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Review

Vestibular rehabilitation assisted by virtual and augmented reality – new therapeutic directions for peripheral balance disorders

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Abstract: Peripheral vestibular balance disorders affect a significant proportion of the population and are frequently associated with dizziness, vertigo, postural instability, and anxiety. These symptoms negatively impact quality of life and the ability to perform daily activities, requiring complex rehabilitation interventions. In this context, modern technologies such as virtual reality (VR) and augmented reality (AR) provide new therapeutic opportunities by creating controlled and interactive environments that stimulate sensory adaptation and vestibular compensation processes. The present narrative review analyzed studies published between 2015 and 2025, highlighting the role of VR and AR technologies in restoring vestibular function and balance control in patients with peripheral vestibular disorders. The results suggest that VR/AR-assisted rehabilitation improves postural stability, reduces dizziness intensity, and alleviates anxiety, achieving outcomes comparable to or superior to those of conventional rehabilitation methods.

Keywords: Vestibular rehabilitation, Virtual reality, Augmented reality, Peripheral vestibular disorders, Dizziness and vertigo

1. Introduction

Balance disorders represent a common health concern with a substantial burden on patients' quality of life. These conditions may arise from various etiologies, among which dysfunctions of the vestibular system play a central role. In the context of an aging population and the increasing prevalence of peripheral vestibular disorders, understanding the underlying mechanisms and incidence of these conditions becomes essential both for accurate diagnosis and for the development of innovative rehabilitation strategies.

According to the scientific literature, the most common vestibular conditions associated with balance disorders include benign paroxysmal positional vertigo (BPPV), vestibular neuritis, and Ménière's disease [1]. Benign paroxysmal positional vertigo (BPPV) represents the most frequent cause of vertigo worldwide, with a lifetime prevalence of 2.4% and an annual prevalence of 1.6% [2]. This condition accounts for approximately 24.1% of all hospital visits related to dizziness, where vertigo represents the primary symptom [2]. A study conducted by Kim H.J. and colleagues, which investigated the etiological distribution of vertigo in South Korea, reported that in 2019 the number of hospital visits due to dizziness and vertigo reached approximately 3,974 per 100,000 inhabitants, with projections suggesting that this figure may increase to 6,057 by 2050 — a 52% rise [3]. Vestibular neuritis has an estimated incidence ranging

between 3.5 and 25 cases per 100,000 individuals [4], [5] while the prevalence of Ménière's disease varies from 17 to 200 cases per 100,000 inhabitants, depending on the country [6].

Vertigo is defined as a false sensation of movement, most commonly perceived as the rotation of the surrounding environment or of one's own body. It may be accompanied by nausea, imbalance, oscillopsia, and, in some cases, loss of postural control [7] [8]. The impact on patients' daily life is substantial, affecting basic activities such as walking, driving, or the ability to work. Recurrent episodes often lead to social isolation, loss of independence, and a decreased quality of life. Chronic vertigo is frequently associated with emotional disturbances, including anxiety and depression, thereby creating a vicious cycle between vestibular dysfunction and psychological distress [9] [10].

Vestibular rehabilitation is a specialized exercise-based therapy designed to reduce vertigo, improve balance, and enhance the quality of life in patients with vestibular disorders. Recent research highlights its effectiveness across a wide range of peripheral vestibular conditions; several systematic reviews and randomized controlled trials have demonstrated that vestibular rehabilitation significantly decreases the frequency and severity of vertigo and dizziness compared with no intervention or standard medical care [11], [12], [13]. Patients undergoing vestibular rehabilitation report improved balance, greater independence in daily activities, and enhanced overall quality of life. These benefits are documented through validated assessment tools such as the *Dizziness Handicap Inventory* (a standardized questionnaire assessing the impact of dizziness and vertigo on patients' quality of life) and the *Vertigo Symptom Scale* (a standardized instrument measuring the frequency and severity of vertigo and dizziness symptoms) [12], [14].

An emerging and promising trend in vestibular rehabilitation involves the integration of modern technologies into therapeutic practice. The use of virtual reality (VR) and augmented reality (AR) provides a safe, controlled, and adaptable environment for functional training, particularly in the context of balance, spatial orientation, and the reduction of movement-related fear. These technologies enable the simulation of dynamic scenarios that challenge the vestibular system, enhance patient engagement, and contribute to increased motivation and adherence to the rehabilitation program.

