

Sleep bruxism and sleep disorders in adolescents

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ABSTRACT

Sleep Bruxism, the sleep-related movement disorder of tooth grinding and clenching, is highly reported in pediatrics with a prevalence of up to 40 % during childhood and adolescence. The precise etiology of sleep bruxism remains unknown, but it may involve genetic and psychosocial components (such as anxiety and stress).

Clinicians should be aware that quite often sleep bruxism is associated with other disorders, such as snoring, sleep-disordered breathing, sleep complaints, and behavioral problems. These comorbidities should be investigated, because they may be severe and prolonged if they are not treated.

SB may lead to morning jaw muscle soreness or pain, headache, masticatory muscle hypertrophy, temporomandibular disorders, and tooth wear. Especially in pediatrics, sleep bruxism is usually managed with conservative therapies, such as sleep hygiene, behavioral modifications, biofeedback, familial counseling and, only in cases of severe tooth wear or other serious possible consequences of SB, soft occlusal splints.

KEY WORDS

Sleep bruxism, sleep disorders, sleep-disordered breathing, sleep quality, oral parafunction

SLEEP DURING ADOLESCENCE

It is estimated that humans spend more than a third of their lives asleep. Sleep is in fact an essential component for physical and mental health, and especially during childhood and adolescence when it plays a key role in growth and development.

The structure and need for sleep changes with age—newborns sleep 12–18 h a day, whereas 12–17-year-old adolescents need at least 8–9 h of sleep a night. However, adolescence is marked by profound sleep

changes, especially a decrease in deep slow-wave sleep, the recuperative phase of sleep, and a change in circadian rhythm. These changes are associated with major changes in the adolescent's lifestyle that are linked to academic constraints, the multiplicity of extracurricular activities, and freedom from family supervision. In addition, the appearance of new behaviors, such as the overuse of cell phones or computers, can alter an adolescent's bedtime

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and sleeping patterns, delaying their falling asleep, interrupting their sleep, and compromising sleep quality.

Insufficient sleep and sleep disorders are unfortunately very common in children and adolescents. Some epidemiological surveys report that 25%–50% of young people are affected by some type of sleep disorder during their childhood or adolescence, but it is recognized that sleep disorders are generally underdiagnosed and undertreated in the pediatric population. In addition, the presence of medical conditions, such as neurological and psychiatric disorders is associated with an increased risk of concomitant sleep disorders³⁴.

Inadequate sleep has a negative impact on the adolescent's overall health,

cognitive function, and quality of life. In sleep deprivation, adolescents tend to be sleepy during the day and this can have many cognitive, behavioral, and metabolic consequences. Unsatisfactory school performance, mood disturbances, and drug and alcohol abuse can also be a consequence of sleep disorders³. The most common sleep disorders among adolescents include insomnia (with an average prevalence of 9%–13%), habitual snoring (8%–15%), obstructive sleep apnea (1%–4%), and sleep bruxism (14%–25%).

In the following sections, we will detail the main features of sleep bruxism to provide clinicians with an epidemiological, diagnostic, and therapeutic overview of this disorder, which is so common in adolescents.

SLEEP BRUXISM

Sleep bruxism (SB) is the involuntary, repetitive, and rhythmic activity of the masticatory muscles that occurs during sleep, such as clenching or grinding of the teeth, often associated with typical noises produced by contact between teeth³⁰. SB is classified among movement disorders related to sleep in the International Classification of Sleep Disorders (ICSD-III)¹, and it is one of the oral parafunctions most frequently seen in children and adolescents⁶. The grinding and especially clenching of the teeth can also occur during the day and this is often referred to as daytime bruxism (DB). The two circadian forms of bruxism share several risk factors and often coexist in the same individual, but they are distinguished by one fundamental characteristic: The ability

to become aware of the activity and to stop it. In fact, although both represent involuntary behavior, DB can be controlled and prevented during waking hours, whereas SB is subject to the complex mechanisms that regulate sleep physiology and is very difficult to modify^{5,38}. The consequences of DB and SB would seem to be different as well; this would seem to be mainly related to the force exerted and the duration of the contractions of the masticatory muscles involved in the clenching and grinding activity of the teeth.

