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Effects of Treadmill-Based Perturbation Training on Balance Impairments in Chronic Obstructive Pulmonary Disease Patients and Older Adults at Risk of Falls : A Literature Review

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ABSTRACT

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is a illness characterised by persistent respiratory symptoms and airflow restriction due to airway abnormalities caused by harmful particles or gases. The main cause is smoking tobacco, but other factors include air pollution and occupational exposures. Diagnostic criteria include a ratio of less than 0.70 between FVC and FEV1. COPD is expected to become a major health issue by 2030.

Pulmonary rehabilitation is a multidisciplinary therapy programme that includes quitting smoking, taking prescribed corticosteroids and bronchodilators, and participating in exercise training. It is most effective for COPD patients with reduced quality of life, anxiety, dyspnoea, and those willing to commit to a rigorous education and exercise regimen.

Aim: This study is being performed to assess the effectiveness of treadmill based perturbation training on balance in people suffering from COPD, while drawing insights from studies on its application in older adults with balance impairments.

Materials and Methods: PubMed, Google Scholar and Research Gate were searched using phrases such as COPD, chronic obstructive pulmonary disease, balance training, perturbation, treadmill, and related topics. Out of the 63 articles that were retrieved, 20 were found to be pertinent following careful examination. Articles published on or after 2018 and randomised controlled trials were included. Systematic reviews, case control studies, articles without abstracts or full English text, articles published on or before 2017 and articles with subjects having a history or risk of dizziness and loss of consciousness were excluded.

Results: This review of the literature on perturbation-based balance training in older individuals encompasses a diverse range of research analysing different treatments and their impacts on fall risk, balance, and associated outcomes. Studies conducted by Jens Eg Nørgaard et al. (2023), Leon Brüll et al. (2023), and Natalie Hezel et al. (2023) shed light on the effectiveness of various PBT paradigms, demonstrating reductions in laboratory falls and improvements in fall-risk-related indicators. Investigations by Jacqueline Nestico et al. (2021) provide insights into the mechanisms underlying reactive stability and gait variability as markers of balance control. Additionally, studies by Jon D. Lurie et al. (2020), Yiru Wang et al. (2020), illustrate the ability of PBT to enhance proactive and reactive adaptation, reduce fall-related injuries, and improve voluntary step execution. Moreover, research such as that by Marissa H. G. Gerards et al. (2021) delves into the acceptance of PBT procedures among the elderly population, offering valuable insights for practical application.

Conclusion: Perturbation-based training (PBT) shows significant promise in improving balance and reducing fall risk, particularly in older adults. While specific evidence for its application in COPD patients remains limited, the potential benefits suggest PBT could be effective for this population as well. The reviewed literature consistently highlights the efficacy of PBT interventions—whether treadmill-based or stability-focused—in enhancing balance, improving reactive stability, and reducing fall risk. Key factors, such as optimal dose, progression, and training duration, have been identified as crucial for maximising outcomes. Furthermore, the importance of tailoring PBT protocols to individual needs and preferences has been emphasised, with an ongoing need for research to identify the most responsive subgroups. Future studies should focus on long-term effects and further refinement of PBT techniques to ensure broader applicability and effectiveness across diverse patient groups.

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