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REVIEW ARTICLE

The use and effectiveness of the TRV Chair – a literature review

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ABSTRACT:

Introduction: Vertigo is a subjective sensation of swaying, tilting, spinning, instability, or being off-balance [1]. The concept of vertigo is not a precise term due to the possibility of its being related to numerous variable, frequently co-occurring sensations as experienced by the patient. For this reason, diagnosing the origin of vertigo quite frequently poses a serious dilemma for physicians. Dizziness can be of peripheral or central origin. Benign paroxysmal positional vertigo (BPPV) is the most common cause of peripheral vertigo and is currently considered to account for about 14–42% of all cases of vertigo, depending on the authors [2–4]. However, this figure may be underestimated due to frequent misdiagnoses.

Aim: The aim of this paper is to review the currently available international literature on the use of the TRV chair so as to assess its usefulness and effectiveness in the diagnostics and possibly subsequent treatment of BPPV and its components.

Materials and methods: Included in this literature review are peer-reviewed papers authored by various research teams as available in PubMed, Google Scholar, and Scopus databases.

Results: The TRV chair is helpful in precise diagnosis and subsequent treatment of BPPV subtypes (canalithiasis and cupulolithiasis) as well as in the evaluation of the number of affected canals, as shown in the papers analyzed in this review.

Conclusions: The use of TRV in the context of diagnosis and therapy of benign paroxysmal positional vertigo presents with potential for the improvement of diagnostic results, management protocols, and patients' quality of lives.

KEYWORDS: benign postural vertigo, BPPV, diagnostic maneuvers, residual dizziness, TRV chair, vertigo

ABBREVIATIONS

BPPV – benign paroxysmal positional vertigo
ABPPV – anterior benign paroxysmal positional vertigo
CRP – canalith repositioning procedure
HBPPV – horizontal benign paroxysmal positional vertigo
PBPPV – posterior benign paroxysmal positional vertigo
RD – residual dizziness
TRV – TRV Chair

INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) was first described in 1921 by Barany as a characteristic nystagmus associated with a change in position [5]. Within the background of the disorder lie disorders of the canalocupular complex of the inner ear. BPPV is a non-life-threatening condition manifested by suddenly occurring symptoms of vertical or horizontal spinning dizziness. Symptoms are triggered by a specific position of the head, or a change in body position [6]. Degeneration of the otolithic organ of the utricle and otoliths being released from the macula of the utricle or the saccula and migrating into the endolymphatic space of the semicircular canals play a significant role in the pathomechanism of these symptoms. As a result, pathological action potentials are generated at the crest receptor during head movements, translating into the subjective sensation of dizziness [7]. The pathology can be classified on the basis of the semicircular canal involved into posterior benign paroxysmal positional vertigo (PBPPV) 85–95% of cases, horizontal benign paroxysmal positional vertigo (HBPPV) 5–15% of cases, anterior benign paroxysmal positional vertigo (ABPPV) 2% of cases, as well as into multicanal or bilateral multicanal disorders [8–10]. Another classification system is based on the mechanism of onset and consists in the disorder being due to canalithiasis vs cupulolithiasis [11]. It is crucial to differentiate BPPV from other causes of dizziness as a broad spectrum of disease processes, from benign to life-threatening conditions (stroke, CNS tumors), must be taken into account in differential diagnosis [12]. The diagnostic process is seemingly straightforward, as it consists of a characteristic history and positive results of Dix-Hallpike maneuver or Roll Test [3, 13]. At present, BPPV cannot be confirmed by any other method [10]. Unfortunately, it turns out that despite a diagnostic tool such as the above-mentioned maneuvers being available, it is frequently impossible to use it. In everyday medical practice, difficulties can arise from technical reasons including lack of appropriate equipment within the physician's office, to patient-related reasons such as cervical spine disorders or excessive body weight. In light of these difficulties, tools such as the TRV as designed by Dr. Thomas Richard-Vitton, have been developed to facilitate diagnosis and subsequent treatment [6]. The TRV is a mechanical device that facilitates patient rotation in the planes of all semicircular canals while simultaneously and precisely

monitoring eye movements using videonystagmography. In practice, this translates into easier diagnosis of ailments and detection of even discrete nystagmus, thereby increasing the sensitivity and specificity of the diagnostic method, and thus improving patient outcomes. The TRV also provides a solution for patients who cannot have maneuvers performed in the classic manner, for psychological reasons [10]. The aim of this paper is to review the currently available international literature on the use of the TRV so as to assess its usefulness and effectiveness in the diagnosis and possibly subsequent treatment of BPPV and its components.