2. Matherials and Methods

For the preparation of this narrative review, several scientific databases and virtual libraries were consulted, including Google Scholar, ScienceDirect, PubMed Central, the National Library of Medicine, and the Academic Physiotherapy Conference Proceedings. The literature search covered the period between 2015 and 2025, using keywords such as "virtual reality vestibular rehabilitation", "augmented reality balance training", "benign paroxysmal positional vertigo", "vestibular neuritis", "Ménière's disease", "otolith repositioning" and "peripheral vestibular disorders".

Study selection was based on scientific relevance and clinical applicability. Only articles that evaluated the utility of virtual reality (VR) and augmented reality (AR) technologies in the rehabilitation of patients with peripheral vestibular disorders—such as benign paroxysmal positional vertigo (BPPV), vestibular neuritis, and Ménière's disease, where dizziness and vertigo represent the primary symptoms—were included. Studies focusing exclusively on central vestibular disorders, non-clinical simulations, technical VR development, pediatric populations, case reports, articles without access to full text or studies not published in English were excluded. Following the literature search, it was observed that the number of relevant clinical studies remains relatively limited, highlighting the emerging nature of this research field and the need for further in-depth clinical evaluations regarding the effectiveness of VR/AR-based interventions in vestibular rehabilitation.

After screening the titles and abstracts of the records identified during the initial literature search, a total of 11 studies were included in this narrative review. These

studies were subsequently examined in depth to illustrate the promising, yet still limited, therapeutic potential of VR and AR-based interventions in the rehabilitation of patients with peripheral vestibular vertigo.

The main objective of this analysis was to identify how immersive technologies (VR and AR) can support vestibular function retraining, reduce specific symptoms, and improve patients' quality of life. Additionally, the review aimed to highlight the advantages of these interactive environments—such as active engagement, real-time visual feedback, and increased motivation during rehabilitation sessions—compared with conventional vestibular rehabilitation methods, as well as to discuss the main limitations of the analyzed studies.

3. Results and discussion

The integration of virtual reality (VR) and augmented reality (AR) technologies into vestibular rehabilitation has, over the past decade, led to an increasing number of clinical studies and systematic reviews evaluating the therapeutic effects of these interventions on dizziness, balance, and quality of life. The results obtained indicate that immersive environments can enhance the effects of conventional vestibular exercises by promoting sensory adaptation and increasing patient engagement in the therapeutic process. The following section provides an overview of the identified clinical studies, meta-analyses, and systematic reviews, presented in reverse chronological sequence (2025 to 2015), highlighting the specific peripheral vestibular disorders examined, the VR/AR rehabilitation protocols employed, and the resulting clinical outcomes.

A study published in 2025 [15] compared the effectiveness of virtual reality–assisted vestibular rehabilitation therapy (VR-VRT) with that of conventional vestibular rehabilitation (VRT) in patients with acute unilateral vestibulopathy. The study included 60 patients who were randomly assigned to two groups: one group used a head-mounted display incorporating a smartphone to deliver virtual reality stimuli, while the other group performed traditional vestibular exercises. Both groups followed individualized home-based exercise programs for eight weeks. The final results demonstrated significant improvements in both groups, as reflected by enhanced scores on the Dizziness Handicap Inventory (DHI) and the Activities-specific Balance Confidence (ABC) scale. However, the VR group exhibited a faster recovery in physical function and balance confidence, likely due to the visual feedback provided by the virtual environment. No significant differences were found between groups regarding dizziness intensity, as measured by the Visual Analogue Scale (VAS), or adherence to the rehabilitation program. „The study concluded that VR-assisted VRT is as effective as conventional therapy, while providing a faster trajectory of functional recovery." Reported limitations included the absence of objective balance assessments and the use of a VR system restricted mainly to visual adaptation exercises.

Kuzu, Ö., Bayraklı, B.B., and Çelik, C. (2025) published in the Indian Journal of Otolaryngology and Head & Neck Surgery [16] a retrospective study that investigated the effectiveness of augmented reality (AR) and virtual reality (VR)–assisted vestibular rehabilitation combined with a home-based exercise program in patients diagnosed with Persistent Postural-Perceptual Dizziness (PPPD) — a chronic functional vestibular disorder characterized by persistent dizziness, imbalance, and non-spinning vertigo. The study included 15 patients (80% female; mean age 47.4 years) diagnosed according to the Bárány Society criteria (2017) [17]. The rehabilitation program was conducted over five weeks, comprising ten supervised sessions (two per week, 45 minutes each), using the C-Mill VR+ system (Motek Medical, Netherlands). This system integrates gait, balance, and gaze stabilization exercises with visual stimulation and interactive AR/VR-based tasks. Each participant also received a personalized home exercise program monitored by a physiotherapist. Outcome measures included the Numeric Rating Scale (NRS) for dizziness severity, the Dizziness Handicap Inventory (DHI) for functional handicap, the Berg Balance Scale (BBS) for balance, and the

