



Australian Society
of Orthodontists



THE UNIVERSITY OF
SYDNEY

Orthodontics & Obstructive Sleep Apnoea PART 1

Creating Brighter Futures

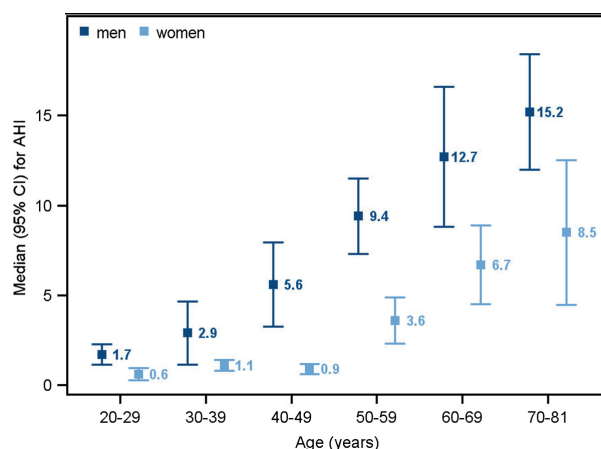
EDITION 2 2021

Orthodontics & Obstructive Sleep Apnoea PART 1

Obstructive Sleep Apnoea (OSA) is a specific diagnosis of a larger group of conditions under the umbrella of Sleep-Related Breathing Disorders (SRBDs)¹. It is characterised by a collapse of the upper airway, despite respiratory effort, and leads to a complete cessation of airflow. OSA is considered the most severe form of sleep-disordered breathing (SDB)². Hypercarbia (an increase in carbon dioxide in the bloodstream) and hypoxaemia (low level of oxygen in the bloodstream) ensue and ultimately sleep disturbance occurs in order to restore normal and adequate muscular tone and airway patency.

The causes of OSA are vast and best described as being multifactorial. Furthermore, the adult and paediatric presentations are starkly different so that their subsequent management also differs. In the adult population, OSA affects 14% of men and 5% of women, while in the paediatric population the prevalence ranges from 1 – 4% equally distributed between boys and girls¹. The incidence increases with age for men and women with a later onset for women (Figure 1)³.

Figure 1 Estimated AHI median for age by 10-year increments, separated for gender. AHI, apnea-hypopnea index, measures



OSA severity. Boxes represent estimated median scores and whiskers 95% confidence interval.

A useful analogy is to consider the airways as a system of pipes; an obstruction at any point along this system can lead to the sequelae of OSA. With age, the dimensions of airways generally increase, however it has been found that in severe OSA, the volume of the parapharyngeal fat pad and the length of the soft palate were all positively correlated with increasing age⁴, highlighting the influence of age and obesity on OSA. Furthermore, with age the strength of the muscles lining the pipes and the responsiveness of the airway reflexes tends to decrease^{4,5}, increasing the collapsibility of the upper airway.

The definitive diagnosis of OSA can only be performed by a sleep physician using the gold standard overnight sleep study, polysomnography (PSG). This is a multi-channelled comprehensive study of a patient's sleep including but not limited to electroencephalography (EEG), electromyography (EMG), electrocardiography (ECG), airflow, pulse oximetry and respiratory effort. Sleep phases are staged and scored by the physician including the number of 'events'. Such events include apnoeas, a cessation of airflow, hypopnoeas, a reduction in airflow and respiratory effort-related arousals (RERAs). These are then scored for their frequency per hour of sleep, giving rise to several indices such as the apnoea/hypopnoea index (AHI) or the respiratory disturbance index (RDI). The International Classification of Sleep Disorders includes many criteria for a diagnosis of OSA, however simpler diagnostic cut-offs include an AHI > 5 events per hour of sleep for adults and an AHI > 1 event per hour of sleep in children⁶.

The role of dental professionals in the management of OSA is becoming more significant. With a broad and regular patient base, ranging from children to adolescents to adults of all ages, the dental professional should be well equipped to screen and identify 'at risk' patients. A collaborative management approach with medical professionals, such as sleep physicians, is highly recommended to optimise care of these patients.

Adult vs Paediatric OSA

The biggest predisposing factor for OSA in adults is obesity⁷. However, while significant in children, it is not the prime factor, as being underweight has also been regularly reported⁸. This somewhat paradoxical presentation is hypothesised as being the result of an ensuing failure to thrive due to fragmented sleep in OSA patients. Nonetheless, obesity does increase the risk of OSA with 50% of overweight and obese children presenting with OSA, compared to 1-4% of the general paediatric population⁹.

The most common cause of OSA in the paediatric population is enlarged tonsils and/or adenoids¹⁰ as seen in figure 2. Typically, presentation tends to peak during the pre-school years as the lymphoid tissues grow rapidly. With reference to the pipe analogy, enlargement of these lymphoid tissues encroaches on the diameter of the pipes (oropharynx and nasopharynx respectively), increasing the likelihood of obstruction, particularly during sleep when muscle tone is decreased.

