Obstructive sleep disordered breathing in children: Beyond adenotonsillectomy.

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I. Introduction
Obstructive sleep disordered breathing (SDB) ranges from simple snoring to obstructive sleep apnea syndrome with blood gas anomalies. Consequences of untreated SDB in children include cognitive, behavioral, cardiac and growth abnormalities leading to decreased quality of life. Adeno- and/or tonsillectomy (AT) is the first-line treatment in most children with SDB, with the general belief that it is curative. However, persistence of polysomnography (PSG) indices of SDB was recently reported in 47% to 75% of cases after AT (1,2). While obesity was recognized as the main culprit in one study (1), associated craniofacial anomalies were underlined in the other (2). Also, recurrence at a later age occurs in an unknown proportion of patients after AT (3). Hence, an important challenge in children’s SDB is to recognize those at risk for persistence or recurrence of SDB after AT. The purpose of this short review is to summarize current knowledge on available treatments for children’s SDB beside AT.
II. **Continuous positive airway pressure (CPAP)**

Several reports have highlighted the ability to use CPAP in children and infants with SDB (4-9), especially with associated medical conditions, including syndromic craniofacial anomalies, Down syndrome, morbid obesity or upper airway muscle weakness. Hence, CPAP often replaces surgery and tracheotomy in severe SDB children. In addition, CPAP is increasingly used when an apnea-hypopnea index (AHI) greater than 5 per hour is present after AT (10).

While CPAP treatment is highly efficacious in SDB children, it must be used every night on a long-term basis, making compliance a real hurdle, with a mean use of only 5 hours/night in experienced teams (11,12). In addition, prolonged use of nasal CPAP bears the risk of mid-face hypoplasia due to impaired growth (13), which in turn can increase SDB. Finally, optimal CPAP equipment is still lacking for young children.

III. **Anti-inflammatory therapies for children with SDB**

**Nasal glucocorticoids.** Since the first positive results obtained with nasal fluticasone in a randomized, controlled trial (14), beneficial effects of various nasal glucocorticoid solutions on symptoms and/or PSG indices of SDB have been confirmed, including in children without allergy (15,16). Interestingly, the effects persist for several weeks after treatment.

**Antileukotrienes.** Montelukast, an antagonist of the cysteinyl leukotriene receptor LT1-R, was recently assessed in children with mild SDB. Oral montelukast for 16 weeks significantly improved adenoid size and PSG indices of SDB (17). However, further studies are needed to delineate the indications of montelukast for mild SDB before and after AT.

**Finally, a combination of nasal steroids and oral montelukast** for 12 weeks has been shown to normalize PSG indices in an open label study conducted in children with residual mild SDB after AT (= AHI between 1 and 5) (10).

IV. **Orthodontic treatments of SDB in children**

Craniofacial growth and development are the result of both genetic and environmental determinants. Importantly, studies in animals and children have shown that upper airway obstruction with mouth breathing can induce craniofacial anomalies, which can be improved or even normalized after SDB cure (18-20). While the presence of significant craniofacial anomalies
is variable between children with SDB, systematic detection of craniofacial/dental anomalies and awareness of the available orthodontic treatments must be the rule in children with SDB.

**Orthodontic treatments** include mandibular repositioning devices and rapid maxillary expansion.

The use of mandibular repositioning devices is generally accepted in adults with SDB. In the only randomized controlled trial conducted in children with SDB + malocclusion (80% also with tonsillar hypertrophy), mean AHI fell significantly in the treated children only, from 7 to 2.5 by hour. However, the long-term risks and benefits are yet to be known.

The rapid maxillary expansion procedure aims at restoring normal nasal airflow (by widening the nasal fossa) and increasing the dimensions of the oral cavity. Beneficial effects of RME in children with SDB + narrow maxilla have been shown by rhinomanometry, cephalometry and PSG in uncontrolled studies, even in the presence of enlarged tonsils (21,22).

The above results clearly suggest that it is time to involve orthodontists in the multidisciplinary management of children with SDB. Further randomized controlled trials are needed, including long-term studies to see whether orthodontic treatments can prevent recurrence of SDB at adult age.

**V. Conclusion**

1. Careful follow-up for persisting or recurring SDB is mandatory in all children after AT.
2. While CPAP is highly efficient in children with SDB, its long-term use is associated with difficulties and complications.
3. Nasal steroids and/or antileukotrienes are promising; however, their indications must be delineated.
4. Orthodontic evaluation should be mandatory in all children with SDB. In the presence of craniofacial anomalies such as malocclusion, orthodontic treatments should be considered.
References