Beck Anxiety Inventory (BAI) for anxiety. Post-intervention analyses revealed statistically significant improvements across all measures (DHI: p=0.002; NRS: p=0.001; BBS: p=0.001; BAI: p=0.003). The authors concluded that AR/VR-assisted vestibular rehabilitation, combined with home-based exercises, is effective in reducing dizziness, improving balance, and decreasing anxiety levels in patients with PPPD. This innovative, immersive technology–based approach enhances patient motivation and adherence and should be considered a promising therapeutic option for chronic vestibular disorders.

Yan, S., Gao, P., and Wu, W. (2024) published in the Journal of International Advanced Otology [18] a prospective clinical study that investigated the effectiveness of a comprehensive virtual reality (VR)–based vestibular rehabilitation program in reducing persistent residual symptoms following otolith repositioning maneuvers in patients diagnosed with benign paroxysmal positional vertigo (BPPV)—a peripheral vestibular disorder caused by the displacement of otolithic particles from the utricle into the semicircular canals. The study included 124 patients treated between September 2020 and July 2023 who exhibited residual dizziness 24 hours after successful repositioning maneuvers. Participants were randomly assigned to four groups: a control group with no intervention, a group performing Cawthorne–Cooksey exercises, a group performing Brandt–Daroff exercises, and a VR-based rehabilitation group that combined traditional vestibular exercises with immersive, interactive simulations. Assessments using the Dizziness Handicap Inventory (DHI), Vestibular Symptom Index (VSI), Berg Balance Scale (BBS), ocular and cervical Vestibular Evoked Myogenic Potentials (oVEMP and cVEMP), as well as the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS), revealed significant improvements across all rehabilitation groups compared to the control. However, the VR-based intervention produced the most pronounced effects on reducing dizziness, restoring postural balance, and normalizing otolithic function. The authors concluded that integrating VR technology into vestibular rehabilitation provides an effective, engaging, and customizable alternative to traditional exercises, enhancing patient compliance and contributing to the recovery of peripheral vestibular function following BPPV treatment. The study highlights the significant potential of VR-assisted rehabilitation within the fields of otoneurology and balance recovery.

Nagwa Mohamed Hazzaa et al. (2023) conducted a meta-analysis assessing the efficacy of virtual reality (VR)–based rehabilitation programs [19]. The meta-analysis included data from three studies that reported posturography outcomes (center of pressure on a stable surface with eyes closed). The findings indicated that VR-based interventions were more effective than conventional methods in improving postural control and increasing the limits of stability. This result was attributed to VR's ability to enhance vestibular sources of spatial information, promote central recalibration, and improve afferent postural control [20]. Furthermore, the VAS-SAT scale demonstrated that patients in the VR groups expressed greater satisfaction with the VR-based rehabilitation approach. Virtual reality was described as an enjoyable and easily accessible form of therapy. Stankiewicz et al. [21] also reported that initial clinical improvements occurred sooner in patients treated with VR-based therapy than in those following traditional rehabilitation methods. However, results regarding the Activities-Specific Balance Confidence (ABC) Scale were mixed. Two of the included studies, by Meldrum et al. and Micarelli et al., presented differing outcomes: although participants reported VR therapy as more enjoyable, less fatiguing, and easier in terms of balance exercises, it should be noted that Meldrum et al. utilized a home-based VR program. In contrast, Micarelli et al. [22] observed a significant post-treatment improvement in ABC scores, consistent with findings from a systematic review conducted by Xie et al. [23]. The meta-analysis of the Dizziness Analogue Scale (DAS), applied by Garcia et al. and Stankiewicz et al., revealed that the VR groups achieved greater reductions in DAS scores, indicating more pronounced improvements in dizziness episodes compared with control groups. Adverse effects related to VR interventions were examined by

Micarelli et al. using the validated Simulator Sickness Questionnaire (SSQ). The authors evaluated patient adaptation at the end of each rehabilitation week and found that symptoms decreased progressively over time. There was a significant reduction in nausea, oculomotor strain, and disorientation from the first to the fourth week of VR therapy.