Epidemiology

According to the most recent studies, the prevalence of SB does not vary by sex but by age. A peak prevalence of

up to 40% is observed between 9 and 11 years, falling to 10%–14% during adolescence and stabilizing at approximately 7%–8% in adulthood^{7,9,15,31,32}. SB prevalence increases in some populations: it is 3–4 times higher in children and adolescents with a concomitant psychological disorder and 1–2 times higher in adolescents with other sleep disorders (e.g., for example, sleepwalking, obstructive sleep apnea). SB is therefore a very common sleep disorder. Nevertheless, it must be considered that most of the epidemiological studies reported are population-based surveys based solely on questionnaires (self-evaluation of bruxism), whose validity as diagnostic tools remains debated because of the many confounding factors. For example, the typical noise of SB produced by the grinding of the teeth does not occur in all bruxism sufferers, nor necessarily in all episodes of bruxism (it is estimated that only 50%–60% of SB episodes produce any kind of noise). In addition, the absence of grinding noise or a situation when the affected individual is sleeping alone can influence the ability to notice and report bruxism activity during sleep. In general, regarding the pediatric population, it is often the parents who report and consult for their child's SB, but it has been observed that the reliability of the parents' report and their knowledge of the problem are not good⁴⁴. It should also be considered that the SB is concomitant with DB in approximately one-third of adolescents, and these two activities may be confused by the young patient or their parents. *Conversely* to SB, the

prevalence of DB increases with age, estimated at 12% in children aged 7–17 years and at >20% in adults⁶.

Physiopathology

The pathophysiology of SB has been extensively studied in experimental studies using polysomnography studies to assess the brain, muscle, and respiratory functions of the sleeping subject²⁹. These studies have described sporadic rhythmic activity of the masseter and temporal muscles in almost 60% of the general adult population, but in SB patients, episodes of tightness/grinding are much more frequent (at least two episodes/hour of sleep) and are associated with more intense muscle contractions^{28,29}. SB episodes occur during specific periods of sleep: They occur mainly in light sleep and in association with microarousals or other orofacial or body movements. SB episodes are associated with increased sympathetic nervous system tone, cardiac activity, and blood pressure. It may also be associated with transient hypoxia (a reduction in oxygen levels), which normally recovers within 7–9 s but supports the hypothesis of a relationship between SB and ventilation (or respiratory disorders) during sleep^{12,25}.

Although the precise etiology of SB remains unknown, a genetic component is strongly suspected. Although a gene or genetic polymorphism specific to bruxism has not yet been identified, the data show that there is family aggregation and strong link between monozygotic twins^{23,24,36}.

Table I: Clinical consequences of sleep bruxism in adolescents.

Clinical signs	Associated symptoms
Abnormal wear on teeth and restorations	Masticatory muscle pain and fatigue
Linea alba (white line on the cheek along the occlusal plane)	Headache (frequent upon waking)
Imprints of teeth on the tongue	TMJ Clicking
Hypertrophy of the manducator muscles	Dry mouth upon waking
Oral respiration	Occlusal discomfort

SB is therefore very likely to have a central origin, but some peripheral influences may play a role. Stress, anxiety, and other psychosocial components are now considered as risk factors for bruxism. In particular, compared to adolescents without SB, those with SB are more stressed, less able to handle stress, often perfectionist and more aggressive, and have a higher rate of psychosocial and behavioral disorders^{9,10,15,39,46}. In addition, adolescents who report bruxism (either SB or DB) would have a greater risk of concomitant sleep problems⁷, including snoring, oral respiration, respiratory sleep disorders, excessive daytime sleepiness, and poor sleep quality¹⁹. An alteration of the physiology of sleep is associated with the presence of bruxism remains to be defined.

Certain studies show that the structure of sleep is preserved, whereas others report that it is modified with more sleep disturbances than in the absence of SB^{20,35}. In general and in the absence of other sleep pathologies, the subject is not disturbed by their parafunction. However, it can often be annoying for the bedroom partner who is the active witness these grinding noises if they are not sleeping too deeply.

