

# CHANGING LIVES,

## Rapid palatal expansion

### Abstract

Myriad articles indicate a possible link between maxillary constriction and airway resistance; this piece proposes to show how orthodontic treatment with rapid palatal expansion may improve both orthodontic malocclusion and signs of airway resistance—including snoring and obstructive sleep apnea syndrome (OSAS)—in young, growing patients, resulting in an overall, life-changing health improvement.

### Educational objectives

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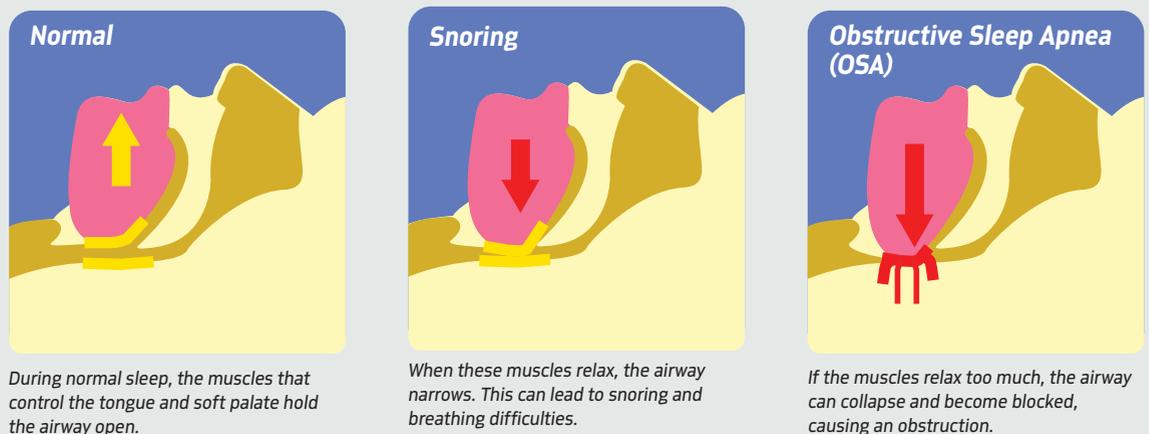
1. Define pediatric obstructive sleep apnea and related terminology.
2. List common symptoms and treatment of obstructive sleep apnea syndrome.

3. Identify which questions are appropriate for diagnosis and treatment-planning young orthodontic patients.
4. Determine possible methods to orthodontically assist patients who have OSAS.

### Introduction

Many orthodontists struggle with determining the appropriate course of action for early-age orthodontics: Is this treatment necessary and, if so, how is it helping? Am I doing enough? Too little? Adopting a treatment philosophy centered on overall patient health, instead of being limited to thoughts of crowding and Angle's Classification, can expand the scope of influence we have on our patients.

Fig. 1



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# One Airway at a Time

## and reducing airway resistance

The American Association of Orthodontists recommends that we begin screening patients at age 7 for orthodontic treatment. As orthodontists, we have the potential to influence the lives of our patients for a longer term if we are aware of the questions to ask and how to diagnose and treatment-plan certain conditions. How many young observation patients do we see who may have that may have underlying medical conditions? This may be because we didn't ask the appropriate questions and parents are not aware of the scope of what we can do if informed.

The purpose of this article is to show how proper airway assessment and airway management using rapid maxillary expansion can change the scope of influence we have on developing patients. As a result, care provided in our orthodontic practice becomes much more valuable in the total health of the patients that we treat.

### Pediatric obstructive sleep apnea

In 2016, the American Academy of Pediatric Dentistry (AAPD) released a policy that recognizes obstructive sleep apnea (Fig. 1) in the pediatric population.<sup>1</sup> The policy encourages health care professionals to routinely screen for obstructive sleep apnea (OSA) and, when indicated, to refer to appropriate medical professionals, such as sleep medicine physicians or ear, nose and throat specialists.

