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Effectiveness of Canalith repositioning Manoeuver on balance in patients with bilateral vertigo

Natha Sneha [1] and Natasha Verma [2,*]

[1] *Post Graduate Student, Master of Neurological Physiotherapy, Garden City University, Bengaluru, Karnataka, India.*
[2] *Assistant Professor, Department of Physiotherapy, Garden City University, Bengaluru, Karnataka, India.*

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Abstract

Background: Bilateral vestibular dysfunction is a challenging condition that significantly impacts balance and overall quality of life. One of the causes of this dysfunction is benign paroxysmal positional vertigo (BPPV), which affects the inner ear and leads to episodes of dizziness. The Canalith Repositioning Maneuver (CRM) is a widely recognized treatment for BPPV in unilateral cases, but its effectiveness in bilateral vertigo remains less explored. This review aims to assess the current literature on the effectiveness of CRM in improving balance in patients with bilateral vertigo.

Methods: A systematic review of studies was conducted using databases such as PubMed, Scopus, and Google Scholar. Inclusion criteria were studies that specifically addressed the use of CRM in patients with bilateral vertigo, examining outcomes related to balance, dizziness, and quality of life. Data was analyzed for trends in treatment success, adverse effects, and comparative effectiveness.

Results: The review revealed that while CRM has shown significant effectiveness in managing unilateral BPPV, evidence for its success in bilateral vertigo is limited and inconclusive. A few studies indicated improvement in balance and reduction in dizziness after CRM, but these findings were often based on small sample sizes and varied methodologies. In some cases, patients experienced partial or temporary relief. Additionally, the effectiveness of CRM was found to depend on the specific type of vestibular dysfunction and the frequency of vertigo episodes.

Conclusion: The Canalith Repositioning Maneuver may offer some benefit in patients with bilateral vertigo, but the evidence remains insufficient to draw definitive conclusions. Larger, well-designed clinical trials are needed to better understand its effectiveness and to establish specific guidelines for its application in this patient population. Until then, CRM should be considered on a case-by-case basis, with ongoing evaluation of its impact on balance and overall functionality.

Keywords: Unilateral Vertigo; BPPV; Canalinth Repositioning Maneuver; Balance; Epley Maneuver; Berg Balance Scale; Timed up and go test; Falls

1. Introduction

Dizziness is frequently reported by patients in primary care and emergency departments. Vertigo, the sensation of motion when there is none, arises from a mismatch of information from visual, vestibular, and proprioceptive systems. It can be classified as central or peripheral, with central vertigo generally being more serious.[1]

* Corresponding author: NATASHA VERMA

Approximately 45% to 54% of patients seeking care for dizziness experience vertigo, mainly due to conditions like acute peripheral vestibulopathy, Ménière's disease, and benign paroxysmal positional vertigo (BPPV), with BPPV being the most common. The prevalence of dizziness is about 5% to 10% in the general population, increasing to around 65% in individuals over 65. Annually, 15% to 20% of adults are affected, with vestibular vertigo accounting for a quarter of these cases.[2]

BPPV occurs when otoconia, small calcium carbonate crystals, become displaced from the otolithic membrane, often due to trauma or aging. This displacement stimulates the semicircular canals incorrectly, causing vertigo. Balance relies on complex interactions between vision, vestibular input, and motor output. Canalith repositioning maneuvers (CRMs), particularly the Epley maneuver, are effective treatments for BPPV by moving the displaced otoliths back into the utricle.[3,4]

Bilateral vertigo involves dysfunction in both vestibular systems, leading to unique diagnosis and management challenges. While unilateral BPPV can often be treated with CRMs, the treatment for bilateral BPPV is less clear due to the impairment of both vestibular organs, which results in greater balance difficulties.

Balance is a crucial function that helps individuals maintain an upright posture and coordinate their movements. It relies on the integration of input from multiple sensory systems, including the vestibular system, vision, and proprioception. The vestibular system, located in the inner ear, plays a key role in balance by detecting changes in head position and motion. It provides the brain with essential information about spatial orientation, acceleration, and deceleration, allowing the body to respond appropriately to maintain stability.

