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Araştırma Makalesi / Research Article

Effect of Epley Maneuver on Balance Change in Benign Paroxysmal Positional Vertigo

Vertigolu Hastalarda Epley Manevrası Öncesi ve Sonrasında Denge Değişimi

[1]Nevsun Pıhtılı Taş, [2]Nihat Susaman

[1]Department of Physical Medicine and Rehabilitation, Elazig Fethi Sekin City Hospital, Elazig, Turkiye.

[2]Department of Otolaryngology, Elazig Fethi Sekin City Hospital, Elazig, Turkiye.

Abstract

Benign paroxysmal positional vertigo (BPPV) is the most common cause of peripheral vertigo. It has been supported in the literature that the patients' balance is getting better with the Epley maneuver. The aim of the study is, to evaluate the effect of the Epley maneuver on balance in patients with BPPV with a balance device. The prospective clinical study was completed with 104 patients. Before and after the Epley maneuver, static and dynamic balance changes were evaluated with a balance device with eyes open and closed. The mean age of the patients was 45.8±16.34 (range, 18-83). 75 patients (72.1%) were female and 29 patients (27.9%) were male. Stable area with eyes open (p=0.137), 'stable length with eyes open (p=0.184), 'stable angle with eyes open (p=0.155), 'stable rate with eyes open (p=0.100), 'stable area with eyes closed' (p=0.06) and 'stable angle with eyes closed' (p=0.310) values were not significantly different between pre-and post-Epley measurements. There was a significant difference between the values of "stable length with eyes closed" (p=0.00), and "stable speed with eyes closed" (p=0.007) before and after the Epley maneuver. Better static balance with the Epley maneuver showed that, body stability and postural balance could be better controlled after the Epley maneuver. There was no improvement in dynamic balance. This suggested that, patients with BPPV could not adapt to changes in proprioceptive and visual stimuli. The Epley test is an effective method for getting better balance disorder and the prevention of related complications which is an important problem in patients with vertigo.
Keywords: Vertigo, Epley, Balance, HUR Btg4 Balance System

Özet

Benign paroksismal pozisyonel vertigo (BPPV), periferik vertigonun en sık nedenidir. Epley manevrası ile hastaların dengesinin düzeldiği literatürde desteklenmiştir. Çalışmanın amacı, BPPV'li hastalarda Epley manevrasının denge üzerine etkisini denge cihazı ile değerlendirmektir. Prospektif klinik çalışma 104 hasta ile tamamlandı. Epley manevrası öncesi ve sonrasında, statik ve dinamik denge değişiklikleri gözler açık ve kapalı halde denge cihazı ile değerlendirildi. Hastaların yaş ortalaması 45,8±16,34 (dağılım, 18-83) idi. 75 hasta (%72,1) kadın ve 29 hasta (%27,9) erkek idi. Gözler açık stabil alan (p=0.137), 'gözler açık stabil uzunluk, (p=0.184), 'gözler açık stabil açı (p=0.155), 'gözler açık stabil hız (p=0.100), 'gözler kapalı stabil alan' (p=0.06) ve 'gözler kapalı stabil açı' (p=0.310) değerlerinde Epley öncesi ve sonrası ölçümler arasında anlamlı fark yoktu. Epley manevrası öncesi ve sonrası, gözler kapalı stabil uzunluk" (p=0,00) ve "gözler kapalı stabil hız" (p=0.007) değerleri arasında anlamlı fark vardı. Epley manevrası ile daha iyi statik denge, Epley manevrasından sonra vücut stabilitesinin ve postüral dengenin daha iyi kontrol edilebileceğini gösterdi. Dinamik dengede düzelme saptanmadı. Bu durum BPPV'li hastaların proprioseptif ve görsel uyaranlardaki değişikliklere uyum sağlayamadığını düşündürdü. Epley testi, vertigolu hastalarda önemli bir sorun olan denge bozukluğunu iyileştirmede ve buna bağlı komplikasyonların önlenmesinde etkili bir yöntemdir.
Anahtar Kelimeler: Vertigo, Denge, Epley, HUR Btg4 Denge Sistemi

Correspondence:
Nevsun PIHTILI TAŞ
Department of Physical Medicine and Rehabilitation, Elazig Fethi Sekin City Hospital, Elazig,Turkey
e-mail: nevsunpihtili@gmail.com

