

# Novel Approaches to the Management of Sleep-Disordered Breathing



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## KEYWORDS

- Sleep-disordered breathing • Oral appliance • Oropharyngeal exercise • Myofunctional therapy
- Oropharyngeal exercise • Calibration • Dental sleep • Positional therapy

## KEY POINTS

- For several reasons, continuous positive airway pressure (CPAP) intolerance is widespread, leading physicians to consider alternative treatments for patients with sleep-disordered breathing.
- Novel treatment options, such as oral appliances, positional therapy, pharmacologic therapy, expiratory positive airway pressure, and myofunctional approaches, are emerging that serve as alternative to nasal CPAP.
- Selection of an appropriate alternative therapy, including newer surgical approaches, oral appliance therapy, positional therapy, and orthodontic therapy, should be made based on an evaluation of each patient's personal needs and a review of their phenotypic traits.

 Video content accompanies this article at <http://www.sleep.theclinics.com/>

## INTRODUCTION

Sleep-disordered breathing (SDB) conditions exist along a continuum of severity, ranging from “benign” snoring on rare occasions to profound collapse of the upper airway, which is associated with significant cardiovascular risk and increased mortality. Obstructive sleep apnea (OSA) is the largest subset of significant SDB presentations and is considered one of the most prevalent medical disorders in developed countries, affecting about 20% of the US population. Benign snoring is ubiquitous, affecting upward of 100 million people in the United States alone. Contrary to being held simply as a social malady, however, loud and chronic snoring has been associated with hypertension, carotid artery disease, and increased motor vehicle crashes, implying a pathologic role.

According to the American Academy of Sleep Medicine (AASM), the first choice of treatment for patients with moderate or severe OSA is

continuous positive airway pressure (CPAP).<sup>1</sup> First described in 1981,<sup>2</sup> positive pressure devices work by splinting the airway open to facilitate proper airflow. Manufactured and developed for widespread use during the 1980s and 1990s, traditional CPAP has since undergone many technological advancements that have improved patient satisfaction. Despite this, however, adherence to positive airway pressure (PAP) therapy remains relatively poor, leading providers on a search for alternative treatment options.

Several novel approaches to treating snoring and sleep apnea have emerged that may be better suited for milder SDB. Dental devices, primarily introduced in the 1990s and 2000s, have gained popularity among dentists and sleep physicians primarily for consideration as a “rescue” therapy for those patients intolerant to CPAP. In recent years and as empirical evidence has grown, oral appliance therapy (OAT) has gained momentum

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Conflicts of Interest: Intellectual property owner in the Apnea Guard Trial Oral Appliance; Inventor- Pharyngeal Training Appliance.

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as a first-line therapy in mild or moderate OSA. Other novel nonsurgical approaches that have demonstrated a positive impact on SDB include expiratory positive airway pressure (EPAP), nasal dilators, oral negative pressure devices, positional therapies, orthodontic expansion, oropharyngeal exercise (OPE)/myofunctional therapies, and pharmacologic therapy.

This article explores the evolving role of newer technology and improvements to therapies that may serve as an alternative to, or work in tandem with, PAP machines that may lead to better adherence, patient satisfaction, and improved public health.

### ***Surgical Treatment Options for Obstructive Sleep Apnea***

Surgical procedures are less commonly deployed in the treatment of OSA and usually considered only after conservative modalities have failed. Most clinicians are quite familiar with the array of soft tissue surgeries available to OSA patients, and those are listed in **Box 1**. For purposes of this article, the focus will be narrowed to 2 particular approaches that are recently gaining momentum: a revised version of uvulopalatopharyngoplasty (UPPP) and bariatric surgery.

#### ***Bariatric surgery***

More than 2 of 3 patients with OSA are obese, making obesity the most important risk factor for OSA.<sup>3</sup> Weight loss, therefore, is an important tool for the sleep physician, who must consider all of the surgical and nonsurgical options available to their patients. In a 5-year observational study by Tuomilehto and colleagues,<sup>4</sup> following 57 patients who used dietary and lifestyle changes to lose weight, the progression of OSA was stalled in all but 2 patients. Most of those who were able to maintain their weight loss (n = 13/20) demonstrated a sustained reduction in Apnea-Hypopnea Index (AHI), which was curative in milder cases. In another study comparing bariatric surgical patients to traditional diet and exercise

programs, an even greater weight loss and drop in AHI were seen in the surgical patient group.<sup>5</sup>

Several permutations on techniques used for bariatric surgery are available and all have been shown to assist in significant weight loss, including restrictive surgeries, such as gastric banding that reduces stomach capacity, or resection surgeries, such as gastric bypass. One recent novel approach delivers a rechargeable implanted device to the abdomen that can send intermittent signals of satiations to the brain via the vagus nerve trunk (Maestro EnteroMedics Inc, St. Paul, MN, USA). In a controlled trial of 239 subjects, the implanted device demonstrated a significantly greater weight loss in the active group versus control.<sup>6</sup>

#### ***Uvulopalatopharyngoplasty***

UPPP was first described as a surgery for OSA by Fujita and colleagues<sup>7</sup> in 1981. Their study of 54 patients who underwent the procedure and then were retested with polysomnography (PSG) about 1 year later experienced a significant drop in their postoperative AHI by almost 50%. Predictors of success were hard to identify, however, and it is interesting that responders to the UPPP showed a highly significant postoperative increase in anterior tongue strength.<sup>7</sup> In 1996, the UPPP procedure was modified by Powell and colleagues<sup>8</sup> to predominantly become a flap procedure, which touted less postoperative pain and was reversible. A recent review of the literature on UPPP outcomes, however, still only demonstrated an overall success rate of 33%, even while using a relaxed definition of success as a drop by 50% in AHI and less than 15 per hour. Despite lackluster results in many patients, UPPP procedures continue to be the most frequently performed surgery for OSA in the United States.<sup>9</sup>

#### ***Oral Appliances***

In 2015 the AASM and the American Academy of Dental Sleep Medicine (AADSM) jointly commissioned a 7-member task force to develop recommendations based on the quality of the evidence available.<sup>10</sup> A summary of their recommendations is shown in **Table 1**. In addition, the AADSM in 2013 released "Protocol for Oral Appliance Therapy for Sleep Disordered Breathing in Adults: An Update for 2012" that delineates the collaborative roles of the physician and dentist in the delivery and testing for OAT, based on licensure and scope of practice. Part of the dentist's expertise lies in the selection of an appropriate appliance design of which there have been many permutations through the years as technology has advanced. Recent evidence suggests that mandibular

#### **Box 1**

#### **Upper airway soft tissue surgical modalities for treatment of obstructive sleep apnea**

Uvulopalatopharyngoplasty  
Laser-assisted uvuloplasty  
Adenotonsillectomy  
Genioglossal advancement  
Hyoid suspension  
Nasal surgery

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