Bilateral vertigo, which is often caused by bilateral vestibular dysfunction or bilateral vestibular loss (BVL), refers to a condition in which both vestibular systems (in the left and right inner ears) are impaired. This dysfunction results in the loss of sensory input from both sides of the vestibular apparatus, complicating the brain's ability to perceive changes in position and motion. As a result, individuals may experience imbalance, dizziness, and a lack of coordination during daily activities.

Unlike unilateral vestibular loss, where the brain still receives input from one vestibular organ, bilateral vestibular loss significantly compromises the body's ability to maintain balance. Patients with bilateral vestibular loss often experience chronic dizziness, an unsteady gait, and difficulty focusing during visual tasks.[5,6,7]

2. Review literature

Table 1 Characteristics of Extracted Articles

Sl no	Author	remarkes	Conclusion
1	Sen yan [8]	2024	A randomized control trial (RCT) was conducted to assess the role of comprehensive vestibular rehabilitation using virtual reality (VR) technology for residual symptoms following canalith repositioning procedure (CRP) in patients with benign paroxysmal positional vertigo (BPPV). A total of 124 patients with residual symptoms 24 hours after CRP were divided into four groups: a normal control (NC) group, a Cawthorne-Cooksey exercise group, a Brandt-Daroff exercise group, and a VR group. The NC group received no intervention, while the other groups received their respective therapies. The study concluded that VR-based vestibular rehabilitation effectively alleviates residual symptoms, reduces abnormal rates of OVEMP and CVEMP, and improves balance.
2	mohammad abu shaphe [9]	2023	A randomized control trial was conducted to compare the effectiveness of Epley-canalith repositioning procedure (ECRP) and vestibular rehabilitation therapy (VR) in diabetic patients with posterior benign paroxysmal positional vertigo (BPPV). Thirty Type 2 diabetes mellitus patients, aged 40-65, were randomly assigned to either ECRP or VR groups. Outcomes, including the Vertigo Symptom Scale-Short Form (VSS-sf) and Berg Balance Scale (BBS), were assessed before and after 4 weeks of treatment. Both treatments improved VSS-sf and BBS scores, suggesting that VR therapy is an effective option for improving vertigo, postural stability, and daily function in diabetic BPPV patients.

3	mohamad alfarghal [10]	2023	A systematic review and meta-analysis was conducted to evaluate the treatment efficacy of repositioning maneuvers in multiple canal benign paroxysmal positional vertigo (BPPV). A literature search was performed across PubMed, Scopus, and Web of Science databases. After removing duplicates and screening articles, discrepancies were resolved by independent reviewers. The study concluded that repositioning maneuvers provide rapid and long-lasting relief in single canal BPPV, while multiple canal BPPV often requires repeated treatments, with a higher risk of recurrence.
4	se to, phuliline [11]	2022	A randomized controlled trial was conducted to assess the effects of customized vestibular rehabilitation (VR) combined with canalith repositioning maneuver (CRM) on gait and balance in adults with benign paroxysmal positional vertigo (BPPV). Twenty-eight adults were randomized into control (CRM for 2 weeks) and experimental (customized VR plus CRM for 6 weeks) groups. Gait measures were recorded at baseline, week 4, and 6. The study found that six weeks of customized VR combined with CRM was more effective than CRM alone in improving balance and gait in adults with posterior canal BPPV.
5	Phui lin [12]	2022	A randomized controlled trial investigated the effects of customized vestibular rehabilitation (CVR) on static balance in adults with idiopathic unilateral posterior canal BPPV. Twenty-eight adults were randomized into control (CRM only) and experimental (CVR + CRM) groups for six weeks. Static balance was measured using a kinematic sensor at baseline, week 4, and week 6 while standing on firm and foam surfaces with eyes open and closed. The results showed that CVR, in addition to CRM, significantly improved static balance in adults with posterior canal BPPV by week 6.
6	Barnana roy [13]	2022	This study aimed to assess the effectiveness of Cawthorne-Cooksey exercises in improving balance in patients with vertigo and dizziness. A systematic review of eight randomized controlled trials, published from 2003 to 2021, met the inclusion criteria: patients with dizziness and balance impairment, and Cawthorne-Cooksey exercise as an intervention. The search followed the PRISMA protocol, and quality was assessed using the PEDro scale. All studies provided good evidence quality. The findings suggest that Cawthorne-Cooksey exercises, especially in modified or multimodal forms or combined with other interventions, effectively improve balance in patients with dizziness and vertigo.
7	Wu peixia [14]	2021	A randomized controlled trial conducted Effect of dynamic balance during the onset of benign paroxysmal positional vertigo on residual dizziness after successful repositioning from January 2018 to August 2019 assessed the impact of dynamic balance on residual dizziness after successful repositioning in patients with unilateral posterior or horizontal semicircular canal BPPV. Dynamic balance was measured using the sensory organization test (SOT) before the repositioning maneuver. Residual symptoms and their duration were followed up for up to three months. The study concluded that impaired dynamic balance at the onset of BPPV, characterized by abnormal vestibular input, predicts residual symptoms like unsteadiness or floating, but not the duration of these symptoms.
8	cohen-shwartz, yafit [15]	2020	A randomized controlled trial assessed the effects of canalith repositioning procedure (CRP) on gait and static balance in individuals with posterior semicircular canal BPPV. Gait and balance tests were performed at baseline and re-evaluated one week after CRP. The Hallpike-Dix test identified patients who improved or showed no improvement in BPPV signs and symptoms. The study concluded that, in addition to alleviating vertigo and balance issues, BPPV patients also exhibit walking modifications. CRP effectively improves both vertigo and restores gait and balance in individuals with BPPV.
9	lin, sang-i [16]	2020	A randomized controlled trial examined balance performance in response to visual stimuli in patients with BPPV, comparing them to healthy young and older adults. Participants were tested under three conditions: eyes open, watching a static picture, and watching a rotating visual scene. Antero-posterior, lateral, and total