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1. Introduction

Vertigo is classified as peripheral and central vertigo depending on the location of the vestibular dysfunction. Although vertigo is seen in all age groups, its incidence increases with age. The frequency of vertigo in individuals aged 18-79 years is 7.4% 1,2. There is no underlying cause in 50-70% of the cases and this variation of vertigo is called idiopathic or primary benign paroxysmal positional vertigo (BPPV). This clinical condition, which often develops as a result of peripheral diseases, can also be seen in neurological and metabolic diseases. The symptoms are more severe in peripheral vertigo than in central vertigo. Common peripheral vestibular diseases are vestibular neuritis, Meniere's disease, otitis, trauma, BPPV, and ototoxic drug use Peripheral vestibular disorders are characterized by dizziness, which is the most common clinical form of vertigo 3. BPPV, which is a sudden-onset disease triggered by certain positions of the head and lasts for seconds, is responsible for 50% of vertigo in advanced age groups. Moreover, it is twice more common in women than in men. The diagnosis of BPPV is clinical and with a careful anamnesis, an opinion can be obtained at a rate of 70%. In patients without any pathology after Ear Nose Throat (ENT) and neurological physical examination, vestibular tests can mainly determine the channel and type of BPPV. Detection of rotatory nystagmus during the Dix-Hallpike test described in 1952 is diagnostic for BPPV. It is the gold standard diagnostic test in BPPV and has a sensitivity of approximately 80% 4-6. Dizziness in patients with BPPV usually begins while lying down and is affected by head movements 7. Another important feature of the disease is the spontaneous regression of clinical findings within weeks or months with self-limiting treatment 8. Repositioning maneuvers and vestibular rehabilitation exercises are also considered to be effective and safe 9. Described by John M. Epley in 1992, the Epley maneuver is the most commonly used test to treat BPPV 10,11.

Decreased postural control in patients with BPPV limits functionality. Disruption in balance; causes an increase in falls, fractures, and other fall-related injuries. Therefore, disturbances in balance should also be taken into account in patients with vertigo 3,4.

Balance is simply the ability to maintain the body's center of gravity on the base of support 6. Studies have shown that balance ability is impaired in BPPV patients after sudden head movement 5. Different video-based systems, accelerometer methodologies, and devices were used to test balance. Despite the large number of studies showing the effect of the Epley Maneuver on vertigo symptomatology, there is little literature in the literature that addresses the clinical aspects of vertigo symptoms and postural balance after the maneuver. To the best of our knowledge; A study evaluating the response to the Epley maneuver with the HUR Btg4 Balance Master System® has not been found in the literature. Therefore, our study, it was aimed to evaluate the change in static-dynamic balance with the balance device before and after the Epley maneuver applied in BPPV patients.

2. Material and Methods

The clinical-prospective study included 104 patients aged 18-70 years who applied to our hospital's ENT clinic between March 2020 and March 2021 with the complaint of vertigo. All patients underwent physical examination (neurological and neurotological) by an ENT specialist. Patients with a history of transient vertigo related to head position ranging from 1 day to 2 years and whose blood pressure was controlled were included in the study. Patients did not use all anti-vertigo drugs or sedatives 48 hours before the maneuver. For the differential diagnosis of peripheral and central vestibular disorders, appropriate case history, otoscopic examination, and audiological evaluation such as pure tone audiometry, impedance audiometry, and subjective vestibular evaluation were performed. Epley maneuver was applied to patients diagnosed with BPPV. Balance assessment with the device was evaluated before the Epley maneuver and in the first week after the maneuver. Patients who agreed to participate in the study were included. In accordance with the Declaration of Helsinki, an informed consent form was obtained from the patient group.

History of orthopedic disorders, neurologic disorders, psychiatric disorders, the use of anti-vertigo or psychotropic medication; who did not previously undergo vestibular rehabilitation or maneuvers cognitive impairment, alcohol consumption within 24 hours of the test, pregnancy, cerebrovascular disease, visual and auditory deficits BPPV patients with bilateral involvement were excluded from the study.

Clinical data and objective balance measures were evaluated at baseline and one week after the maneuver using the HUR Btg4 Balance Master System® (HUR International, FINLAND) balance device (Figure1). Static and dynamic balance assessments of the patients were performed.

Balance rating

1) Static evaluation: After standing on a foam-based solid surface with eyes open and closed, the area, length, speed, and angle parameters of the oscillation and the oscillation times and distances in all directions were evaluated in the oscillation test. This test was repeated three times. Visual system or proprioception impairment was evaluated with this test.

2) Dynamic evaluation: The leaning angle is based on the person's height and how far the center of pressure moved from the normal position. The person leans forward, backward, right, and left with eyes open, and the average values of swing speed (degrees per second) and distance are measured.