METHODS

Included in this literature review were peer-reviewed papers authored by various research teams as available in PubMed, Google Scholar, and Scopus databases. The inclusion criteria for the papers were as follows: study population age of 18–80 years, IF-scored articles, publications available in English. Exclusion criteria included studies in children, studies of unclear methodology, studies reporting on interventions in patients following previous TRV treatment. The data obtained were grouped and presented in a table according to the analyzed variables: number of patients by gender, age, number of patients treated by the classic canalith repositioning procedure (CRP), number of patients treated using the TRV, improvement after the first maneuver, total improvement rate, follow-up time, number of maneuvers needed to achieve improvement, and treatment failures.

RESULTS

A total of 5 articles on the diagnosis and treatment of BPPV using the TRV have been included in this literature review. The data from the papers published to date appear promising.

The first paper included in the analysis was that by Tan et al. [1]. The study was carried out in a group of 165 patients diagnosed with BPPV. Patients were divided into two groups according to their CRP *vs.* TRV treatment. The two groups did not differ with respect to clinical and demographic baseline values. Patients were evaluated sequentially at 1 week, 4 weeks, 3 months, and 6 months after the first treatment. In cases of failure at follow-up (recurrence of vertigo with concomitant nystagmus as provoked by the Dix-Hallpike maneuver), the therapeutic maneuver the patient had undergone during the first session was performed again. The authors observed that the treatment efficacy as assessed 1 week after the procedure was higher in patients in the TRV group than in patients in the CRP group. However, a higher success rate after all sessions was observed in the CRP group. The number of treatment sessions needed for successful repositioning as assessed 4 weeks after the first treatment was significantly lower in the TRV group than in the CRP group. At 6 months of follow-up, improvement was observed in all patients. Patients with recurrence reported a reduction in the severity of vertigo as compared to that before their first visit [1].

In the second study, West et al. recruited 150 patients with refractory vertigo suspected of having BPPV [14]. Ninety-five patients were diagnosed with BPPV, including 81/95 (85.3%) patients being diagnosed using the TRV. The researchers divided their BPPV patients into subgroups based on the canal involved and the mechanism of origin. CRP, Epley Omniax positioning system, TRV, or combinations of the above were used for patient treatment. The inclusion criteria included symptoms, such as duration of vertigo attacks, frequency of symptoms, and triggers. Classic methods were used in 9 patients, while the TRV was used in 38 patients [14]. Data summarizing treatment with classic maneuvers and the TRV are presented in Tab. I.

Pedersen et al. carried out a study in a group of 81 patients with atypical and refractory BPPV with a history of CRP failing to produce the intended therapeutic effect. All patients were treated using the TRV. Patients reported to at least one follow-up visit following the initial treatment; follow-up visits were scheduled until the treatment was deemed effective (no nystagmus being observed upon diagnostic maneuvers and no sensation of dizziness being reported). Follow-up visits were scheduled 2–4 weeks after the treatment, on average every 26 days. The treatment efficacy was demonstrated after an average of 2.23 (±1.66) treatments using the TRV, with an overall improvement rate of 92.4%. Six patients required more than 10 treatment maneuvers and were therefore classified as failures. As many as 60% of patients within the study group reported marked symptom relief after just 1 maneuver [10].

Hougaard et al. carried out a 7-year study involving TRV treatment of 635 BPPV patients. A total of 15 patients dropped out during the study. As shown by the researchers, the treatment success rates in all patients were 39%, 58%, 70%, 94%, and 100% for 1, 2, 3, 10, and as many as 55 treatments, respectively. For unilateral pathologies within a single canal, the improvement rates amounted to 60%, 72%, 87%, and 98%, respectively, with a range 1–25 treatments. Patients (45) who required more than 10 treatments to achieve a therapeutic effect were classified as treatment failures. After accounting for treatment failures, the overall average number of treatments required to achieve successful treatment in the study amounted to 2.7. No gender differences were observed with regard to the number of maneuvers required (2.7 *vs.* 2.7); however, the need for treatment was found to increase by 0.5% per year with age. The authors also showed that BPPV that involved more than one canal required more maneuvers in comparison to patients reporting complaints of single canal origin [15].