			sway paths were analyzed. The study found that patients with BPPV had similar balance control to older adults, but poorer control than young adults. The reduced balance control in the coronal plane in BPPV patients may affect their balance strategy after external perturbations.
10	Ali Khalaf Mahrous [17]	2020	A randomized controlled trial study conducted on a Effectiveness of Epley's Repositioning Maneuver in the Treatment of Benign Paroxysmal Positional Vertigo methos e searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register; CENTRAL; PubMed; EMBASE; CINAHL; Web of Science; Cambridge Scientific Abstracts; ICTRP and additional sources for published and unpublished trials. The date of the most recent search was 23 January 2014. Concluded that Epley's maneuver was successful in 90% of cases who presented with posterior canal BPPV. This tallies with the world literature in terms of the success rate
11	Eyvonne sim ma dvphysiosci [18]	2019	A systematic review and meta-analysis included prospective experimental or observational studies on adults with BPPV treated with repositioning maneuvers, with a minimum one-month follow-up. Studies were excluded if they were not available in English or focused solely on positional tests and subjective vertigo ratings. Methodological quality was assessed using the Joanna Briggs Institute Checklists. The analysis compared outcomes between younger and older adults (≥60 years). The study concluded that while repositioning maneuvers are effective in managing BPPV, some patients experienced residual dizziness, instability, recurrences, and psychoemotional effects. Older adults showed less improvement in dynamic balance and self-perceived handicap compared to younger adults.
12	Ujwal lakshman yeole [19]	2018	A randomized controlled trial evaluated the effect of proprioceptive exercise versus vestibular rehabilitation therapy on fall risk in elderly individuals. Sixty participants were randomly assigned to either Group A (proprioceptive training) or Group B (vestibular training). Fall risk was assessed pre- and post-intervention using the Berg Balance Scale, Time Up and Go Test, Fall Efficacy Test, and Functional Reach-out Test. The study concluded that proprioceptive training was more effective than vestibular rehabilitation in reducing the risk of falls in the elderly.
13	Nicole knights [20]	2018	A case study conducted on a canalith-repositioning maneuvers and balance interventions on a patient with multiple-canal bppv .concluded that After treatment with the epley maneuver and balance activities, the patient demonstrated improvement in the this as evidenced by the patient's ability to perform functional tasks and mobility with less dizziness
14	Linda J. D'Silva [21]	2017	Randomized control study conducted on a The impact of diabetes on mobility, balance, and recovery after repositioning maneuvers in individuals with benign paroxysmal positional vertigo methods of the study Fifty participants, BPPV (n=34) and BPPV+DM (n=16) were examined for symptom severity (dizziness handicap inventory, DHI), mobility (functional gait assessment, FGA), and postural sway (using an accelerometer in five conditions) before and after the CRM. The number of maneuvers required for symptom resolution was recorded.Concluded that efficacy of CRM treatments in people with posterior canal BPPV canalithiasis with and without DM
15	Hale Karapolat [22]	2015	A systematic review compared the effectiveness of vestibular rehabilitation in patients with unilateral (n=42) and bilateral vestibular dysfunction (n=19). Patients were evaluated before and after eight weeks of customized vestibular rehabilitation using the Dizziness Handicap Inventory (DHI), Activities-specific Balance Confidence Scale (ABC), Timed Up and Go Test (TUG), Dynamic Gait Index (DGI), and static posturography. The study concluded that vestibular rehabilitation was equally effective in both unilateral and bilateral vestibular dysfunction patients in improving disability, dynamic balance, and postural stability.

