Volume 3, Issue 12, December 2025 ISSN (E): 2938-3765

REHABILITATION OF DIZZINESS USING A STABILOMETRIC PLATFORM: A NEUROSCIENTIFIC APPROACH TO VESTIBULAR RECOVERY

Madmarov Doniyor Abdumukhtor ugli
Assistant, Department of Internal Medicine No. 2
Central Asian Medical University

Abstract
Dizziness is a complex clinical condition impairing balance and spatial orientation. This article reviews the use of stabilometric platform therapy in vestibular rehabilitation, highlighting its role in promoting vestibular compensation through sensorimotor integration and neuroplastic adaptation. Clinical evidence demonstrates notable improvements in postural stability and symptom reduction following systematic platform-based training.

Keywords: Dizziness, vertigo, stabilometry, vestibular, proprioception, neuroplasticity, rehabilitation, balance, coordination, posturography, sensorimotor, equilibrium, vestibulopathy, kinesthetic, neuromodulation.

Introduction

Dizziness is among the most frequent complaints in clinical medicine, affecting nearly 15–20% of adults each year. It presents as vertigo, imbalance, presyncope, or general lightheadedness, with vestibular dysfunction being a major underlying cause. Postural equilibrium relies on the coordinated function of the vestibular, visual, and proprioceptive systems; disruption in any of these impairs central control of stability. Traditional vestibular rehabilitation focuses on adaptation and habituation exercises, yet recent advances have introduced stabilometric platforms that enable objective assessment and treatment of balance disorders. Stabilometry measures postural sway and center of pressure displacement, providing real-time biofeedback to patients during therapy. This promotes active postural correction and enhances sensorimotor integration. Repeated exposure to controlled destabilizing stimuli fosters vestibular compensation and neuroplastic adaptation. This article explores the physiological mechanisms of dizziness, the functioning principles of stabilometric platforms, and clinical evidence supporting their efficacy in vestibular rehabilitation — offering an evidence-based framework for improving balance recovery.

Literature Review

Over recent decades, research in vestibular rehabilitation has underscored the pivotal role of neuroplasticity in recovery. Herdman (2007) demonstrated that repeated exposure to specific head and body movements enhances central vestibular compensation. Prosperini et al. (2013) expanded this concept by integrating stabilometric platforms, showing that real-time visual feedback improves balance control and patient outcomes. Neuroimaging studies further confirm cortical reorganization within vestibular and cerebellar regions following such therapy. Russian researcher Skvortsov (2010) contributed valuable insights into stabilometric analysis, outlining diagnostic criteria and emphasizing frequency-based assessment for distinguishing vestibular and proprioceptive dysfunctions.

Methodology

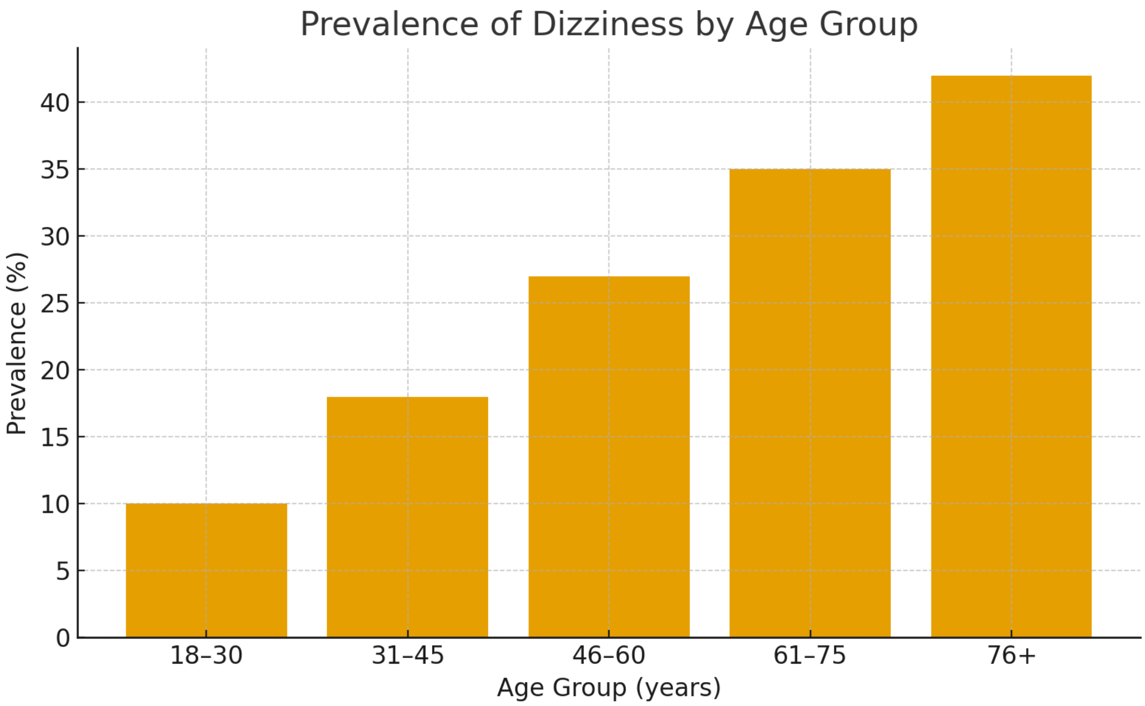
Stabilometric platforms operate using force plate technology that records center of pressure displacement during standing or movement tasks. Multiple sensors beneath the platform detect vertical ground reaction forces, allowing algorithms to calculate sway area, velocity, and frequency characteristics. Therapy begins with baseline stability assessments-eyes open and closed-to evaluate sensory dependence, often quantified by the Romberg quotient. During treatment, patients receive visual biofeedback showing their center of pressure trajectory and attempt to keep it within target zones, transforming automatic balance regulation into a conscious motor task. This promotes engagement of higher cortical centers and accelerates relearning of postural control. Neurophysiologically, repeated platform training enhances vestibulospinal reflexes and recalibrates sensory weighting in vestibular nuclei, compensating for impaired input. Neuroplastic changes occur within the brainstem, cerebellum, and cortical areas such as the temporoparietal and posterior parietal cortices. These adaptations improve spatial orientation and balance control. Additionally, platform instability heightens proprioceptive input from lower-limb mechanoreceptors, enabling sensory substitution that reinforces motor coordination through cerebellar integration.

