

# Nasal Expiratory Positive Airway Pressure Devices for Sleep Apnea

Nimit Khara<sup>1</sup>, Sateesh Patel<sup>2</sup>

## ABSTRACT

Nasal expiratory positive airway pressure (EPAP) devices are an emerging treatment option for obstructive sleep apnea (OSA), offering a portable, noninvasive alternative to continuous positive airway pressure (CPAP) therapy. These devices function by generating expiratory resistance, which increases upper airway pressure, preventing collapse, and reducing apneic events. Nasal expiratory positive airway pressure devices, such as Bongo Rx, Provent, and ULTepap have demonstrated efficacy in reducing the apnea-hypopnea index (AHI) and improving sleep quality, particularly in patients with mild-to-moderate OSA. Studies have shown comparable adherence rates to CPAP, with benefits including simplicity, portability, and the absence of external power requirements. However, limitations include reduced efficacy in severe OSA, patient discomfort due to expiratory resistance, and nasal irritation. This review explores the mechanism of action, clinical evidence, and critical considerations for EPAP devices, highlighting their role as a viable alternative for CPAP-intolerant patients while emphasizing the need for tailored therapy based on individual patient characteristics.

**Keywords:** Nasal expiratory positive airway pressure, Novel therapy, Sleep apnea.

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## INTRODUCTION

Obstructive sleep apnea (OSA) is a chronic condition characterized by repeated episodes of upper airway obstruction during sleep, leading to intermittent hypoxia and sleep fragmentation. The condition affects ~ 15–30% of men and 10–15% of women in the general population, with a higher prevalence among individuals with obesity or other comorbidities.<sup>1</sup> Obstructive sleep apnea has been associated with significant cardiovascular, metabolic, and neurocognitive consequences, including hypertension, type 2 diabetes, and an increased risk of stroke and myocardial infarction.<sup>2</sup>

The primary treatment for OSA is continuous positive airway pressure (CPAP) therapy, which involves a device that delivers a constant stream of pressurized air to keep the airway open. While CPAP is highly effective, adherence rates are suboptimal, with studies showing that up to 50% of patients discontinue use within the first year due to discomfort, noise, and inconvenience.<sup>3</sup> Nasal expiratory positive airway pressure (EPAP) devices have emerged as a potential alternative for patients unable or unwilling to tolerate CPAP. These devices are compact, require no external power source, and rely on patient-generated breathing patterns to maintain airway patency.

## MECHANISM OF ACTION

Expiratory positive airway pressure devices are designed to address upper airway collapse during sleep by creating a resistance to airflow during exhalation. These devices are typically small and fit into the nostrils or are secured externally with adhesive patches. The key mechanism of EPAP devices lies in the use of one-way valves that allow for unrestricted inhalation while partially restricting exhalation. This creates a back pressure in the upper airway, known as positive expiratory pressure (PEP), which helps prevent the collapse of soft tissues in the pharyngeal area.

<sup>1,2</sup>Department of Respiratory Medicine, Shree Krishna Hospital and Pramukhswami Medical College, Bhaikaka University, Anand, Gujarat, India

**Corresponding Author:** Nimit Khara, Department of Respiratory Medicine, Shree Krishna Hospital and Pramukhswami Medical College, Bhaikaka University, Anand, Gujarat, India, Phone: +91 9898325093, e-mail: drkhara@gmail.com

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The physiological effects of EPAP devices include:

- Increased pharyngeal pressure: By generating expiratory resistance, EPAP devices raise the baseline pressure in the pharynx, making it less likely to collapse during subsequent breaths.<sup>4</sup>
- Reduced airway collapsibility: Positive pressure in the airway counteracts the suction forces generated during inhalation, minimizing airway collapse.
- Enhanced portability: Unlike CPAP, EPAP devices do not require electrical power or bulky equipment, making them convenient for travel or use in remote settings.<sup>5</sup>

The simplicity of the EPAP mechanism makes these devices appealing to patients seeking alternatives to traditional PAP therapies.