Heffernan, A. et al. (2023) conducted a study evaluating the potential of commercially available virtual reality (VR) video games as adjunct tools in vestibular rehabilitation therapy (VRT) for patients with peripheral vestibular disorders [24]. The primary objective was to identify VR-based games that most accurately replicate the exercises used in standard vestibular rehabilitation therapy (VRT). Four free VR racing games available for Android and iOS platforms were systematically selected and analyzed. A group of 40 specialized physiotherapists assessed, through a structured questionnaire, how effectively each game reproduced gaze stabilization and habituation exercises, as well as their overall usefulness as complementary therapeutic tools. The results showed that VR Tunnel Race (VRTR) and VR Real World Bike Racing (VRWBR) demonstrated the highest rehabilitation potential. Although both games were considered effective, VRWBR was preferred due to its ease of use and the ability to adjust optokinetic stimulation intensity. The authors concluded that VRTR and VRWBR could effectively support vestibular rehabilitation and warrant further exploration in future clinical trials. They recommended additional well-controlled studies to validate the therapeutic efficacy of these accessible and motivational VR-based interventions for patients suffering from chronic dizziness of peripheral origin.

Ersin, K. et al. (2023) published a cross-sectional study [25] that investigated the effect of visual content type used in virtual reality (VR)–based vestibular rehabilitation on the sensory systems involved in maintaining postural control. The study included 36 healthy participants, each subjected to the Sensory Organization Test (SOT)—a component of Computerized Dynamic Posturography (CDP)—under three different conditions: without VR (control), with stress-inducing visual scenes (a VR simulation of being inside an elevator at a height of 40 meters), and with relaxing visual scenes (nature-based meditation). The level of stress was assessed using the State–Trait Anxiety Inventory (STAI). The results showed that stressful visual environments significantly increased anxiety levels and produced notable changes in sensory balance integration—specifically, a decrease in visual system contribution and a compensatory increase in somatosensory system involvement. Conversely, relaxing visual environments reduced stress levels and were associated with an increase in vestibular activity and a corresponding decrease in reliance on visual input. The authors concluded that the type of visual imagery used in VR environments directly influences sensory integration mechanisms, thereby affecting balance control and compensatory strategies. In peripheral vestibular rehabilitation, relaxing visual content should be prioritized for patients with vestibular dysfunction, whereas moderately stressful environments may be beneficial for stimulating the somatosensory system in balance disorders of non-vestibular origin.

Başoğlu, Y., Şerbetçioğlu, M.B., Çelik, İ., and Demirhan, H. (2022) published in the Turkish Journal of Medical Sciences [26] a prospective clinical study evaluating the efficacy of virtual reality–based vestibular rehabilitation therapy (VR-VRT) in patients diagnosed with peripheral vestibular hypofunction (PVH). The study included 25 patients aged between 18 and 65 years, diagnosed according to Bárány Society criteria through videonystagmography (VNG) and caloric testing. Among participants, 52% had vestibular neuritis, 28% Ménière's disease, 8% post-labyrinthectomy, and 4% vestibulotoxicity. The rehabilitation protocol was conducted over four weeks, with two sessions per week (30–40 minutes each), using the Sony PlayStation 4 VR system and the games Danger Ball, Beat Saber, and Shooting Range. These were adapted to stimulate the vestibulo-ocular reflex (VOR), postural control, and ankle–hip balance strategies. Assessments included the Dizziness Handicap Inventory (DHI), Sensory Organization Test (SOT), Adaptation Test (ADT), Limits of Stability (LOS), and Rhythmic

Weight Shift (RWS), performed before, immediately after, and eight weeks following the intervention. The results demonstrated significant improvements in postural stability and a marked reduction in DHI scores. Additional progress was observed in movement velocity and directional control during the LOS and RWS tests, with no reports of cybersickness. The authors concluded that VR-based vestibular rehabilitation represents a safe, effective, and motivating approach for improving balance, postural stability, and quality of life in patients with peripheral vestibular dysfunction. The assessment conducted at eight weeks suggested that the progress achieved was maintained over the medium term.

