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A hands-free, oral positive expiratory pressure device: Pep buddy

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) imposes a significant burden, with exertional dyspnoea and desaturation driven by dynamic hyperinflation. Positive expiratory pressure (PEP) techniques, such as pursed lip breathing, alleviate these symptoms but are inconsistent in practice. The PEP Buddy, a novel hands-free oral PEP device, delivers 4-10 cm H₂O of expiratory pressure, offering a practical alternative for COPD management. This review synthesizes evidence on the PEP Buddy's design, mechanisms, clinical benefits, and integration into pulmonary rehabilitation. Studies indicate it improves dyspnoea in 71.8% of COPD patients and mitigates desaturation in 35.7% of those affected, enhancing quality of life (QoL) and exercise tolerance. Its hands-free design supports self-management, complementing interventions like breathing exercises and physical activity. Limitations include minor usability issues (e.g., saliva buildup) and limited long-term data. The PEP Buddy holds promise as an adjunct to comprehensive COPD care, warranting further research on optimal use and scalability.

Keywords: COPD, positive expiratory pressure, PEP Buddy, dyspnoea, pulmonary rehabilitation

Introduction

Chronic Obstructive Pulmonary Disease (COPD) affects over 384 million people globally, contributing to 3.7 million deaths annually. Exertional dyspnoea, reported by 80% of patients, stems from dynamic hyperinflation due to expiratory airflow limitation, leading to reduced exercise capacity and quality of life (QoL). Dynamic hyperinflation also exacerbates ventilation-perfusion mismatches, causing exertional desaturation. Positive expiratory pressure (PEP) techniques, such as pursed lip breathing, reduce hyperinflation by prolonging exhalation and maintaining airway patency, but their effectiveness is limited by inconsistent application and patient fatigue.

The PEP Buddy, a hands-free oral PEP device, addresses these challenges by delivering consistent expiratory pressure (4-10 cm H₂O) through airflow resistance at the mouth. Held by the lips and secured with a neck lanyard, it enables use during daily activities, promoting adherence. Early studies report significant improvements in dyspnoea (71.8% of COPD patients) and desaturation (35.7% of affected patients), alongside gains in QoL and exercise tolerance. This review examines the PEP Buddy's design, mechanisms, clinical evidence, role in pulmonary rehabilitation, limitations, and future research needs, positioning it as a promising tool within comprehensive COPD management strategies.

PEP Buddy: Design and Mechanisms

The PEP Buddy is a lightweight, disposable device designed for ease of use. It features two pressure settings: Level 1 (4-7 cm H₂O) for beginners or patients with severe COPD, and Level 2 (7-10 cm H₂O) for those tolerating higher resistance, approximating the expiratory pressure of pursed lip breathing. The device is inserted into the mouth, allowing nasal inhalation and oral exhalation through a resistance valve, eliminating the need for hand-held operation or face masks, which can restrict exercise capacity.

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Mechanistically, the PEP Buddy acts as a pneumatic stent, preventing airway collapse during exhalation and reducing air trapping. This mitigates dynamic hyperinflation, a key driver of dyspnoea, by prolonging exhalation time and lowering breathing frequency. The consistent pressure delivery fosters mindfulness in breathing, potentially enhancing patient confidence in self-management. Unlike traditional PEP devices (e.g., threshold PEP), which require active hand use, the PEP Buddy's hands-free design supports integration into daily activities like walking or household tasks, improving adherence.

Clinical Evidence for PEP Buddy

Clinical studies, though limited, provide compelling evidence of the PEP Buddy's efficacy. Zafar *et al.* (2023)^[1] evaluated its use in 39 COPD patients (mean FEV1 40.6% predicted), finding that 71.8% reported improved exertional dyspnoea (UCSD Shortness of Breath Questionnaire, SOBQ) and 35.7% of those with desaturation showed reduced oxygen decline during exercise. Quality of life, measured by the St. George's Respiratory Questionnaire (SGRQ), improved significantly, with patients noting less reliance on rescue inhalers. The device was particularly effective in patients with severe COPD (GOLD Stage D), where baseline hyperinflation was pronounced. Additional case reports highlight the PEP Buddy's benefits in specific contexts. For instance, a patient with exertional desaturation achieved sustained oxygen saturation during walking, attributing this to the device's consistent pressure delivery. Patient feedback emphasizes ease of use, portability, and reduced breathlessness, aligning with findings from pursed lip breathing studies, which report 20-30% reductions in dyspnoea scores (mMRC scale). However, direct comparisons with pursed lip breathing or other PEP devices are sparse, limiting conclusions about relative efficacy.

