason is that the Semont maneuver needs to change position more quickly than the Epley maneuver.

In our opinion, Both treatments have good success rate but the Epley maneuver is less dizzy at immediate post treatment. But, the good point of the Semont maneuver is that it is easy to do by themself at home. We recommend doing the Epley maneuver as treatment in an in-office situation and Semont maneuver for patients who cannot reach a hospital or clinic such as tele-medicine in a remote area, needs quarantine due to covid-19 or patient in negative-pressure room.

At present, there are many studies about Self-administered Epley maneuver. Radke et al showed success rate at 95% of the Self-administered Epley maneuver group compared with 58% of the Semont maneuver group. Self-administered Epley maneuver is a new treatment that includes the advantage of both Epley and Semont maneuver together (good success rate and Self-administered) but needs to focus on how to advise patients to do it correctly at home.[23,24]

## 5 | SUMMARY

There was no statistically significant difference in the results of treatment of BPPV by the Semont maneuver and the Epley maneuver. Regarding the severity of dizziness after treatment, the Epley maneuver produced significantly better results than did the Semont maneuver. However, these findings are only preliminary, and further studies with larger sample sizes and compared with Self-administered Epley maneuver are needed.

### CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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