Clinical consequences

Bruxism is a well-known problem for dentists who must manage its consequences on the oral cavity on a daily basis, including abnormal wear on teeth, restorations, and prostheses. The association between SB and wear has been demonstrated in several studies. Although tooth wear cannot be considered as an absolute diagnostic criterion, it is a pathognomonic sign. Adolescents with SB have an 8-times higher risk of excessive tooth wear⁷. They are also more likely to report fatigue or pain in the masticatory muscles, a clicking in the temporomandibular joints, and frequent headaches compared to adolescents without bruxism (Table I). In particular, adolescents who engage in the activity of clenching their teeth for long periods of time during the day would show early signs and symptoms of masticatory dysfunction¹⁶. In contrast, adolescents with SB only (in the absence of other parafunctions) would be more likely to experience pain and muscle fatigue upon waking. These different manifestations of fatigue and/or pain in the masseter and temporal muscles can help to differentiate the two circadian forms of bruxism and therefore target which is more likely to be the cause⁴.

SB AND COMORBIDITIES

Snoring and obstructive sleep apnea

As stated earlier, the prevalence of SB is higher in adolescents with snoring or obstructive sleep apnea; 40%–50% pediatric and adult patients with respiratory sleep disorders also experience SB activity^{13,22,43}. On the basis of this data, the research hypothesis that there is a potential “cause-and-effect” link between sleep ventilation and SB has been advanced. Precisely, this hypothesis suggests a protective role of bruxism, which would be triggered following an obstruction of the upper airways with consequent alteration of O₂ and CO₂ levels, to participate in the relocation of the permeability of the oropharynx and therefore the resumption of normal ventilation. The most recent studies confirm that it has a strict temporal connection between SB episodes and that of obstructive apnea or oxygen desaturation³⁷, but the exact nature of this relationship has yet to be determined. However, some interventional clinical studies in pediatric populations have shown that treatments for obstructive sleep apnea are also effective in decreasing the number of SB episodes. Specifically, in children with obstructive sleep apnea treated by tonsillectomy, the frequency of bruxism decreased from 45% to 11.8% following the resolution of the respiratory problem^{11,14}. Similarly, orthodontic treatment with rapid palatal expansion, known to improve ventilation during sleep and decrease apneic episodes in children and adolescents, seems to influence the activity of

grinding and clenching of teeth in 65% bruxism sufferers². Finally, mandibular advancement devices, usually used for the treatment of obstructive sleep apnea in adults, have been shown to be effective in managing SB as well as decreasing the intensity of material headaches and snoring in young adults and adolescents^{8,17,26,27}. These preliminary results support the hypothesis that SB may be related to the mechanisms that regulate the physiology of the upper airways during sleep. But these avenues of research are still under investigation.

Attention deficit (hyperactivity) disorder (ADD/ADHD)

In adolescents, SB has been particularly linked to behavioral problems (hyperactivity, attention deficit, drowsiness, and poor school performance), and signs and symptoms consistent with ADHD^{18,20}. A distinction must be made between behavioral signs related to specific psychosocial factors or stressful and anxiogenic situations and the diagnosis of ADHD⁴⁰. In case of confirmed ADHD, there is often one or more associated disorders, including sleep problems other than SB, such as insomnia, sleep apnea, circadian rhythm disturbances, restless leg syndrome, and parasomnias⁴¹. Children and adolescents with ADHD often have difficulty initiating sleep, interrupted sleep, and waking up early in the morning without being able to fall asleep again. They do not recuperate during their sleep and a nonrestorative sleep always has an impact

Table 2: Other pathologies and sleep disorders often associated with sleep bruxism in the pediatric population.