Integration into Pulmonary Rehabilitation

The PEP Buddy's design makes it an ideal adjunct to pulmonary rehabilitation, a cornerstone of COPD management. Rehabilitation programs typically include breathing exercises (e.g., diaphragmatic breathing, pursed lip breathing), physical activity (upper/lower limb exercises), smoking cessation, medication adherence, dietary guidance, vaccination education, and stress management. The PEP Buddy complements these by providing a structured, low-effort method to enhance expiratory pressure, reinforcing techniques like pursed lip breathing or balloon blowing, which are part of patient education materials.

For example, the PEP Buddy can be used during upper limb exercises (e.g., wall hand climbing, rope turning) to synchronize breathing with movement, reducing dyspnoea.

Its portability supports home-based programs, where patients practice 15-30 minutes daily, as recommended in comprehensive interventional packages. The device's alignment with mindfulness-based breathing also enhances stress management, a critical component of QoL improvement. Educational handbooks, such as those emphasizing patient-centred COPD care, can incorporate PEP Buddy instructions alongside exercises like balloon blowing, fostering adherence through visual and practical guidance.

Limitations and Challenges

Despite its promise, the PEP Buddy has limitations. Minor usability issues, reported by 10-15% of users, include saliva buildup and initial discomfort, particularly at higher pressure settings (Level 2). These are less restrictive than face-mask PEP devices but may deter some patients. The device's disposable nature raises cost concerns, though its affordability (estimated \$10-20 per unit) compares favourably to reusable PEP systems. Long-term adherence data are lacking, with studies limited to 8-12 weeks, raising questions about sustained use in real-world settings.

Clinical evidence is also constrained by small sample sizes (e.g., $n=39$ in Zafar *et al.*) and a focus on severe COPD, limiting generalizability to milder stages (GOLD A-B). The absence of head-to-head trials with other PEP devices or pursed lip breathing hinders comparative assessments. Finally, while the PEP Buddy supports self-management, its effectiveness depends on patient education and motivation, underscoring the need for integrated rehabilitation programs.

Future Directions

Future research should address these gaps through:

- **Large-Scale Trials:** Randomized controlled trials with diverse COPD populations (GOLD Stages A-D) to confirm efficacy and optimal pressure settings.
- **Comparative Studies:** Head-to-head comparisons with pursed lip breathing, threshold PEP, or oscillatory PEP devices to establish relative benefits.
- **Long-Term Outcomes:** Studies evaluating adherence, QoL, and exacerbation rates over 6-12 months.
- **Cost-Effectiveness:** Analyses of PEP Buddy's affordability versus traditional PEP devices, particularly in low-resource settings.
- **Integration Models:** Trials embedding PEP Buddy in comprehensive interventions, including digital health tools (e.g., telemonitoring), to enhance adherence.

Innovations could include adjustable pressure settings or reusable designs to reduce costs. Educational strategies, such as incorporating PEP Buddy into patient handbooks with colourful illustrations, could further improve uptake, aligning with trends in patient-centred COPD care.

Conclusion

The PEP Buddy represents a significant advancement in COPD management, offering a hands-free, user-friendly approach to positive expiratory pressure. Its ability to reduce dyspnoea, mitigate desaturation, and enhance QoL positions it as a valuable adjunct to pulmonary rehabilitation. While clinical evidence is promising, larger and longer-term studies are needed to confirm its benefits and address usability challenges. By integrating the PEP Buddy into

comprehensive interventional packages, clinicians can empower COPD patients to breathe easier and live better, advancing self-management in primary care.

Conflict of Interest

Not available

Financial Support

Not available

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