Our study was approved by the Local Ethics Committee. (Decision date: 02.01.2020; Decision number: 18).

3. Results

In the study in which 104 patients participated, the mean age of the patients was 45.8±16.34 years. 75 patients (74%) were female and 29 patients (26%) were male (Table 1). The mean body mass index was 25.06±3 kg/m2, migraine was present in 22 (9.2%) patients (Table 1). No significant difference was found between pre and post-Epley values for 'stable area with eyes open (p=0.137), 'stable length with eyes open (p=0.184), 'stable angle with eyes open (p=0.155), 'stable speed with eyes open (p=0.100), 'stable area with eyes closed' (p=0.06) and 'stable angle with eyes closed' (p=0.310). However, a significant difference was found between pre- and post-Epley values for 'stable length with eyes closed' (p=0.00) and 'stable speed with eyes closed' (p=0.007) (Table 2).

No significant difference was found between pre- and post-Epley values for 'tendency to deviate to right with eyes open, 'tendency to deviate to left with eyes open, 'tendency to deviate to right with eyes closed, and 'tendency to deviate to left with eyes closed' (p>0.05) (Table 3).

Table 1. Demographic and clinical characteristics

	Patients (n=104)	*P*
Age (mean ± SD)	45.64± 16.3	0.98
Gender (F/M)	75/29(9	0.72
BMI (mean ± SD)	25.06± 3.5	0.24
Ear fullness (yes / no) %	55.6/44.4	0
Headache (yes / no) %	67.7/32.3	0
Migraine (yes / no) %	22.2/77.8	0
Tinnitus (right / left) %	67/33	0
Disease onset (sudden / gradual) %	60/40	0
Course of dizziness (continuous/intermittent) %	35/65	0
Affected by head movement (yes / no) %	89/11	0

SD: Standard deviation, F: Female, M: Male

Table 2. Static balance assessment results

Parameters	Before Epley Maneuver (Mean ± SD)	After Epley Maneuver (Mean ± SD)	*p* value* (Wilcoxon's test)
Stable area with eyes open (mm^2)	271± 316.4	280.3± 433.8	0.137
Stable length with eyes open (mm)	276.4 ±158.9	267.7 ±108.8	0.184
Stable angle with eyes open (degree)	18.45± 59.9	5.6 ±61.01	0.155
Stable speed with eyes open (mm/sec)	11.07± 18.78	6.3± 3.5	0.100
Stable area with eyes closed (mm^2)	500.3±353	424 ±211	0.06
Stable length with eyes closed (mm)	116.63± 111.8	267.7 ±108.8	0.00
Stable angle with eyes closed (degree)	3.2± 65.4	14.37± 81.37	0.310
Stable speed with eyes closed (mm/sec)	12.19 ±9.57	10.7± 5.9	0.007

SD: Standard deviation

Table 3. Dynamic Balance Assessment Results

	Before Epley Maneuver (Mean ± SD)	After Epley Maneuver (Mean ± SD)	*p* value* (Wilcoxon's test)
Tendency to deviate to right with eyes open	50.2± 2.5	54.06± 38.8	0.800
Tendency to deviate to left with eyes open	49.7± 2.5	49.7 ±2.9	0.995
Tendency to deviate to right with eyes closed	50.3± 2.5	49.5± 5.4	0.441
Tendency to deviate to left with eyes closed	49.6± 2.5	52.08± 2.7	0.180

SD: Standard deviation

Statistical analysis

Statistical analysis was performed using the IBM SPSS version 26.0 software (IBM Corp., Armonk, NY, USA). Data were expressed in mean±standard deviation or median and interquartile range (25th and 75th percentiles) in parametric or non-parametric tests, respectively. The normality assumption of the related data was checked by the Shapiro-Wilk test. Independent samples t-test or Mann-Whitney U test was used to compare each variable between the groups according to the normality test result. The paired t-test or Wilcoxon signed-rank test was used in the case of within-subject comparisons. The effect size of the analyses was calculated. A p-value of <0.05 was considered statistically significant.

4. Discussion

In this study, we examined the change of balance on static and dynamic grounds by using the HUR balance device before and after the Epley maneuver in patients with BPPV. According to our results, it has been shown that the Epley maneuver provides an improvement in static balance. On the other hand, it was determined that no improvement could be achieved in the dynamic balance, which is the sudden response of people to the deterioration of balance while in motion.