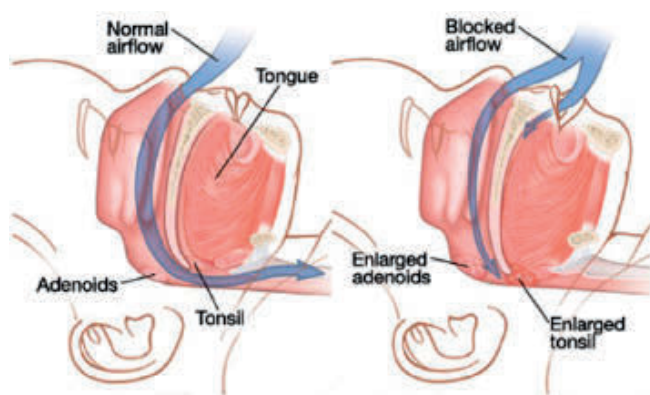


Figure 2 - The effect of enlarged tonsils and/or adenoids in obstructing the airway (Source: <https://www.fairview.org/patient-education/88985>)

The most obvious differences between adult and paediatric OSA can be summarised in the table below:

Adults	Children
Daytime sleepiness (cardinal sign)	Hyper-activeness. Occasional daytime sleepiness
Most common cause = obesity	Most common cause = adeno-tonsillar hypertrophy
Alternating snoring and obstructive apnoeas	Continuous snoring with episodic hypopnoeas/apnoeas
Avoid sleeping on back	Unusual sleeping positions; hyperextended neck. Frequent position changes
Male predominance	Equal distribution male and female
Overweight/obese	May be underweight; failure to thrive
AHI > 5 defines OSA	AHI > 1 defines OSA
Breathing event = >10 seconds	Breathing event = 2 breaths

Sleep indices such as the Respiratory Disturbance Index (RDI) are generated from assessment of a sleep study (PSG). They are based on the number of respiratory disturbances per hour of sleep. A breathing event is an example of a respiratory disturbance, however the definition of such events differ in adults and children. As seen in the table above, the definition of a breathing event in an adult is one which lasts at least 10 seconds, whereas in children it is defined as lasting at least two breaths¹. In general, the paediatric indices are more sensitive and less tolerant of any respiratory disturbances.

Management in Children

The most common form of treatment for OSA in children is adenotonsillectomy. Pharmacological agents to reduce the size of the nasal lymphatic tissues may also be prescribed as well as other nasal surgeries like turbinate reduction or septal deviation corrections. Weight reduction management and the use of Positive Airway Pressure (PAP) devices may also be employed when indicated.

Newer links to the causes of paediatric sleep disorders include oesophageal reflux and allergic rhinitis. The actual reflux is thought to cause the sleep arousal as opposed to the physical obstruction of the airway, leading to the sleep fragmentation¹¹. Conversely, there is the suggestion that OSA itself may cause the reflux during sleep¹². The potential for multiple confounding factors to OSA highlights the importance of a comprehensive

patient assessment and management in a coordinated and multidisciplinary fashion.

Management in Adults

In the adult population, PAP devices such as continuous PAP, bi-level PAP or auto-titrating PAP are generally the first lines of treatment, along with weight management programs. PAP devices work by acting as a pneumatic splint to reduce the collapsibility of and maintain the patency of the airways during sleep¹³. As a result, and especially in those with severe OSA, the related symptoms of daytime somnolence and cognitive impairment, are reduced¹⁴. Unfortunately, compliance with PAP devices is relatively poor with non-adherence rates ranging from 29% - 83%¹⁵. Consequently, dental mandibular advancement splints and orthodontic management may be beneficial alternatives for OSA patients who cannot tolerate PAP therapy.

Pre-orthodontic assessment of OSA

The significance of untreated OSA is often under-appreciated. The repetitive cycle of reduced airflow, hypoxia and cerebral arousal leading to fragmentation of the natural progression through sleep cycles may have many long-term consequences which are now better understood.

Children

In children, impaired growth, failure to thrive and cardiovascular dysfunction are of greatest concern¹. Widely reported are the effects on academic performance by way of impaired neurocognitive function as well as the growing trend of behavioural problems. Furthermore, snoring and bed-wetting can lead to social embarrassment which may ultimately affect interpersonal relations.

A dental professional is well-positioned to screen for signs of snoring, daytime sleepiness, difficulty concentrating and/or attention deficit-hyperactivity disorder, such that if seen, may be hints of an underlying sleep issue. The guideline "If they snore, you must do more"¹⁶ has often been used to focus the attention of the clinician and spark the need for a referral to a sleep physician.

Aside from a thorough history and examination, tools that may be used in order to screen for at risk patients include the Paediatric Sleep Questionnaire (PSQ)¹⁷ and the Epworth Sleepiness Scale for Children and Adolescents¹⁸.

Clinically, while enlarged tonsils, which are classified using the Brodsky scale² (figure 3), may indicate oropharyngeal constriction, their size does not correlate with OSA severity. Additionally, retrognathic and/or constricted maxillae, and retrognathic mandibles, are skeletal discrepancies that may predispose a patient to OSA¹⁹⁻²¹.