### Cycle of Obstructive Sleep Apnea

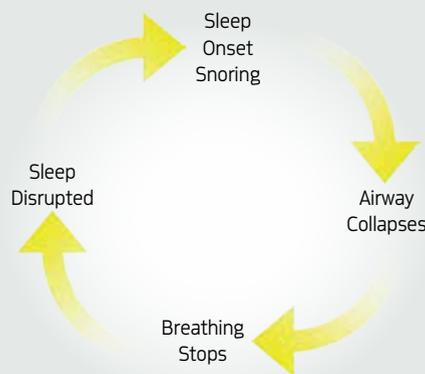


Fig. 2

OSA is characterized by prolonged partial upper airway obstruction or intermittent complete obstruction that disrupts normal sleep ventilation, resulting in loss in the patterns of normal sleep.<sup>2</sup> It's seen in up to 5 percent of children, commonly between the ages of 2 and 7.<sup>3</sup>

Obstructive sleep apnea occurs when muscles in the back of the throat relax, causing the airway to narrow and increase resistance during inspiration. This is believed to lower the oxygen saturation in the blood, which alerts the brain and causes the person to awaken and subsequently inhale in an effort to replace oxygen. This disrupted cycle occurs multiple times throughout the night, which prevents the individual from obtaining deep, restorative sleep (Fig. 2).

by Dr. Manjari Kulkarni



**Dr. Manjari Kulkarni** is a native of Pittsburgh, where she earned both her Doctor of Dental Medicine and a master's in orthodontics

at the University of Pittsburgh. After completing her orthodontics training, Kulkarni spent eight years in Manhattan practicing orthodontics in the New York/ New Jersey area before returning home with her husband and two daughters. She has served on the University of Pittsburgh Orthodontics faculty for six years, and believes in sharing her skills with both her students and patients with love. Kulkarni practices alongside Dr. John Grady at GKG Orthodontics, where there is a special emphasis on comprehensive care along with excellent customer service.

#### Disclosure:

The author declares that neither she nor any member of her family has a financial arrangement or affiliation with any corporate organization offering financial support or grant monies for this continuing dental education program.

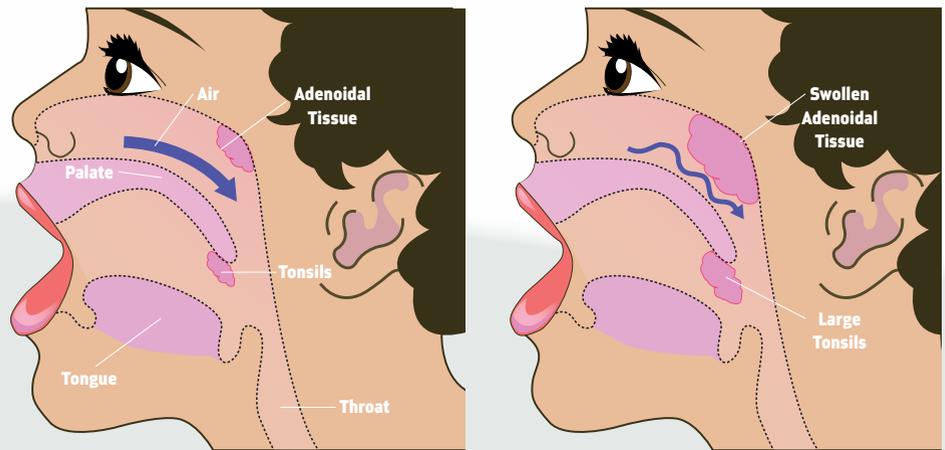


Fig. 3

### Common causes and treatments of pediatric OSA

The common causes of OSA in healthy children are adenotonsillar hypertrophy, tongue position and obesity.<sup>4</sup>

The most common cause of pediatric OSA is adenotonsillar hypertrophy (Fig. 3), which provides orthodontists a unique opportunity to recognize problems for patients at an early age. The typical sequence for referral for treatment of OSA in the case of adenotonsillar hypertrophy is as follows:<sup>5</sup>

1. Referral to ENT specialist for evaluation for possible adenotonsillectomy.
2. If the specialist determines that adenotonsillectomy is necessary, treatment is rendered.
3. If tonsils and adenoids are not the cause, or if signs of OSA persist even after surgery, an ENT specialist or medical doctor might recommend a polysomnography (sleep study, leading to use of a continuous positive airway pressure [CPAP] device.)

### Sleep studies and the apnea-hypopnea index

During a sleep study, breathing patterns and bodily movements are measured. Afterward, an apnea-hypopnea index value (AHI) is assigned to the patient to indicate the severity of sleep apnea. The figure represents the number of apenic events per

hour of sleep, as well as the degree of oxygen desaturation in the blood.

