

Multimodal OSA Treatment: Nerve Stimulation, Surgery, Oral Appliances

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Obstructive sleep apnea (OSA) management frequently relies on continuous positive airway pressure (CPAP), yet adherence remains a significant clinical challenge. The ATS 2026 conference addressed the evolving landscape of OSA treatment, focusing on mechanistic and multimodal strategies that target specific anatomical and physiological deficits, offering alternatives for patients intolerant or unresponsive to CPAP.

KEY TAKEAWAYS

- **The Pivot:** OSA treatment is expanding beyond CPAP to include targeted interventions like hypoglossal nerve stimulation, various surgical techniques, and oral appliance therapy.
- **The Data:** Hypoglossal nerve stimulation has demonstrated a mean AHI reduction of 68% in appropriately selected patients.¹
- **The Action:** Clinicians should consider a broader differential for OSA management, evaluating patient-specific anatomical and physiological factors to guide treatment selection beyond standard CPAP.

Obstructive sleep apnea (OSA) is characterized by recurrent episodes of upper airway collapse during sleep, leading to intermittent hypoxia and sleep fragmentation. While CPAP remains the gold standard for moderate to severe OSA, its efficacy is contingent on consistent use, which is often suboptimal.¹ The ATS 2026 presentations underscored the necessity of understanding the underlying mechanisms of airway obstruction to implement more precise and effective non-CPAP therapies. These mechanisms include anatomical factors such as tonsillar hypertrophy, retrognathia, and a large tongue, as well as physiological factors like impaired upper airway dilator muscle activity, high ventilatory control loop gain, and low arousal threshold.² The prevalence of OSA is substantial, affecting an estimated 1 billion adults aged 30-69 years globally, with significant implications for cardiovascular health, metabolic disorders, and neurocognitive function. The economic burden associated with untreated OSA is also considerable, highlighting the need for diverse and effective treatment modalities beyond CPAP.

Mechanistic and Multimodal Approaches

Hypoglossal nerve stimulation (HNS) has emerged as a viable option for select patients with moderate to severe OSA who have failed or are intolerant to CPAP. This therapy involves implanting a device that stimulates the hypoglossal nerve, thereby activating the genioglossus muscle and maintaining upper airway patency during sleep. Clinical trials have demonstrated significant reductions in the Apnea-Hypopnea Index (AHI) with HNS. For example, one study reported a mean AHI reduction of 68% (from 29.3 events/hour to 9.0 events/hour) and a mean oxygen desaturation index (ODI) reduction of 70% in patients with an AHI between 20 and 65 events/hour and a body mass index (BMI) less than 32.

kg/m².³ Patient selection is critical, typically excluding those with complete concentric collapse at the soft palate, as identified via drug-induced sleep endoscopy (DISE).⁴ The procedure involves a minimally invasive surgical implantation of a neurostimulator, sensing lead, and stimulation electrode. The device is activated nightly by the patient, delivering mild stimulation synchronized with respiration to prevent airway collapse. Long-term data suggest sustained efficacy and high patient adherence rates, making it an important alternative for carefully selected individuals.

Surgical interventions for OSA encompass a range of procedures targeting specific anatomical obstructions.

Uvulopalatopharyngoplasty (UPPP) aims to enlarge the oropharyngeal airway by removing excess tissue from the uvula, soft palate, and pharynx. While UPPP can be effective for some patients, its success rate varies, with AHI reduction rates ranging from 30% to 60% depending on patient selection and surgical technique.⁵ Maxillomandibular advancement (MMA) surgery, which repositions the maxilla and mandible forward, is considered one of the most effective surgical treatments for OSA, particularly in patients with retrognathia. MMA has been shown to achieve AHI reductions of 80% or more in highly selected patients.⁶ Other surgical options include genioglossus advancement, hyoid suspension, and tonsillectomy, often performed in combination to address multiple levels of obstruction.⁷ The choice of surgical approach depends on the specific anatomical sites of obstruction identified through clinical examination and imaging, often supplemented by DISE. Limitations of surgical interventions include invasiveness, potential for complications, and variable long-term success, necessitating careful patient counseling and selection.