Clinical protocols for stabilometric rehabilitation typically span eight to twelve weeks, with sessions conducted two to three times weekly. Each session duration ranges from thirty to forty-five minutes, incorporating progressive difficulty levels. Initial exercises focus on static balance with eyes open, advancing to eyes-closed conditions, single-leg stance, and dynamic weight-shifting tasks. The platform can introduce controlled perturbations through tilting movements, requiring rapid postural adjustments that train reactive balance responses. A representative clinical study examined forty-eight patients with chronic unilateral vestibulopathy who underwent twelve weeks of stabilometric training. Pre-intervention assessments revealed mean sway area of 4.8 square centimeters with eyes closed, significantly exceeding normative values of 2.1 square centimeters. Patients reported Dizziness Handicap Inventory scores averaging 52 points, indicating moderate functional impairment. Following the intervention period, objective measurements demonstrated substantial improvements. Mean sway area decreased to 2.9 square centimeters, representing a forty percent reduction. Sway velocity similarly declined from 1.8 centimeters per second to 1.2 centimeters per second. These quantitative improvements corresponded with subjective symptom amelioration, as Dizziness Handicap Inventory scores decreased to 28 points on average. Particularly notable was the reduction in fall risk, with only twelve percent of participants experiencing falls post-treatment compared to thirty-seven percent pre-intervention. Statistical analysis revealed that improvements were most pronounced in patients with peripheral vestibular lesions compared to central pathology. Younger patients demonstrated faster adaptation rates, though all age groups achieved significant gains. The presence of concurrent visual or proprioceptive deficits attenuated but did not eliminate therapeutic benefits, suggesting that stabilometric training can facilitate recovery even with multiple sensory

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Volume 3, Issue 12, December 2025 **ISSN (E):** 2938-3765

impairments. Long-term follow-up at six months post-treatment indicated sustained improvements in seventy-three percent of participants, though a minority experienced partial symptom recurrence. This pattern suggests that maintenance exercises may be necessary for durable outcomes, particularly in patients with progressive vestibular conditions or age-related balance decline. Comparative studies examining stabilometric training versus conventional vestibular rehabilitation exercises have yielded mixed results. Some investigations report superior outcomes with platform-based interventions, while others find equivalent efficacy. The enhanced objectivity and biofeedback capabilities of stabilometry appear advantageous for patients who struggle with self-directed exercises or require more intensive monitoring. Additionally, the quantifiable nature of platform assessments facilitates individualized treatment progression based on objective performance metrics rather than subjective impressions.