BPPV is the most common and treatable vestibular cause of vertigo 3,13-15. Body balance is a complex system that is affected by visual, vestibular, and somatosensory systems, muscle harmony especially muscle tone 16. Muscles provide postural balance and are effective in standing upright against gravity. Balanced stance is coordinated in response to changes in the center of gravity 17. A balance disorder is seen in approximately 30% of people over the age of 65 and in 50% of people over the age of 80 18. Cardiovascular, metabolic, osteoarthritic diseases 19,20, and carotid vertebral artery stenosis are the factors that increase the risk with age, balance disorder, and dizziness 21. This age-related decrease in postural balance control has been interpreted as a deterioration

of sensory, motor, or cognitive systems 22. Although patients with known metabolic and cardiovascular diseases were not included in our study, the mean age of our patients was 45.8 + 16.34.

Balance is examined in two sub-sections as static and dynamic balance. Static balance is defined as the ability to control postural sway while standing still. Dynamic balance is the ability to predict postural changes that occur during movement and to give appropriate responses to balance changes. Balance devices help to evaluate different body balances and to objectively evaluate static and dynamic balance changes 23. We found improvements in measurement results, especially in static evaluations, with the Epley maneuver. BPPV patients show increased postural instability in some static and dynamic balance with altered or absent visual input for several weeks after the maneuver 24,25. A study by Horak et al., compared individuals with vestibular dysfunction and individuals with normal vestibular function and showed that vestibular and somatosensory system disorders caused balance disturbances in the patient group 26. Stambolieva and Angov compared body balance in healthy adults and in patients with BPPV using static posturography with eyes open and closed both before and after the Epley maneuver and showed that the patients' balance changed after the maneuver and that the maneuver provided a vertical standing position by affecting the visual-vestibular system 27. In another study evaluating the effectiveness of the Epley maneuver on treatment and balance using posturography, a significant improvement in stability was observed in patients after Epley, which is consistent with our study 16. Consistent with the studies in our study, we aimed to show the effect of Epley on the balance; we found significant improvement in static balance after Epley. This made us think that body stability and postural balance could be better controlled after Epley. No significant changes were observed before and after Epley in eyes-open static assessments. Our evaluation, in line with other studies, has shown that visual and/or proprioceptive senses are effective in maintaining body balance in patients with vestibular disorders. In the evaluations of the stable area with eyes closed, length and velocity, there were significant changes before and after Epley. The decrease in the swing area and speed showed the accuracy and efficiency of the maneuver, as well as suggesting that it contributed to the improvement in balance. In a study in which patients with BPPV were evaluated after the Epley maneuver, a significant improvement was found in the evaluations of the patients with eyes closed, similar to our study 28.

We did not detect any significant improvement in dynamic balance scores. This made us think about whether patients with BPPV could adapt to changing proprioceptive and visual stimuli. Normal dynamic stability may not be achieved in all patients after a successful Epley maneuver 29. Dannenbaum et al. In their study on vestibular-evoked exercise training, a significant increase in the dynamic balance score was observed in patients 30. Shumway-Cook et al. also found a significant improvement in dynamic gait index after vestibular stimulated exercise training 31. In a study of 26 patients undergoing vestibular rehabilitation, it was found that there was a significant improvement in dynamic balance and self-sufficiency compared to patients treated with the Epley maneuver alone 32. Supported by the literature; vestibular rehabilitation exercises are important for significant improvement in dynamic balance 33. This situation supports that vestibular stimulated exercise training should be added to the treatment except for the Epley maneuver in order to improve the dynamic balance. This explains the absence of change in dynamic balance in our study. In the literature, we could not find any other study in which the balance was evaluated with the HUR balance device we used in our study. There are very few studies in which the change in balance is evaluated with the device before and after Epley treatment, especially in patients with vertigo. In our study, the usability of the Epley maneuver in treatment, especially its effect on the balance parameters of the individuals, was revealed more clearly with the measurements made with the device.

The main limitations of the study; are the small sample size, we don't have a control group, cannot to apply vestibular stimulated exercise training to our patients, and cannot to follow up with our patients. Dizziness is multifactorial in its cause. It requires diagnosis and treatment in the physical, psychological and emotional areas. Comparing Epley's maneuver with other treatment methods, patients could be re-evaluated with vestibular rehabilitation for dynamic balance improvement. Further work can be done in this context.

5. Conclusion

The Epley test is an important and effective method for getting better balance disorder, which is an important problem in patients with vertigo, and the prevention of related complications. The inclusion of patients in a vestibular balance training program in addition to maneuvers will also contribute more positively to their recovery.

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Ethics

Ethics Committee Approval: The study was approved by Firat University Noninterventional Clinical Research Ethical Committee (Number:2020/01-18, Date: 02.01.2020).

Informed Consent: The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.

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