Kanyılmaz, T., Topuz, O., Ardıç, F.N., Alkan, H., Öztekin, S.N.S., and Topuz, B. (2022) published in the Brazilian Journal of Otorhinolaryngology [27] a randomized controlled clinical trial comparing the effectiveness of conventional vestibular rehabilitation therapy (VRT) and virtual reality–based vestibular rehabilitation (VR-VRT) in elderly patients with chronic dizziness of peripheral vestibular origin. The study, conducted at Pamukkale University (Turkey), included 32 patients aged ≥65 years with uncompensated peripheral vestibular dysfunction persisting for more than three months. The treatment protocol lasted three weeks, consisting of 15 sessions of 30 minutes each, performed five days per week. The experimental group performed vestibular exercises assisted by Samsung Gear VR headsets, which simulated realistic visual environments (e.g., crowded markets, supermarkets) to induce complex visuo-vestibular responses and stimulate adaptation and habituation mechanisms. The control group performed identical exercises without VR support. Intervention efficacy was assessed using the Vertigo Symptom Scale (VSS), Dizziness Handicap Inventory (DHI), Berg Balance Test (BBT), Timed Up and Go (TUG), Hamilton Anxiety Scale (HAM-A), and International Falls Efficacy Scale (IFES), measured at baseline, post-treatment, and six months after the intervention. Results demonstrated significant improvements across all functional and psychological outcomes in both groups; however, progress was more pronounced and sustained in the VR group, particularly in terms of dizziness reduction, enhanced postural stability, and anxiety alleviation ($p < 0.05$). The authors concluded that virtual reality represents an effective, safe, and engaging tool for the rehabilitation of elderly patients with peripheral vestibular dysfunction.

Austin Heffernan et al. (2021) published a systematic review and meta-analysis evaluating the effectiveness of virtual and augmented reality (VR/AR) as adjunct tools in vestibular rehabilitation therapy (VRT) for peripheral vestibular disorders [28]. The analysis included five randomized controlled trials (RCTs) and demonstrated that VR/AR interventions significantly reduced dizziness-related handicap within the first three months compared with conventional therapies. Clinic-based VR interventions showed the highest therapeutic effectiveness. Reported adverse effects were minor and transient, and treatment adherence was high across studies. However, the overall quality of evidence was limited by potential risk of bias, underscoring the need for more rigorous and standardized clinical trials to validate these findings.

In 2019, Kinne et al. [29] conducted a systematic review to evaluate the effectiveness of home-based virtual reality (VR) systems on the outcomes of vestibular rehabilitation. The authors concluded that such interventions effectively achieved the primary goals of vestibular rehabilitation, although their efficacy was comparable to that of traditional rehabilitation programs. The authors observed that the combined use of home-based VR therapy and conventional vestibular rehabilitation methods may enhance the overall effectiveness of the intervention.

Bergeron et al. (2015) [30] demonstrated the promising potential of virtual reality (VR) in vestibular rehabilitation, despite notable variations in the protocols and outcome assessment methods used across the analyzed studies. The authors reported that none of the seven included studies exhibited poor methodological quality; however, only four incorporated a control group, which reduced the overall methodological rigor. Furthermore, few studies employed validated questionnaires, making direct and

standardized comparison across studies unfeasible. Nevertheless, the authors concluded that the duration of VR training sessions contributed more significantly to treatment efficacy than the total number of sessions, suggesting that longer sessions over a shorter period may represent both an effective and convenient therapeutic strategy.

The recent studies reviewed on virtual reality (VR)– and augmented reality (AR)–based vestibular rehabilitation present several methodological limitations that restrict the generalizability of their findings. Most investigations included small and heterogeneous samples, with short intervention durations and limited follow-up periods, thereby constraining the assessment of long-term outcomes. In addition, the variability of VR equipment and the lack of standardized vestibular exercise protocols reduce the comparability across studies. To rigorously validate the efficacy of these emerging rehabilitation methods, large-scale, multicenter randomized controlled trials are required, incorporating extended follow-up periods and objective posturographic assessments to evaluate long-term therapeutic effects.

To facilitate a comparative analysis of the literature and provide a clear structure of the available evidence, the relevant information has been synthesized into two distinct tables. **Table 1** presents the clinical and experimental studies included, organized according to the first author and year of publication, study design, diagnosis examined, sample size, the VR/AR system used, and the characteristics of the intervention (duration and frequency). This structure allows for a quick visualization of methodological differences and of the intervention characteristics applied across various peripheral vestibular disorders.