3. Methodology

The evidence was gathered from online web publications obtained from different search engines, including Google Scholar, PubMed, and other obesity journals. A tailored search was conducted using effectiveness of canalith repositioning manoeuvre on balance in patients with bilateral vertigo. to retrieve relevant publications. The period was designated as 2015 to 2024 to gather precise and current facts from throughout the globe over the past decade. We have identified a total of 15 articles that meet our specific criteria for inclusion and exclusion. All 15 publications were obtained in their entirety to be analyzed and continued with further analysis. The results are derived using a systematic approach from all articles and displayed in a tabular format for enhanced comprehension. The selection techniques are detailed in the PRISMA.

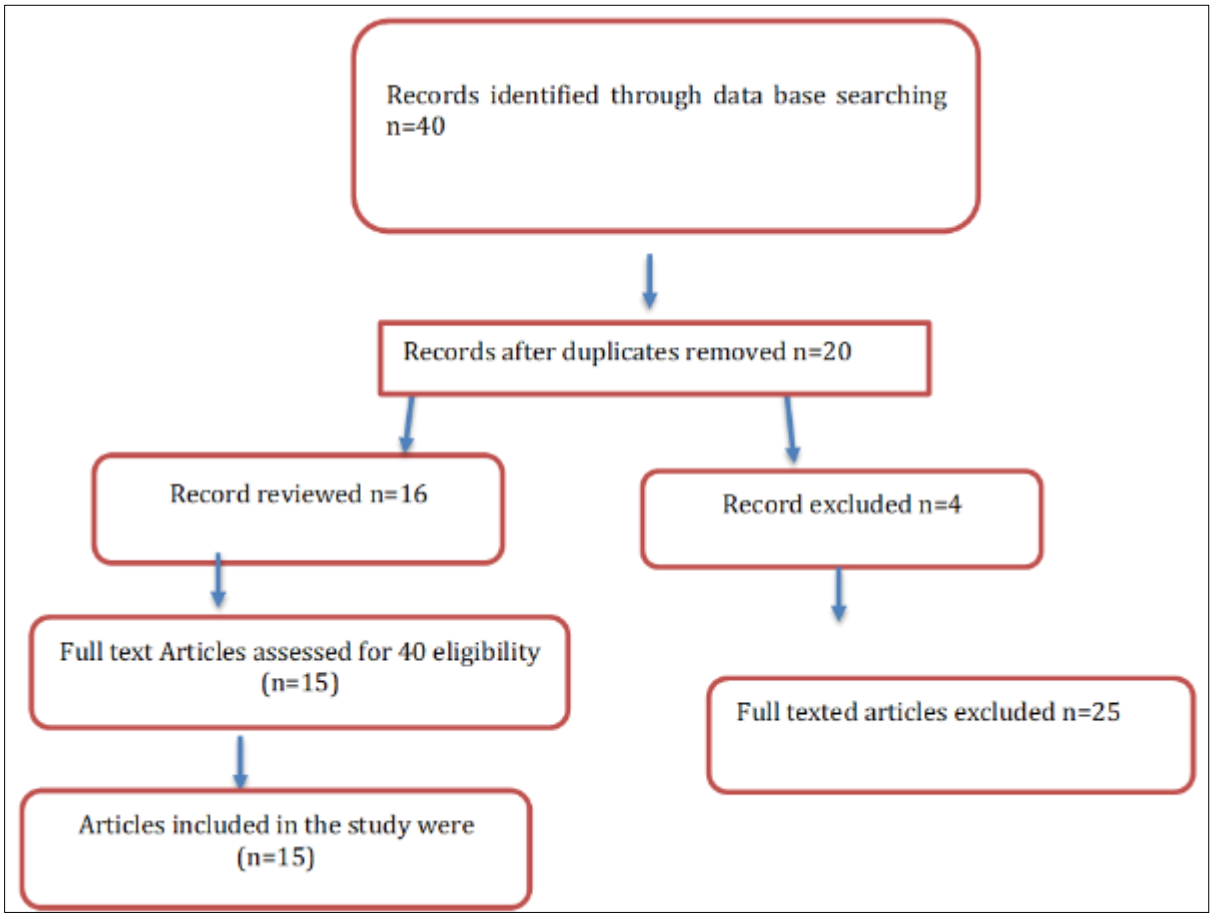

Figure 1 Flow Chart

4. Discussion

4.1. Mechanism of Canalith Repositioning Maneuvers

Canalith repositioning maneuvers (CRMs), including the Epley and Semont maneuvers, are designed to move displaced otoconia from the semicircular canals back to the utricle, helping to alleviate vertigo symptoms. These maneuvers involve specific head movements to facilitate the movement of otoconia. While CRMs are effective for unilateral benign paroxysmal positional vertigo (BPPV) (Hain & Helminski, 2010)[23], their application in bilateral vertigo is more complex, as both vestibular systems are affected and may compromise the body's ability to restore balance.

4.2. CRMs in Bilateral Vertigo

Applying Canalith Repositioning Maneuvers (CRMs) to bilateral vertigo is challenging due to dysfunction in both vestibular systems, which can lead to significant balance impairments. While studies have shown mixed results, Casani et al. (2010)[24] reported that patients with bilateral Benign Paroxysmal Positional Vertigo (BPPV) experienced

improvements in vertigo symptoms after CRMs, though complete resolution of balance deficits was not achieved, suggesting a need for additional rehabilitation.