Soylemez et al. focused on the impact of TRV treatment on residual dizziness (RD) after BPPV had been treated successfully using repositioning maneuvers. RD was defined as feeling off-balance without the presence of rotational or positional vertigo. The group of 33 patients with BPPV was divided into two subgroups; patients having received TRV maneuvers (17 patients) and patients having received CRP (16 patients), all to successful outcomes. Patients successfully cured of BPPV following the maneuvers were presented with a VAS questionnaire to assess RD. Patients were asked to fill out this form daily. Patients reporting no RD (VAS = 0) had their follow-up terminated while the remaining patients continued to fill out the forms until complete recovery. In the TRV group, the RD rate on the first day was 94.1% VAS, and

Tab. I. Comparison of the available scientific reports.

NO.	PUBLICATION YEAR, AUTHORS	NUMBER OF BPPV PATIENTS	TRV (MEN/WOMEN)	CRP (MEN/WOMEN)	MEAN AGE (YEARS) ±SD	IMPROVEMENT AFTER THE FIRST MANEUVER	IMPROVEMENT AFTER SUBSEQUENT MANEUVERS (TOTAL)	NUMBER OF MANEUVERS REQUIRED TO ACHIEVE IMPROVEMENT	FOLLOW-UP PERIOD	FAILURES REPORTED
1)	2014 Tan et al.	165	81 23/58	84 21/63	TRV 52.51 ±11.35 CRP 55.13 ±11.20	TRV 69 (85.2%) CRP 61 (72.6%)	After 4 weeks: TRV + 675 (92.6%)] CRP + 1980 (95.2%)] After 6 months: TRV + 4 [79 (97.5%)] CRP 80 (95.2%	4 weeks: 1.20 ±0.46 3 months: 1.31 ±0.68.6 6 months: 1.38 ±0,75	1 week 4 weeks 3 months 6 months	–
2)	2015 West et al.	95 68/27	38	9	60 ±17		TRV 35 CRP 4	TRV 3.23 (±1.96 SD) CRP 1	6 months	TRV failure: 1 Dropouts: TRV 2 CRP: 5
3)	2020 Pedersen et al.	81	81 (27/54)	–	61.80 (±15.26)	45 (55.6%)	+30 [75 (92.6%)]	2.23 (±1.66 SD)	2–4 weeks after the maneuver	6 (7.4%)
4)	2022 Hougaard et al.	635	635 (208/427)	–	64 (16.3)	242 (39 %)	After 2 maneuvers: 360 (58%) After 3 maneuvers: 434 (70%) After 10 maneuvers: 583 (94%) After 55 maneuvers: 620 (100%)	2.7	9–12 months	15 (2%) dropped out during the study 45 (7%) regarded as failure
5)	2023 Soylemez et al.	33	17 (4/13)	16 (6/10)	TRV group 43.00 ±7.02 (mean, 34–57) Hand group 44.06 ±8.96 (average, 32–60)	Assessment of RD following the maneuver Day 1 TRV group 16 (94.1%) Manual group 16 (100%)	Assessment on the following days TRV Group Day 2: 10 subjects (58.8) Day 3: 5 subjects (29.4%) Manual group Day 2: 14 subjects: (87.5%) Day 3: 1 subjects: (68,7%)	Duration of RD (days) TRV group 2.47 ±1.77 (0–7) Manual group 3.38 ±1.70 (1–7)	8 days	–

TRV – patients subjected to maneuvers using the TRV chair; CRP – patients subjected to classic canalith repositioning procedure; RD – residual dizziness

the duration of RD was 2.47 ±1.77 (0–7) days. In the CRP group, the RD rate on the first day was 100%, and the RD duration was 3.38 (±1.70) days. There was no statistically significant difference between the groups in terms of RD duration ($p > 0.05$). The average severity of RD during the first 3 days was lower in the group having undergone TRV maneuvers as compared to the group having undergone CRP ($p < 0.05$). No significant differences were observed between the groups on other days ($p > 0.05$). In addition, a positive correlation between RD and DHI and the duration of BPPV ($p < 0.05$) was observed [16].

DISCUSSION

Due to the retrospective nature of the publications discussed in this review, the low number of available scientific reports, and the diverse group of patients studied over a 10-year period, standardization of observations of the use of the TRV and determination of its potential superiority over manually performed maneuvers is difficult and definitely requires further research.

