Improving Positive Airway Pressure Adherence in Children

Michelle S. King, MD, Melissa S. Xanthopoulos, PhD, Carole L. Marcus, MBBCh*

KEYWORDS

• Adherence • Continuous positive airway pressure • Obstructive sleep apnea syndrome • Children • Behavioral intervention

KEY POINTS

- Obstructive sleep apnea syndrome (OSAS) is a relatively common disorder affecting approximately 1% to 5% of children aged 5 to 13 years, and is associated with adverse neurobehavioral, cognitive, and physiologic consequences.
- Adenotonsillectomy is considered to be the first-line treatment; however, not all patients are surgical candidates and some patients will continue to have symptoms after surgery.
- Continuous positive airway pressure (CPAP) is a safe and effective treatment for children with OSAS who do not improve with surgery or who are not candidates for surgery. The major limiting factor for successful treatment with CPAP is adherence.
- Psychosocial factors and patient characteristics are the main predictors of poor adherence, with low maternal education being the strongest.
- Managing suboptimal adherence entails engaging and educating the child and parent about CPAP; this involves discussing preexisting attitudes, outcome expectations, and side effects, in addition to providing constant support from a dedicated team.
- More intensive cognitive behavioral interventions may prove useful in overcoming poor CPAP adherence in complex cases.

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is estimated to affect approximately 1% to 5% of children between the ages of 5 and 13 years.[1–4] OSAS has been shown to contribute to neurobehavioral and cognitive morbidity in children, including poor school performance, impaired language skills, inattention, hyperactivity, and reduced quality of life.[5–10] OSAS is also associated with significant physiologic consequences, including insulin resistance, elevated markers of inflammation, systemic hypertension, and, in severe cases, left ventricular dysfunction and cor pulmonale.[11–17]

Pathophysiologic mechanisms for the development of OSAS can be broadly divided into anatomic factors that reduce the caliber of the upper airway, such as craniofacial abnormalities, obesity, and adenotonsillar hypertrophy, and factors that increase upper-airway collapsibility, such as neurologically based alterations in upper airway muscle tone.[18–20] Deficits in central control of ventilation (eg, Chiari malformation) may also play an etiologic role in some cases.

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Sleep Center, The Children's Hospital of Philadelphia, Perelman School of Medicine, University of Pennsylvania, 34th and Civic Center Boulevard, Philadelphia, PA 19104, USA
* Corresponding author.
E-mail address: MARCUS@email.chop.edu

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INDICATIONS FOR POSITIVE AIRWAY PRESSURE

The primary risk factors for OSAS in children are distinct from those in the adult population, with adenotonsillar hypertrophy being implicated in most childhood cases.[21–23] Adenotonsillectomy is therefore considered to be the first-line treatment for otherwise healthy children with OSAS.[1] A recent large, randomized controlled trial demonstrated the efficacy of early adenotonsillectomy in improving behavior, quality of life, and polysomnographic features of childhood OSAS.[10] Although most patients with OSAS will undergo surgery, not all pediatric patients with OSAS are appropriate surgical candidates. In addition, some patients continue to be symptomatic and have polysomnographic evidence of residual OSAS after adenotonsillectomy; risk factors include severe preoperative OSAS, obesity, neuromuscular disorders characterized by hypotonia, and craniofacial abnormalities.[24–26] These patients may be candidates for positive airway pressure (PAP) therapy.[27]

MECHANISM OF ACTION OF PAP

PAP is a noninvasive method of treating OSAS, and is the most common treatment modality in adults. The basic mechanism involves it delivering intraluminal airway pressure that is above the critical closing pressure of the airway to overcome dynamic obstruction by stenting the airway open.[28,29] This positive pressure is generated by an air compressor in the continuous PAP (CPAP) machine, and is transmitted to the patient's airway through a single conduit that connects with the patient via a variety of interfaces, including nasal pillows, nasal masks (Fig. 1), and full-face masks. The device continually adjusts its output to the patient's breathing pattern to maintain a constant pressure. A fixed leak valve is positioned near the mask to prevent rebreathing of carbon dioxide. Fig. 1 shows a typical PAP apparatus.

It must be noted that it is not the movement of air but rather the pressure generated and maintained through the airway that prevents obstructive events. Selection of an appropriately sized mask that provides a snug fit devoid of air leaks is central to maintenance of positive pressure throughout the system. Mask straps, cushions around the interface, and forehead spacers facilitate mask fit and comfort.

Contemporary CPAP devices have evolved in both size and function, with devices becoming more portable and technologically advanced. Most CPAP machines available today are equipped with data-storage capabilities, digitally recording the number of apnea events and air leaks over time. Data can be downloaded from the machine during follow-up, and serve as an objective measure of CPAP usage to provide feedback to the patient and family to aid in improving adherence. In addition, the incorporation of a humidifier in PAP devices has been demonstrated in adults to decrease drying of the nasal mucosa that can lead to nasal congestion, dryness, and epistaxis, and to increase adherence.[30,31]

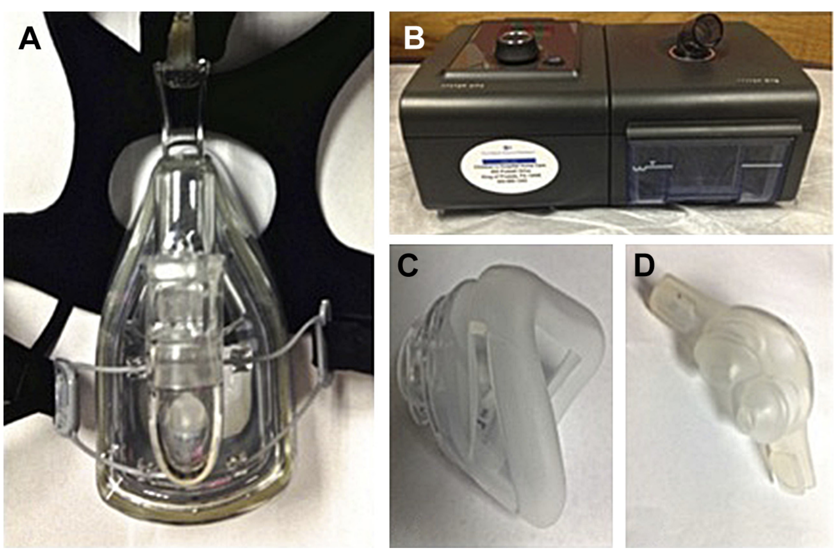

Fig. 1. (*A*) A full-face CPAP mask with headgear attached to a forehead spacer. (*B*) A CPAP air compressor machine with humidifier. (*C*) A nasal CPAP mask. (*D*) A nasal CPAP device with nasal pillows.