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Effect of stress on sleep bruxism in children – a literature review

Wpływ stresu na bruksizm podczas snu u dzieci – przegląd literatury

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Streszczenie

The American Academy of Sleep Medicine defines bruxism as a muscle activity manifesting itself in teeth clenching or grinding. Separate definitions have been established for both sleep (SB) and awake bruxism (AB), thus acknowledging that they are different behaviours occurring during sleep and wakefulness, respectively. There are numerous risk factors for sleep bruxism (SB) in children, but an especially important aspect in the discussion about its origins is stress. Stress as a cause of SB in children has been explored in different studies, but a definite conclusion about its significance has not yet been reached. The results from questionnaire-based research and those using polysomnography to diagnose SB do not coincide. Therefore, the literature review presented below aims to summarize the information regarding the influence of stress on sleep bruxism in children as well as its aetiology, prevalence, diagnosis, treatment, etc.

Summary

Amerykańska Akademia Medycyny Snu definiuje bruksizm jako aktywność mięśniową objawiającą się zaciskaniem lub zgrzytaniem zębów. Ustalono odrębne definicje dla bruksizmu występującego podczas snu (sleep bruxism – SB) oraz podczas stanu wybudzenia (awake bruxism – AB), co potwierdza, że są to zupełnie różne czynności, występujące zgodnie z nazwą, w czasie snu lub czuwania. Istnieje wiele czynników ryzyka bruksizmu występującego podczas snu u dzieci, przy czym szczególnie istotny jest stres. Stres został opisany w różnych badaniach dotyczących etiologii bruksizmu, jednak ostateczne wnioski na temat jego znaczenia nie zostały przedstawione. Wyniki z badań opartych na kwestionariuszach i tych, wykorzystujących polisomnografię w celu diagnozy bruksizmu, różnią się. Przegląd literatury ma zatem na celu podsumowanie informacji dotyczących zarówno wpływu stresu na bruksizm występujący podczas snu u dzieci, jak i jego etiologii, częstości występowania, diagnozy, leczenia itp.

Introduction

In 2013, an international consensus defined bruxism as "a repetitive activity of jaw muscles, characterized by clenching or grinding of the teeth and/or bracing or thrusting of the mandible".[1] The same definition was confirmed by the American Academy of Sleep Medicine (AASM) with the publication of "The International Classification of Sleep Disorders" in 2014. Additionally, it categorized sleep bruxism as a sleep-related movement disorder.[2] In 2018 a new international consensus was reached on the issue. Separate definitions have been established for both sleep (SB) and awake bruxism (AB), thus acknowledging that they are different behaviours occurring during sleep and wakefulness, respectively. Sleep bruxism was defined as "a masticatory muscles activity during sleep that is characterized as rhythmic (phasic) or non-rhythmic (tonic), and is not a movement disorder or a sleep disorder in otherwise healthy individuals". Awake bruxism was defined as "a masticatory muscles activity during wakefulness that is characterized by repetitive or sustained tooth contact and/or by bracing or thrusting of the mandible, and is not a movement disorder in otherwise healthy individuals".[3]

Consequences of SB

SB is a risk factor for clinical consequences such as pain, fatigue and overgrowth of masticatory muscles, limitation of jaw mobility, headaches, temporomandibular disorders, restoration and implant failures as well as damage to the natural teeth (fracturing, pain, tooth wear and pathological mobility) along with oral mucosa disorders.[4,5] However, there is contradictory information on the association between the quality of life (QoL) of children with SB and SB itself. In 2020, a systematic review determined that while one study reported a negative impact of SB on children's quality of life, two others found no link.[6]

Aetiology

There are various theories concerning the aetiology of SB, but the exact origin is nevertheless unknown, though it is believed to be multifactorial and complex.[5]

Peripheral (occlusion-related) components

Peripheral components were once taken into account when discussing the genesis of SB. They included morphological dispositions such as occlusal interferences or discrepancies. Currently, however, peripheral factors are regarded as not significant.[5]

Central components

Nowadays, the researchers agree that the most crucial factor in SB aetiology is the activation of central nervous system during sleep.[7] The disturbance appears to be a deregulation of the dopaminergic system.[8]

SB risk factors specific for children

There are several risk factors specific for children. Different sleep disturbances such as noise, light and problems concerning sleep and its duration are considered especially significant. Psychosocial factor – neuroticism – influences SB greatly, whereas parafunctions are described as moderate risk factors. Passive smoking is also an important element related to SB.[9] Other associated variables are duration of children's exposure to screen and sugar intake since it has been found in a recent study that high amounts of consumed sugar and prolonged screen-time result in exacerbated SB.[10]

Risk factors for adults

Exacerbation of SB in adults is caused by smoking, heavy alcohol intake and caffeine.[11] Different medications such as for example: selective serotonin reuptake inhibitors, selective norepinephrine reuptake inhibitors and antipsychotics also aggravate SB symptoms.[12]