Oral appliance therapy (OAT), primarily using mandibular advancement devices (MADs), is a well-established treatment for mild to moderate OSA and for patients with severe OSA who cannot tolerate CPAP. MADs work by repositioning the mandible forward, thereby increasing the retrolingual and retro-palatal airway space. A meta-analysis of OAT found a mean AHI reduction of approximately 50%, with treatment success (AHI 50% to 70% of patients).⁸ The effectiveness of OAT is influenced by factors such as baseline AHI, BMI, and the degree of mandibular protrusion achieved.⁹

Custom-made MADs are generally more effective than over-the-counter options, requiring fitting by a qualified dental professional. Adherence to OAT is generally higher than CPAP, but potential side effects include temporomandibular joint discomfort, dental changes, and excessive salivation. Regular follow-up is essential to monitor efficacy and manage potential side effects.

Emerging pharmacotherapy represents a promising, albeit nascent, area of OSA treatment. Current research focuses on drugs that target specific physiological deficits. For instance, medications that enhance upper airway dilator muscle activity, such as norepinephrine reuptake inhibitors, are under investigation.¹⁰ Additionally, drugs that stabilize ventilatory control (e.g., carbonic anhydrase inhibitors) or increase the arousal threshold (e.g., sedatives with specific receptor profiles) are being explored. While no pharmacological agent is currently approved specifically for OSA, early-phase trials are evaluating compounds that aim to improve pharyngeal muscle tone or reduce loop gain.¹¹ These agents, if successful, could offer a non-invasive, easily administered option, potentially as monotherapy or in combination with other treatments. The development of these therapies is complex, requiring a deep understanding of OSA pathophysiology and careful consideration of potential systemic side effects. Future research will likely focus on identifying patient subgroups most likely to benefit from specific pharmacological interventions.

CLINICAL IMPLICATIONS

The shift towards mechanistic and multimodal OSA treatment, as highlighted at ATS 2026, underscores a growing recognition that a one-size-fits-all approach is insufficient. Clinicians must move beyond the reflexive prescription of CPAP and engage in a more thorough diagnostic workup to identify the specific anatomical and physiological drivers of a patient's OSA. This requires a deeper understanding of drug-induced sleep endoscopy findings for HNS candidacy, the nuances of various surgical techniques, and the appropriate application of oral appliances. The current landscape demands a multidisciplinary team approach, integrating sleep physicians, ENTs, oral and maxillofacial surgeons, and potentially neurologists, to optimize patient outcomes.

For the industry, this evolving paradigm presents both opportunities and challenges. Manufacturers of HNS devices, such as Inspire Medical Systems, stand to benefit from increased adoption, provided that patient selection criteria are rigorously applied and long-term efficacy data continues to accumulate. Similarly, developers of oral appliances and surgical tools will see continued demand. The nascent field of pharmacotherapy for OSA, while exciting, faces the significant hurdle of demonstrating sustained efficacy and safety profiles that can compete with established mechanical interventions. Companies investing in this area must navigate complex physiological targets and develop agents that can be safely administered long-term, potentially in conjunction with other therapies.

Patients, in turn, stand to gain from a more personalized approach to their OSA management. For those unable to tolerate CPAP, the availability of effective alternatives like HNS, targeted surgeries, and oral appliances offers renewed hope for improved sleep quality and reduced cardiovascular risk. However, the complexity of these options necessitates clear communication from clinicians regarding expected outcomes, potential risks, and the commitment required for each treatment modality. The promise of future pharmacotherapies, while distant, suggests a future where OSA management might become less burdensome, potentially offering a simpler, non-invasive solution for a broader patient population.

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