The AHI value is calculated by dividing the number of apnea events by the number of hours of sleep. The categories for AHI values in adults are:

- Normal: AHI < 5
- Mild sleep apnea:  $5 \leq \text{AHI} < 15$
- Moderate sleep apnea:  $15 \leq \text{AHI} < 30$
- Severe sleep apnea: AHI  $\geq 30$

For children, because of their different physiology, an AHI in excess of 1 is considered abnormal.<sup>6</sup>

What questions should we ask during medical history evaluations to fully understand the scope of the patient we're assessing? A general awareness of the common behavioral symptoms associated with OSA is helpful to aid in recognition. Often, these questions are used to help trigger a discussion from the parent to get a more comprehensive background on the child. Our ability to form a rapport with the parent and child often solidifies with this line of questioning.

### Some common symptoms of OSA:<sup>7</sup>

- Excessive daytime sleepiness.
- Snoring (can be as simple as audible breathing).
- Breathing cessation witnessed by another person.



Fig. 4



Fig. 5

- Awakening with a dry mouth or sore throat.
- Difficulty staying asleep.
- Attention problems.
- Mouth breathing.
- Restlessness.
- Bed-wetting.
- Poor school performance.
- Aggression.
- Developmental delay.

### Questionnaire for OSA during screening

During our routine screenings, a series of questions for the parent or care provider can be helpful in our diagnosis.

1. Does your child snore at night? On a scale of 1–10, how loud is it?
2. Does your child have any habits, like thumb- or finger-sucking, to help comfort him to sleep?
3. Does your child wet the bed frequently?
4. Is it hard to wake your child in the morning?
5. Does your child breathe through her mouth during the day?
6. Does your child fall asleep in school?
7. Does your child have difficulty paying attention or focusing?
8. Has your child been diagnosed with ADHD?
9. Has your child had a sleep study?

10. This lack of restorative sleep and resultant behavioral changes has sometimes been misdiagnosed as attention deficit hyperactive disorder (ADHD).<sup>8</sup> When we see this as a possibility in our patients, we probe further.

### OSA and rapid palatal expansion

In an article from 2008 by Carla Evans, et al., there was a direct correlation found between rapid palatal expansion, nasal cavity size and a subjective decrease in airway resistance.<sup>9</sup> This article and others found a 100 percent increase in nasal cavity volume, with decreased airway resistance and subjective improvement in 60 percent of people studied (Figs. 4 and 5).

In our practice, we subscribe to the idea that the ENT clears the contents and the orthodontist enlarges the container. Our clinical findings are that rapid maxillary expansion plays a key role in improving the lives of our patients, both from an orthodontic perspective—reducing crowding, aiding eruption of teeth, and increasing arch width, resulting in fuller smiles—as well as decreasing airway resistance.

### Case study

This patient came to us with a history of snoring, ADHD diagnosed, general sleepiness and an AHI score of 7.2. Her



Fig. 6



Fig. 7

tonsils and adenoids had been removed, but she still showed signs of OSA. She was a referral from the ENT who had removed her tonsils and wanted her to be evaluated for orthodontic treatment (Fig. 6).

#### The treatment plan:

- Bonded dual-arch expander.
- Maxillary 2–2 fixed appliances.
- Retention with an invisible palatal-coverage retainer.
- Growth and development observation.

After treatment (Fig. 7), the patient's AHI score was greatly reduced to 0.1. Subjectively, her parents let us know that she slept better, performed better in school

and had an overall increase in energy levels. We often hear such feedback from parents in many of our expansion cases.

#### Our expansion methodology

Through our clinical experience, we find that children who have restricted airways often have audible, raspy breathing that automatically triggers us into looking into this further and discussing with the parent, even if there has not been a formal diagnosis of OSA.

We make some critical points in our treatment-planning for maxillary expansion. Often, patients with maxillary constriction do not express posterior crossbites in their occlusion; in these cases, we clinically note a narrow maxillary arch form, often in combination with a high arched palatal vault. The mandibular arch will often show lingually tipped posterior teeth that compensate for the maxillary constriction.

In such cases—which are common in our practice—our methodology is to do substantial palatal expansion; we often aim to incorporate up to 10-millimeter measured maxillary expansion of a bonded maxillary expander appliance (Fig. 8) to see long-term benefits of both permanent tooth eruption and possible reduction in OSA symptoms. To compensate for the resultant overexpansion of the maxillary arch relative to the mandibular arch, we

We find that when we have the correct understanding of how we can truly help our patients, and then ask the right questions, we most benefit our patients and the community.