Tan et al. observed greater efficacy of the TRV maneuvers in the first week as opposed to a greater efficacy rate being observed in the manual treatment group once all sessions had been delivered, with the number of treatment sessions required for clinical improvement being significantly lower in the TRV group than in the CRP group four weeks after the first treatment [1].

In their 2015 study, West et al. demonstrated the efficacy of TRV maneuvers in patients with different types of BPPV (16 patients with posterior canalithiasis, 6 patients with posterior cupulolithiasis, 4 patients with horizontal canalithiasis, 5 patients with horizontal cupulolithiasis and 7 patients with multicanal BPPV) amounting to about 92.1%. However, it should be noted that 2 out of 38 patients (5.3%) dropped out from the study and no improvement was observed in another patient (2.6%). On the other hand, 5 out of the 9 patients with posterior canalithiasis included in the study and subjected to CRP dropped out during the study, and CRP was performed in 4 patients with 100% improvement [14]. The group can be thus considered too small and too undifferentiated for broader conclusions to be drawn from the study.

In the more recent reports by the Pedersen and Hougaard teams, the evaluated groups were larger [10, 15]. The first team focused on a group of 81 patients with BPPV to observe subjective relief of symptoms in 45 (55.6%) patients after the first maneuver using the TRV. Thirty other patients presented with improvement following subsequent maneuvers. In total, improvement was shown in 75 (92.6%) patients with the average number of maneuvers required for improvement amounting to 2.23 (±1.66). Treatment failure was observed in six patients (7.4%). All of these six patients were female, at mean age of 78.3 years, and had presented with vertigo symptoms for an average of 12 months. Subtypes as determined in the BPPV assessment included HBPPV (66%) with equal distribution of canalithiasis and cupulolithiasis; one patient (17%) had been

diagnosed with posterior canalithiasis and one patient (17%) had been diagnosed with multicanal BPPV [10].

In contrast, in Hougaard's study in 620 patients with BPPV, the TRV treatment success rate of 100% was demonstrated, with the number of maneuvers ranging from 1 to as many as 55. When treatment failure was defined as 10 or more treatments required for therapeutic success, the overall success rate amounted to 94%. Patients included in the study presented with all possible types of BPPV. Cupulolithiasis was shown to require more treatments than canalithiasis. The occurrence of RD, which was found in more than half of all patients following successful repositioning and resolved in 95% of cases within 46 days after treatment, was also reported on by the researchers (27). Since most of the patients included in the study had their follow-up appointments scheduled within a few weeks, the authors concluded that patients who experienced subjective improvement were also successfully treated and completely freed from any symptoms of dizziness. The aspect of the effect of the TRV maneuvers on the duration of RD requires further evaluation [15].

The last paper included in this review focused on the aforementioned important problem of residual dizziness. Soylemez et al. examined the length and severity of RD following successful maneuvers performed using the TRV versus classic techniques [16]. It is worth noting that even though the occurrence of RD is far less disruptive to the patient than BPPV as such, it can result in falls and restricted activity, and consequently generate social and economic burdens, particularly in the elderly [17]. Long-term, persistent RD can cause the patient to perceive his or her complaints as a chronic disease definitely reducing the quality of life [18]. Therefore, in addition to the understanding of the RD phenomenon as such, it is also important to aim at reducing its duration. However, the authors failed to demonstrate any significant difference between the groups in terms of RD duration and average severity beyond the third day after the maneuvers [16]. The groups studied by Soylemez et al. consisted of 17 (TRV group) and 16 (CRP group) patients. As emphasized by the authors, the repositioning maneuver as performed using the TRV may reduce the severity of RD, although further research is required on this subject [16].

CONCLUSIONS

In conclusion, using the TRV, the problem of not being able to perform maneuvers in patients with too much weight, cervical spine disorders or difficult cooperation when performing maneuvers in the classic manner, can be easily bypassed. It also seems that the use of TRV facilitates the work of even inexperienced medical personnel and eliminates the risk of performing the examination too slowly or inaccurately, which, as a consequence, may not yield adequate diagnostic and therapeutic results. The chair also helps in the precise diagnosis and subsequent treatment of BPPV subtypes (Canalithiasis and Cupulolithiasis), as well as the assessment of the number of affected canals, as shown in the aforementioned research papers. The use of TRV in the context of diagnosis and treatment of benign paroxysmal dizziness offers hope for improving diagnostic results, treatment, and quality of life in patients. Therefore, further research is extremely important for the future implementation and development of this promising treatment method.

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