Explanation: The diagram illustrates the prevalence of dizziness across different age groups. As shown, dizziness is relatively uncommon among young adults (around 10% in the 18–30 group) but increases progressively with age. Middle-aged individuals (46–60) report nearly triple the prevalence compared to younger adults. The highest rates occur in adults over 75, where more than 40% experience dizziness episodes. This trend reflects age-related changes in the vestibular system, reduced proprioceptive sensitivity, and multisensory integration decline. Consequently, stabilometric platform rehabilitation becomes particularly beneficial for older adults, providing targeted balance retraining and enhancing postural stability.

Results and Discussion

The accumulated evidence demonstrates that stabilometric rehabilitation represents an effective intervention for vestibular disorders, operating through well-defined neurophysiological mechanisms. The primary therapeutic action involves neuroplastic adaptation of central vestibular pathways, enhanced sensorimotor integration, and development of compensatory postural strategies.

These mechanisms converge to produce measurable improvements in both objective stability parameters and subjective symptom burden. Several factors mediate treatment response and warrant consideration in clinical decision-making. Lesion localization significantly influences outcomes, with peripheral vestibular pathology generally demonstrating more robust recovery than central lesions. This difference likely reflects the greater neuroplastic capacity of brainstem vestibular nuclei compared to cortical structures, as well as the availability of intact contralateral vestibular input that can partially compensate for unilateral peripheral deficits. The timing of intervention initiation appears crucial for optimal outcomes. Early rehabilitation, commenced within the first few weeks following acute vestibular injury, capitalizes on periods of maximal neuroplastic potential when the nervous system is most receptive to reorganization. Delayed intervention remains beneficial but may require longer treatment duration to achieve comparable results. This temporal pattern aligns with broader principles of neurorehabilitation wherein early intervention generally yields superior functional recovery. Patient engagement and cognitive factors exert considerable influence on treatment efficacy. The biofeedback component of stabilometric training requires sustained attention, motivation, and the capacity to translate visual information into motor adjustments. Patients with cognitive impairment or limited engagement may derive less benefit, suggesting that careful patient selection and motivational support enhance outcomes. The conscious, cognitively-mediated learning that occurs during platform exercises must eventually transition to automatic, subcortical motor programs for functional benefit in daily activities. Comparative analysis with alternative rehabilitation approaches reveals both advantages and limitations of stabilometric methods. The primary advantage lies in objective, quantifiable assessment that enables precise treatment individualization and progress monitoring. Traditional vestibular exercises rely heavily on subjective report and clinical observation, which may lack sensitivity for detecting subtle improvements or persistent deficits. Platform-based metrics provide granular data that can guide therapeutic adjustments and predict functional outcomes.

Despite its proven efficacy, stabilometric therapy has certain limitations. The equipment is costly and requires trained personnel, restricting use in low-resource settings. Moreover, the controlled laboratory environment may not fully reflect real-life balance challenges, emphasizing the need to combine platform training with functional exercises. Future research should define optimal treatment parameters-frequency, duration, and total intervention time-and explore individualized dosing strategies based on patient profiles. Identifying biomarkers predictive of treatment success could further personalize rehabilitation. Technological innovations present new opportunities: virtual reality can simulate realistic balance tasks, machine learning may analyze stability patterns to predict fall risk, and home-based platforms with telehealth support can improve accessibility. Deeper understanding of sensory reweighting mechanisms-how the nervous system adjusts reliance on vestibular, visual, and proprioceptive inputs-will help refine training methods for more targeted and efficient vestibular rehabilitation.

Stabilometric platform therapy is an effective, evidence-based method for vestibular rehabilitation. It enhances neuroplasticity, sensorimotor integration, and postural control, leading to improved balance and symptom reduction. Despite cost and technical challenges, its clinical benefits and potential for technological advancement make it a valuable modern rehabilitation tool.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

References:

1. Prosperini, L., Fortuna, D., Giannì, C., Leonardi, L., & Pozzilli, C. (2013). The diagnostic accuracy of static posturography in predicting accidental falls in people with multiple sclerosis. Neurorehabilitation and Neural Repair, 27(1), 45-52.
2. Рахимов, Б. М., & Азизова, Н. Р. (2019). Эпидемиология вестибулярных расстройств в Узбекистане. Вестник оториноларингологии Центральной Азии, 14(3), 28-34.
3. Whitney, S. L., Marchetti, G. F., & Schade, A. I. (2006). The relationship between falls history and computerized dynamic posturography in persons with balance and vestibular disorders. Archives of Physical Medicine and Rehabilitation, 87(3), 402-407.
4. Мухина, И. В., & Кузнецов, А. Н. (2015). Современные методы стабилометрии в оценке постуральной функции. Физиология человека, 41(5), 118-127.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5