Sleep disorder	Psychological and behavioral pathologies	Other medical conditions
Snoring	Stress	Headaches
Obstructive sleep apnea	Anxiety	Orofacial Pain
Insomnia	Attention Deficit (Hyperactivity) Disorder (ADD/ADHD)	Manducatory dysfunction
Frequent waking	Depression	Allergies
Incontinence/Bedwetting	School harassment (bullying)	Tonsillar hypertrophy
Sleep talking		Gastroesophageal reflux disease (GERD)
Sleep walking		Alcohol or caffeine abuse
Epilepsy		
Periodic movements of limbs		

during the day, causing the following: fatigue, anxiety, concentration problems, memory problems, irrepressible desire to sleep, or hyperactivity. Bruxism—i.e., SB and DB—in this context, may be an epiphenomenon of a more complex clinical picture, which needs to be detected and treated urgently before the coexisting conditions become chronic disorders. In addition, in case of pharmacological treatment of ADHD

(for example with methylphenidate), intense bruxism activity may be listed as a side effect of the drug⁴².

SB has also been linked to the lubrication of the oropharynx during sleep, a period when salivary flow is normally decreased⁴⁵, with gastroesophageal reflux and swallowing^{21,33}, and with other sleep disorders typical of childhood and adolescence such as incontinence, sleepwalking, and epilepsy (Table II).

ACTION TO BE TAKEN

The management of SB in pediatric patients has not been the subject of long-term research or good-quality randomized clinical trials. Consequently, the recommendations remain rather empirical and must take into account the evolution of this masticatory parafunctional activity over time: Does it persist beyond childhood? What is its variability from night by night? What are the associated clinical signs and symptoms? Do they need treatment?

Asking a few simple questions about sleep (also using validated questionnaires) and a complete medical history is the basic principle of screening for adolescent sleep disorders. The questions should be asked to the adolescents themselves and to their parents who can easily report the signs and symptoms, nocturnal and diurnal, related to sleep disorders. In case of suspicion and comorbidities, the dentist must refer their young patient to the specialist

(for example, the pediatrician or a sleep medicine specialist) who will be responsible for the diagnosis. In many cases, the differential diagnosis and treatment of pediatric sleep disorders requires a multidimensional approach taking into account the coexisting medical and neurological conditions, as well as the behavioral, physiological, environmental, and psychosocial factors.

In the absence of associated pathologies or sleep disorders, the diagnosis and treatment of SB are the responsibility of the oral surgeon. An in-depth oral examination will reveal whether bruxism has had an impact on teeth or masticatory structures. In this case, and in the presence of painful symptomatology, treatment may be considered.

Treatment

SB treatments have proven to be quite ineffective in children and adolescents. Similar to treatments in adults, no therapy has been proven to show effectiveness in stopping the grinding and clenching of the teeth during sleep so far. In addition, some proposed therapeutic approaches for adult patients, including drugs such as clonidine, clonazepam, or proton-pump inhibitors, are not at all indicated in pediatric populations. Therefore, treatment options for pediatric SB are limited.

In the absence of symptoms and after the exclusion of potentially associated comorbidities (e.g., obstructive sleep apnea, other sleep disorders, or neurological diseases), SB could be considered a nonfunctional sleep disorder that “simply” requires long-term monitoring. Monitoring bruxism behavior is fundamental insofar as this behavior could change with age: If SB in children tends to diminish gradually during adolescence, it is true that there is an increasing prevalence of DB during the same period. These changes may or may not have consequences on the oral cavity and it is possible to adopt strategies of observation rather than intervention in young patients³². However, in case of severe symptoms, major complaints and alterations of orofacial structures related to SB (very rare), therapeutic options include: cognitive behavioral therapies, biofeedback, hypnosis, sleep hygiene, and family counseling on sleep patterns to be adapted. The use of occlusal orthoses or mandibular advancement in adolescents is rather anecdotal; depending on the age of the patient and because of the potential consequences on the development of craniofacial structures and occlusion. This treatment should be considered only temporary and in cases of excessive severity⁸.

CONCLUSION

SB is an involuntary phenomenon of teeth grinding and clenching that is very common in the pediatric population. To enable appropriate clinical

management, it must be analyzed in the specific context of the patient, and in relation to physiology and sleep homeostasis, and by evaluating the

presence of comorbidities. The oral surgeon's knowledge of this condition is a prerequisite for a correct differential diagnosis and the choice of the

best therapeutic approach for the adolescent.

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