Fig. 8



Fig. 9



Fig. 10

incorporate mandibular expansion (tipping of teeth), either through a removable Schwartz appliance (Figs. 9 and 10) or a dual-arch expander.

### Timing

Very frequently, expansion takes place before the eruption of the maxillary lateral incisors, between ages 7 and 8. (That's not to say that children would not benefit from earlier expansion; it just so happens that this is the typical age at which we see our initial consults.)

After completing expansion, the lateral incisors may or may not have erupted into the arch. If the laterals have erupted, we will bond the maxillary 2–2 and complete treatment within six months of the placement of the expander and retain with a palatal coverage retainer.

If the laterals have not erupted, we remove the expander after six months, retain with a palatal coverage retainer and continue to observe the patient until the laterals have erupted. Then we bond the 2–2 and retain.

### Summary

Our ultimate findings are that we have helped our patients in two major ways:

1. Aided the eruption of adult dentition so comprehensive treatment is simpler and faster.
2. Changed the life of the patient by potentially reducing airway resistance and

improving life quality for the long term.

We find that when we have the correct understanding of how we can truly help our patients, and then ask the right questions, we most benefit our patients and the community. This has helped us build our practice to one where we continue to get referrals from ENTs, pediatricians and general dentists who want to best serve their patients in a comprehensive, effective and life-changing way. ■

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9. *AJODO* September 2008 Volume 134, Issue 3, Pages 370–382 Relationship between rapid maxillary expansion and nasal cavity size and airway resistance: Short- and long-term effects Nanci Lara Oliveira De Felipe, Adriana C. Da Silveira, Grace Viana, Budi Kusnoto, Bonnie Smith,Carla A. Evans

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- 1) **Obstructive sleep apnea (OSA) is a disorder characterized by:**
  - A) Partial, intermittent or complete airway obstruction.
  - B) Disruption in normal sleep ventilation.
  - C) Loss of normal sleep patterns.
  - D) All of the above.
- 2) **Common causes of obstructive sleep apnea in healthy children are:**
  - A) Adenotonsillar hypertrophy.
  - B) Obesity.
  - C) Tongue position.
  - D) All of the above.
- 3) **Apnea-hypoxia index (AHI) is representative of the number of apneic events:**
  - A) Per second of sleep.
  - B) Per minute of sleep.
  - C) Per hour of sleep.
  - D) Per night of sleep.
- 4) **The typical sequence for referral for adenotonsillar hypertrophy is as follows:**
  - A) Refer to ENT; possible adenotonsillectomy; polysomnography if needed.
  - B) Polysomnography; adenotonsillectomy; refer to ENT.
  - C) Polysomnography; refer to ENT; adenotonsillectomy.
  - D) Polysomnography only.
- 5) **Some common symptoms of OSA are:**
  - A) Restlessness, mouth breathing, snoring.
  - B) Deep sleep, good grades, energetic.
  - C) Aggression, attention problems, noted breathing cessation during sleep.
  - D) Both A and C.
- 6) **Lack of restorative sleep and resultant behavioral changes sometimes has been misdiagnosed as ADHD.**
  - A) True.
  - B) False.
- 7) **In 2008, Evans, et al, found that palatal expansion results in:**
  - A) A 50 percent increase in nasal cavity volume and a 50 percent decrease in airway resistance.
  - B) A 60 percent increase in nasal cavity volume and a 100 percent decrease in airway resistance.
  - C) A 100 percent increase in nasal cavity volume and a 60 percent decrease in airway resistance.
  - D) No change.
- 8) **An AHI score of < 5 in adults is considered normal. An AHI score of > 1 in children is considered abnormal.**
  - A) First part true, second part true.
  - B) First part true, second part false.
  - C) First part false, second part true.
  - D) First part false, second part false.
- 9) **In my practice's treatment philosophy, we expand up to:**
  - A) 6 millimeters.
  - B) 8mm.
  - C) 10mm.
  - D) 12mm.
- 10) **Many patients who require maxillary expansion require mandibular arch treatment because:**
  - A) It decompensates mandibular molar lingual crown torque.
  - B) It allows for greater maxillary expansion.
  - C) It expands the mandibular symphysis.
  - D) A and B only.

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## Changing Lives, One Airway at a Time

by Dr. Manjari Kulkarni

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