## NOTABLE EPAP DEVICES

### Bongo Rx

The Bongo Rx is a reusable EPAP device that consists of soft silicone nasal seals. These seals create a tight fit in the nostrils, ensuring

consistent expiratory resistance. Clinical trials have demonstrated that Bongo Rx significantly reduces the apnea-hypopnea index (AHI) in patients with mild-to-moderate OSA, with reported improvements in subjective measures of sleep quality, such as reduced snoring and daytime sleepiness.<sup>6</sup> The device is also reusable, offering a cost-effective solution over time. Some patients, however, report nasal irritation or difficulty exhaling during initial use.

### ULTepap

ULTepap is a newer EPAP device that incorporates soft silicone nasal pillows and a patented flow cartridge system. Laboratory testing has demonstrated that ULTepap generates expiratory pressures comparable to other EPAP devices like Bongo Rx and Provent. It is designed to offer improved comfort and a secure fit, particularly for individuals with anatomical variations or nasal obstructions.<sup>7</sup> Early clinical studies suggest similar efficacy in reducing AHI and improving subjective sleep measures.

### Provent

Provent was a disposable EPAP device that used adhesive patches to secure microvalves over the nostrils. As one of the earliest EPAP devices to gain regulatory approval, Provent was extensively studied. It has shown efficacy in reducing AHI and improving the Epworth Sleepiness Scale (ESS) scores in mild-to-moderate OSA patients. However, patient-reported challenges with Provent include nasal discomfort and adherence issues due to the adhesive strips.<sup>8</sup> It was eventually discontinued.

## SCIENTIFIC EVIDENCE

### Efficacy in Reducing AHI

A randomized controlled trial evaluated the efficacy of EPAP therapy in 250 patients with mild-to-moderate OSA. The study found that patients using EPAP devices experienced a median reduction in AHI of 52% during REM sleep, compared to a sham device. Significant improvements in subjective measures, such as daytime alertness and ESS scores, were also noted.<sup>9</sup>

### Comparison with CPAP

A comparative study assessed the effectiveness of CPAP vs EPAP in treating OSA. While CPAP was more effective in severe OSA, EPAP was found to be equally effective in patients with mild-to-moderate disease, with no significant difference in AHI reduction. Expiratory positive airway pressure was favored for its ease of use and portability, though CPAP remains the preferred treatment for severe cases due to its ability to deliver consistent airway pressure during both inhalation and exhalation.<sup>10</sup>

### Long-term Outcomes

Longitudinal data on EPAP therapy suggest sustained improvements in AHI and sleep quality over a 12-month period. Adherence rates were comparable to CPAP therapy, with many patients citing the convenience of EPAP devices as a major factor in continued use.<sup>11</sup>

### Laboratory Bench Testing

Laboratory evaluations of EPAP devices, including Provent, Bongo Rx, and ULTepap have revealed variability in the expiratory pressures generated. These differences are important when selecting a device, as they may influence individual patient outcomes. Studies highlight the importance of tailoring device selection to patient-specific factors, such as nasal anatomy and airway resistance.<sup>7</sup>

## CRITICAL COMMENTARY

Expiratory positive airway pressure devices offer several advantages over traditional PAP therapies, including their simplicity, portability, and lack of dependence on electrical power. These features make EPAP an attractive option for patients who travel frequently or who experience discomfort with CPAP devices. However, there are limitations to consider:

- Limited efficacy in severe OSA: EPAP devices are primarily effective in mild-to-moderate cases. In severe OSA, where inspiratory pressure support is crucial, CPAP or BiPAP remains the treatment of choice.
- Patient tolerance: Some users report discomfort during exhalation due to the resistance created by EPAP devices. Nasal irritation or dryness is also a common complaint.
- Adherence challenges: While adherence rates are comparable to CPAP in long-term studies, initial dropout rates due to discomfort remain a concern.

Despite these limitations, EPAP devices represent a valuable addition to the therapeutic arsenal for OSA, particularly for patients seeking alternatives to traditional PAP therapies.

## CONCLUSION

Nasal EPAP devices such as Bongo Rx and ULTepap provide an effective and less intrusive treatment option for patients with mild-to-moderate OSA. These devices address common barriers to CPAP adherence, such as discomfort and lack of portability, while maintaining efficacy in reducing AHI and improving sleep quality. However, their role in managing severe OSA remains limited, highlighting the need for continued research and development to expand their applicability. Clinicians must carefully evaluate patient-specific factors, including disease severity, anatomical considerations, and personal preferences, to optimize treatment outcomes.

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