Table 1. Primary studies using VR/AR in vestibular rehabilitation or vestibular-related balance training

First author, year	Study design	Diagnosis	Sample size (n)	VR/AR system	Intervention (duration & frequency)
Lee et al., 2025 [15]	Single-blind RCT	Acute unilateral vestibulopathy (AUVP, peripheral vestibular neuritis)	60 patients	Head-mounted display (HMD) VR system for VRT	8-week individualized home-based VRT program
Kuzu et al., 2025 [16]	Retrospective clinical study	Persistent Postural Perceptual Dizziness (chronic functional vestibular disorder)	15 patients	AR/VR	5-week, 10 sessions (2×/week, ~45 min), plus daily home exercise program
Yan et al., 2024 [18]	Prospective randomized clinical trial	BPPVwith persistent residual symptoms after successful otolith repositioning	124 patients	Custom VR-based vestibular rehabilitation platform	4-week program; VR group performed complex VR-based vestibular exercises
Ersin K. et al., 2023 [25]	Cross-sectional experimental study	Healthy adults without vestibular pathology	36 adults	VR head-mounted display	Single-session exposure under three sensory conditions: no VR (control), stressful VR scenes, relaxing VR scenes;
Heffernan A. et al., 2023 [24]	Cross-sectional survey of clinicians	Physiotherapists specializing in vestibular rehabilitation (no patient outcomes)	40 physiotherapists	Commercial smartphone-based VR racing games	One-time structured evaluation of four free VR games for their ability to reproduce standard vestibular rehab exercises
Başoğlu et al., 2022 [26]	Prospective clinical trial	Peripheral vestibular hypofunction	25 patients	VR	4-week VR-based VRT: 2 sessions/week, 30–40 min
Kanyılmaz et al., 2022 [27]	Randomized controlled trial	Chronic dizziness due to uncompensated peripheral vestibular dysfunction	32 patients	VR	3-week program, 15 sessions (5×/week, 30 min);

Table 2 summarizes the systematic reviews and meta-analyses identified, structured by first author and year of publication, type of review, target population or scope, the number and type of included studies, and the VR/AR modalities evaluated. Presenting these data in a comparative format facilitates the assessment of the overall level of evidence, the consistency of findings, and the areas where further investigation is required.

Table 2. Systematic reviews and meta-analyses on VR/AR in vestibular rehabilitation

First author, year	Type of review	Population / scope	Number and type of included studies	VR/AR modalities covered
Hazzaa N.M. et al., 2023 [19]	Systematic review and meta-analysis	Adults with peripheral vestibular disorders undergoing VR-based vestibular rehabilitation	Small number of RCTs and controlled clinical trials (posturography and clinical scales reported in only a subset)	Various non-immersive and immersive VR platforms used as adjuncts to conventional VRT
Heffernan A. et al., 2021 [28]	Systematic review and meta-analysis	Vestibular rehabilitation of peripheral vestibular disorders using VR and AR as adjuncts or alternatives to standard VRT	5 randomized controlled trials plus additional controlled studies	Head-mounted VR, projection-based VR, and AR-enhanced environments integrated into standard VRT
Kinne K. et al., 2019 [29]	Systematic review of home-based VR for vestibular rehab	Adults with peripheral vestibular dysfunction using home VR systems as part of VRT	Several small trials and pilot studies using home VR or game-based platforms	Mainly non-immersive or low-cost immersive VR/game systems used at home as an extension of clinical VRT
Bergeron M. et al., 2015 [30]	Early narrative review	Patients with peripheral vestibular disorders undergoing VR-assisted rehabilitation	7 clinical studies using VR in vestibular rehab	Variety of VR systems (CAVE-like environments, dynamic visual scenes, early HMDs)

5. Conclusions

The analysis of the current literature confirms the effectiveness of virtual reality (VR) and augmented reality (AR)–based technologies in the rehabilitation of peripheral vestibular disorders, particularly among patients with persistent residual symptoms following otolith repositioning maneuvers in benign paroxysmal positional vertigo, vestibular neuritis, and Ménière's disease.

Recent studies highlight that the integration of immersive environments into rehabilitation programs contributes to a reduction in dizziness intensity and functional handicap, improvement in postural balance, and decreased anxiety levels associated with vertigo. The use of VR and AR platforms provides additional advantages over conventional vestibular exercises by enhancing sensory adaptation, increasing patient motivation, and offering real-time visual feedback. Furthermore, interactive technologies enable the personalization of exercises and may improve treatment adherence—an essential factor in long-term recovery.

However, the small sample sizes, short intervention durations, and variability of equipment and rehabilitation protocols across existing studies limit the robustness and generalizability of current findings. Therefore, large-scale multicenter studies with extended follow-up periods and objective assessments of balance and vestibular function are required to strengthen the clinical evidence supporting the efficacy of these technologies.

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