The Airway, Breathing & Orthodontics

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Clinicians need to play a bigger role in managing airway development and craniofacial formation even though the relationship between the airway, breathing and malocclusion remains quite controversial.

Certainly, the airway, mode of breathing, and craniofacial formation are so interrelated during growth and development that form can follow function, and function can follow form. So it is imperative to normalize form and function as early as possible, so that function is optimized for life.

Clinicians should be more involved in managing airway development and craniofacial formation in growing children. Already, dentists are increasingly

involved in managing the care and airways of patients of all ages who have sleep-related breathing disorders, which are common and often associated with vascular complications such as arterial hypertension, coronary heart disease and stroke.[1]

Research is clear that airway obstruction impairs respiration. Impaired respiration can cause craniofacial malformation, malocclusion and jaw deformation. Research also shows that abnormal craniofacial formation can lead to airway obstruction, impaired respiration, impaired nasal breathing, chronic mouth breathing, sleep apnea, sleep disorders and lifelong ill-health.

Craniofacial form can follow craniofacial function, and craniofacial function can follow craniofacial form. Therefore, both craniofacial form and function should be managed closely, particularly during the early ages of a child's growth and development.

Early dental diagnosis and treatment of airway dysfunction and craniofacial malformation, starting at birth, is essential. Current literature shows that early orthodontic and orthopedic treatment impacts the airway and breathing. Orthodontic and orthopedic treatments that positively impact the airway and breathing can absolutely lead to a healthier and longer life.

Airway, breathing and malocclusion

As mentioned, the airway, mode of breathing, and malocclusion are so interrelated during growth and development that form can follow function and function can follow form. Because of this connection, both should be treated preventively, and as early as possible.

Dysfunction of the human airway and breathing mechanics can cause malocclusion and skeletal deformation. Prolonged oral respiration (obligate mouth breathing) often results in dental and skeletal malformation in growing children. Some of these negative changes include excessive molar eruption, clockwise rotation of the mandible, increased anterior vertical face height, retrognathia and open bite. Often related and created low tongue posture can result in reduced lateral expansion and anterior development of the maxilla.[2]

Conversely, craniofacial malformation and/or malocclusion can negatively impact airway and breathing function. A simple, subtle, high narrow palate at birth can interfere with breast-feeding and even bottle-feeding, such that aberrant tongue swallowing and mouth breathing habits begin.

Normal airways and normal breathing

Normal, well-developed airways allow normal breathing through the nose, with the mouth closed. Nasal breathing is important because it is now known to be vital to good health. Research has shown that air breathed through the nose is quite different to the body than air breathed through the mouth.

The benefits of nasal breathing begin within hours of birth when nasal nitric oxide gas can first be detected.[3] Nitric oxide is a potent gas and a key component of human health.[4] Nitric oxide is produced in the nasal sinuses, secreted into the nasal passages and inhaled through the nose. It is well known to prevent bacterial growth.[5] In the lungs, nitric oxide improves the ability to absorb oxygen.[6] Nitric oxide is a strong vasodilator and brain transmitter. Furthermore, nitric oxide increases oxygen transport throughout the body and is vital to all body organs.

A good airway and normal nasal breathing are important because nasal airway obstruction has profound effects on the whole body and can even determine a patient's symptoms and complaints.[7]

Airway obstruction

Airway obstruction can cause breathing disorders, and craniofacial deformation and malocclusion. Upper-airway obstruction can be subtle in children, but it can have long-term consequences, including failure to thrive, behavioral disturbances, developmental delay, sleep disorders and cor pulmonale.[8]

Airway obstruction can occur for a variety of reasons, including congenital abnormality, adenoid hypertrophy, tonsil hypertrophy, retruded maxilla (Fig. 1, p. 50), and retruded mandible (Fig. 2, p. 50). Obesity increases any present airway obstruction as the tongue, uvula and throat tissues enlarge.

Nasal obstruction, in particular, is a key villain and cause of abnormal growth and development of the face, jaws and dentition (Fig. 3, p. 50). Nasal obstruction has been linked to a variety of lifelong health disorders, including hypertension, stroke, heart disease and even premature death.


Fig. 1

Small and/or high and/or narrow and/or retruded maxilla (palate)


Fig. 2

Small and/or short and/or narrow and/or retruded mandible (lower jaw)


Fig. 3

Class II malocclusion with or without increased over-jet or "under-jet"


Fig. 4

Diagram of negative action of the Buccinator when the tongue is in a lowered position.


Fig. 5

Any airway obstruction can chronically affect life and may even be life-threatening. But nasal airway obstruction is a primary cause of chronic obligate mouth breathing, which can be so dangerous. Fortunately, certain dental treatments can increase nasal breathing and decrease mouth breathing.

Chronic mouth breathing

Chronic obligate mouth breathing—from impaired nasal respiration—can cause progressively worse abnormal craniofacial development and malocclusion in a growing child, beginning at a very early age. Chronic mouth breathing interferes with proper maxillary and mandibular arch development by disrupting tongue, cheek and lip muscle forces (Fig. 4). Chronic oral breathing causes a down and backward positioning of the mandible, a vertical long-faced growth pattern and multiple abnormal growth patterns in the face, jaws and dentition that are very interrelated.