4.3. Effectiveness of CRMs in Improving Balance

CRMs alleviate vertigo by repositioning displaced otoconia but do not directly address the vestibular insufficiency that causes balance issues (Dieterich & Brandt, 2008)[25]. Balance disorders in bilateral vestibular dysfunction stem from reduced input from vestibular organs. Combining CRMs with vestibular rehabilitation therapy (VRT) has shown promise in improving balance by retraining the brain to compensate for lost input (Horii et al., 2012)[26].

4.4. CRMs for Bilateral BPPV

Research on CRMs for bilateral BPPV is limited. A study by Ko et al. (2013)[27] found that 70% of ten patients reported reduced vertigo and improved balance after Epley maneuvers, but postural stability did not significantly improve. Similarly, Aranda et al. (2019)[28] found that combining CRMs with VRT led to better outcomes in managing vertigo and enhancing balance.

4.5. The Role of Vestibular Rehabilitation

Vestibular rehabilitation therapy (VRT) is widely recommended in the treatment of bilateral vestibular dysfunction, as it can improve postural stability and compensatory mechanisms. A study by Kuo et al. (2015)[29] demonstrated that combining CRMs with VRT resulted in better long-term outcomes for balance in patients with bilateral vestibular disorders. The exercises help stimulate neural compensation, allowing the brain to adapt to the reduced vestibular input.

5. Conclusion

The effectiveness of canalith repositioning maneuvers (CRMs) in improving balance for patients with bilateral vertigo is still under investigation. While CRMs can effectively alleviate vertigo symptoms in those with bilateral benign paroxysmal positional vertigo (BPPV), their impact on balance is uncertain. Patients often need a comprehensive treatment approach, combining CRMs with vestibular rehabilitation therapy to address balance deficits. Future research should focus on larger groups to better evaluate the combined effects of these treatments on balance issues in bilateral vertigo patients.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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