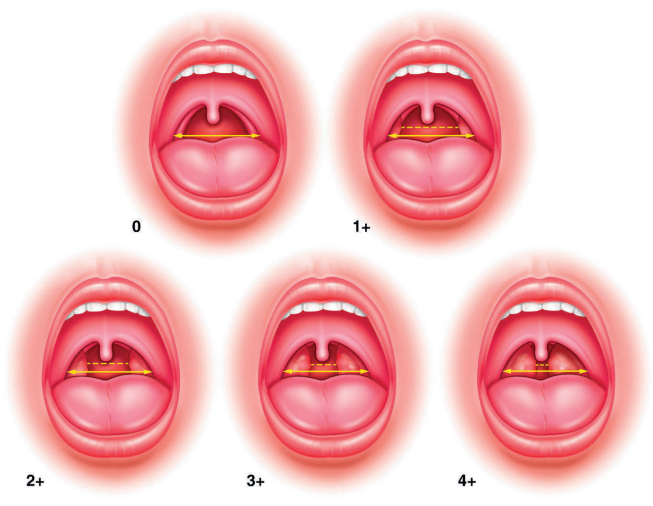


Figure 3 - Brodsky scale for assessing tonsillar enlargement from 0 to 4+. 0 denotes the tonsils entirely in the pillars (solid yellow line), or removed by surgery. From 1 to 4, the tonsils increase in size reducing the lateral dimension of the oropharynx (broken yellow line). (From Surgical Evaluation and Airway Assessment of Patients with OSA; Quimby et al 2019)

Adults

In adults, the implications of excessive daytime sleepiness on the operation of heavy machinery and motor vehicles and resultant accidents is one that is commonly reported²². The link between OSA and Metabolic Syndrome by way of increased activity of the sympathetic nervous system from repeated apnoea is also reported, leading to endothelial damage, increased inflammation and multiple organ disturbances²³. Thus, increased risk of insulin resistance, coronary artery disease, congestive heart failure, myocardial infarction, hypertension, stroke, arrhythmia and sudden cardiac death are linked with untreated OSA.

Tools that may be employed to identify OSA risk in adults include the STOP-BANG questionnaire²⁴. It is based on an acronym; snoring (S) tiredness (T), observed pauses in breathing (O), high blood pressure (P), body mass index (BMI) (B), age (A), neck circumference (N) and male gender (G). High risk applies to those scoring 5 or more 'yes' answers, with high sensitivity in identifying patients with moderate to severe OSA.

Use of Radiographs in Diagnosis

Radiographs have been considered for identifying aberrations in airway dimensions. Unfortunately, radiographs are only a snapshot in time whereas breathing is a dynamic process.

Two-dimensional radiographs such as lateral cephalograms offer little reliability in determining airway patency though enlargement of the adenoids can be identified. Three-dimensional imaging similarly should not be used to diagnose sleep apnoea or any other SRBDs, as it cannot factor neuromuscular tone, susceptibility of collapse and actual function of the airway.

At present, there are no radiographic methods that have sufficient specificity and sensitivity to act as a reliable risk assessment tool to diagnose OSA.

Final Remarks

Obstructive sleep apnoea is a multifactorial syndrome affecting children and adults differently. The role of the dental professional, with their extensive training and regular patient contact, is to identify 'at risk' patients. There are multiple methods whereby dentists and orthodontists may assist patients with OSA, however they should ideally be in collaboration with and at the direction of a sleep physician.

The orthodontic management of OSA patients may vary from simple appliances such as Mandibular Advancement Splints (MAS), to complex orthognathic surgical treatment planning with oro-maxillofacial surgeons. Furthermore, the side effects of other forms of treatment such as positive airway pressure (PAP) may have orthodontic implications. These interesting points will be discussed further in the next edition of Brighter Futures.

References available upon request

 HENRY SCHEIN®

 Rely on Us™

Past issues of Brighter Futures can be accessed at:
www.aso.org.au/resources/brighter-futures-newsletters

 DentiCare
PAYMENT SOLUTIONS

AUTHOR & EDITORS

Dr Ihsan Savran
PRINCIPAL AUTHOR

Dr Ross Adams
Dr Chrys Antoniou
Prof M Ali Darendeliler
Dr Ted Peel
Dr Dan Vickers

Brighter Futures is published by the
Australian Society of Orthodontists

(NSW Branch) Inc. in conjunction with the
Orthodontic Discipline at the University of
Sydney.

The newsletter is intended to help keep
the dental profession updated about
contemporary orthodontics, and also to
help foster co-operation within the dental
team.

Without the generous support of Henry
Schein and Denticare, who are an integral
part of the dental team, this publication
would not be possible.

The statements made and opinions
expressed in this publication are those of
the authors and are not official policy of,
and do not imply endorsement by, the ASO
(NSW Branch) Inc or the Sponsors.

Correspondence is welcome
and should be sent to:
editorbrighterfutures@gmail.com

www.aso.org.au