Characteristics of chronic mouth breathing and respiratory obstruction syndrome include mouth breathing at rest (Fig. 5), hypertrophied tonsils and/or adenoids (Fig. 6), open-bite, crossbite, excessive anterior faced height (Fig. 7), incompetent lip posture, excessive appearance of the maxillary anterior teeth and gums (Fig. 8), narrow external nares, allergic salute (Fig. 9), V-shaped palate (Fig. 10), and venous pooling under the eyes (Fig. 11). Research shows a significant association between nasal resistance and increased overjet, open bite, maxillary crowding, Angle Class II malocclusion and posterior crossbite.[9]

Chronic mouth breathing, and nasal incompetence, leads to disordered growth of the naso-ethmoid-maxillary unit and whole craniofacial complex. Chronic mouth breathing has been shown to be four times more common in children with orthodontic abnormalities.[10]

Oral respiration experiments in primates have shown that obstructed nasal airway leads to open mouth, lower mandible position and facial appearance and dental occlusion different from control animals.[11] Recognition and prevention of nasal incompetence in children—and its treatment—are important steps needed to ensure proper orthodontic stability and craniofacial growth.

Craniofacial growth

Craniofacial growth is 80 percent to 90 percent complete by age 12, so most formation and/or deformation occurs by that age. Unfortunately, age 12 is still the average age that orthodontic and orthopedic treatment starts for most children worldwide. This must change.

The maxilla and mandible are nearly 50 percent grown at birth and about 90 percent grown by age 12. Therefore, about 80 percent of post-birth craniofacial growth occurs between birth and age 12. After age 12, only a fraction of post-birth craniofacial growth remains. It is plain to see that earlier treatment—from birth to age 12, when a majority of post-birth growth potential occurs—can better impact craniofacial growth and development than treatment performed after age 12.

In order to better influence craniofacial growth and development, more attention needs to be placed on routine craniofacial examination, diagnosis and treatment in young children, beginning at birth.

Early diagnosis

Dentists are in a unique position to screen children for the recognizable signs and symptoms of mouth breathing, malocclusion, craniofacial anomalies and related conditions such as obstructive sleep apnea syndrome.[12] Early diagnosis of airway obstruction, obligate mouth breathing and malocclusion, with identification of the underlying causes, is essential to prevent worse orofacial growth abnormalities. It is now understood that early diagnosis can lead to earlier orthopedic treatment, which can be more effective, simpler and less restrictive than care at later ages.

Diagnosis of dental malocclusions and skeletal deformities associated with mouth breathing requires comprehensive and frequent orthodontic examinations.[13]


Fig. 6

Enlarged adenoids and tonsils


Fig. 7

Long face


Fig. 8

Gummy smile


Fig. 9

Allergic salute


Fig. 10

V-shaped palate


Fig. 11

Venous pooling


Fig. 12

Functional appliances can develop dental arches, jaws, airways and proper swallow

Routine early examination and diagnosis should begin at birth or soon after birth. All infants should be screened for craniofacial deformities that can affect airway form and function. Breast-feeding should be encouraged as it promotes good nasal breathing, just as it decreases the incidence of obligate mouth breathing. The reverse is true of bottle-fed infants. So infants who are solely bottle-fed should be screened more often for the subtle effects of mouth breathing, aberrant tongue swallowing and thrusting, and palatal arch deformation.

At the age of 2 and 3, subtle dental signs of nasal obstruction and mouth breathing can be seen. Some of the clearest signs include open bite, posterior crossbite and excessive overjet.

From ages 3 to 12, early airway obstruction and craniofacial deformations too often magnify themselves to such an extent that time inversely relates to the ease and options for correction. To better recognize oral-breathing-caused dento-skeletal dysmorphism, cephalometric analysis should be used to evaluate facial architecture when obligate mouth breathing is suspected.

Early treatment

Early treatment to reduce airway obstruction, obligate mouth breathing, craniofacial deformity and malocclusion is essential to normalizing growth and development. Early treatment maximizes the success of corrective orthodontics and orthopedics (Fig. 12). Dentists and otolaryngologists provide unique treatments that can reduce airway obstruction and craniofacial deformity.

Dental orthodontic appliances have been shown to improve the sagittal dimensions of the upper airway in children.[14] Dental rapid maxillary expansion has been shown to be a simple, conservative method of treating impaired nasal respiration in patients age 4 years to 30 years, but the younger the patient, the better the long-term results.[15] Dental maxillary expansion is an effective method for increasing the width of narrow maxillary arches and it also reduces nasal resistance from levels seen with mouth breathing to levels consistent with normal nasal respiration.[16]

Otolaryngologists play a key role in early airway treatment. It has been shown

that within a year following surgery (tonsillectomy and adenoidectomy) to improve breathing, obligate mouth breathers with dental malocclusion have improved dental occlusion.[17]

Dentists and otolaryngologists (ENTs)

Decades ago, otolaryngologists suggested they should work together with dentists to benefit patients (Crawford 1937, Fowler 1947). More recently, it was again suggested that better communication and interchange of ideas between the various medical and dental practitioners caring for children with "stuffy noses, long faces and dental malocclusion" would benefit children.[18] It is time for dental doctors and medical doctors to work together more in the areas of airway, breathing and orthodontics. ■

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The importance of managing airways in orthodontic treatment

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For more than 100 years, orthodontists have theorized that the airway is extremely important in the development of facial skeleton and dento-facial relationships. The chicken-and-egg argument has been around for equally as long, with the Sicher and Moss theories on hard- and soft-tissue growth—a never-ending discussion.

Advances

With the advent of 3D imaging, studies on airway and the effects of orthodontic care on airway are beginning to appear. Similar to the TMJ being better understood following the implementation of MRI, the routine use of cone-beam X-rays is allowing us to understand the airway much better, especially as it relates to orthodontics.

Current

Most attention is being placed on Class II patients because early and continued research is showing that the more retrusive mandibles have a predisposition for airway malfunction, and possibly sleep apnea.

Future

As our instrumentation of airway diagnosis improves and treatment mechanics is measured against the results on airways, we can look for the orthodontist to move to the forefront in airway management from youth to adulthood.

Want to learn more about airway obstruction? Ask questions at Orthotown.com/magazine.aspx

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