Stress

Stress has been defined by Hans Selye as "non-specific response of the body to any demand".[13] The most essential affected structures include the suprarenal glands resulting in producing humoral mediators (such as cortisol) due to activating the hypothalamic-pituitary-adrenal axis and locus coeruleus. In addition, the autonomic nervous system releases adrenaline and noradrenaline from the brain and the suprarenal medulla.[14]

The influence of stress on children is vastly complex and its perception differs depending on the temperament and psychosocial as well as neurophysiological development. Experiencing stress early in life can be detrimental to physical and mental health of a child, and the consequences that stem from toxic stress may be long-term and not occur until adulthood.[15] Stress can be caused by various, often non-particular events and the reaction it causes depends on the singular qualities of an individual, such as stress sensitivity or personality traits e.g., neuroticism, sense of responsibility.[16] Therefore, it can be concluded that stress, as one of the potential central factors leading to the development of SB in children, can originate from various sources.

One of the primary stress sources often considered in SB research is family relations. An increased probability of SB was reported in children whose mothers experienced stressful events, such as environmental changes.[17] The correlation can be explained by a presumably greater amount of stress in mothers and therefore its influence on their children. Additionally, having divorced parents was also reported as a possible contributing factor.[18] Furthermore, evidence suggests that, as much as the SB aetiology seems to be multifactorial, stress coming, for example, from living in a violent area, where shootings often occur may be one of the chief reasons for SB development in children.[19] Interestingly, 18.75% of children (aged 7-11 years) with parent-reported nocturnal episodes of teeth grinding and clenching exhibited significant psychological and physical stress symptoms, including sleep disorders, teeth grinding, feeling worried, fear, stomach-aches and/or leg pains.[20]

Additionally, children with parafunctional habits as well as those not engaging in any sports had a higher risk of SB.[21] There are also studies suggesting that other personality traits in children, such as an exaggerated sense of responsibility with simultaneous high-stress levels, lead to a 2-fold increase in SB probability.[16] A recent study examining the impact of COVID-19 on SB in 8- to 10-year-olds showed that the prevalence of SB increased during the pandemic, which can presumably be a result of stress and anxiety associated with the said crisis, therefore possibly further confirming the association of stress with SB in children.[22]

PSG results

Discrepancies between reports from parents and polysomnography results have been observed when diagnosing SB in children. Studies subjecting patients to a one-night polysomnography (PSG) test negate the correlation between SB in children and experienced stress.[23,24] It should be noted, however, that the results of PSG might be influenced by the variability of symptoms. Obstructive Sleep Apnea (OSA) is recommended to be diagnosed based on more than one night testing due to a significant fluctuation of symptoms.[25] Possibility of a similar issue ought to be considered with regards to sleep bruxism. Further investigation of the subject should therefore be carried out on a larger scale to establish the association between stress and SB. Acquiring and examining information based on extensive PSG research is needed with parents' report acting as an additional source of information on SB.

Coexistence with other medical conditions and medications

SB has become a sought-after subject matter in dentistry in recent years and it continues to earn recognition due to its association with various medical conditions, sporadic as well as chronic migraines and tension-type headaches.[26]

SB can coexist with numerous disorders including sleep and heart rate disturbances, body movements, respiratory problems as well as increased muscle activity. Additionally, sleep disorders that occur with SB include obstructive sleep apnea, parasomnias, restless leg syndrome, mandibular myoclonus, and rapid eye movement disorders.[27] Orofacial pain, along with nightmares and snoring, manifests itself in children and are likewise correlated with SB.[28]

Different substances can potentially induce or attenuate SB. Though the subject is still understudied, it is believed that medications such as certain anticonvulsants (e.g. barbiturates, benzodiazepines), atypical antipsychotics, norepinephrine reuptake inhibitors, selective antihistamines, opioids and serotonin-norepinephrine reuptake inhibitors intensify SB symptoms. On the other hand, drugs like botulinum toxin A, buspirone, gabapentin and hydroxyzine tend to alleviate the symptoms.[12]

Prevalence

Determining the prevalence rate of SB is another challenge faced when discussing SB in children. Diagnostic criteria used to obtain the required information differ resulting in vague data and incidence rates varying from 7% to 88%.[29] Other studies estimated the prevalence of SB at 3.5 – 40.6% [29] or 5.9 – 49.6%.[30] The relation between children's gender and the prevalence of SB is unclear. A 2020 study noted that girls suffer from SB bruxism less often than boys,[31] whereas a 2022 study observed that SB is diagnosed more often in girls.[32] Claims that gender is irrelevant to how frequently SB occurs can also be found in medical literature.[5] Standardized and validated diagnostic criteria should be, therefore, established and used in further studies to correctly determine the prevalence of SB in children.

Diagnosis

Diagnosing SB can be problematic and the criteria for the condition deviate. Nevertheless, The American Academy of Sleep Medicine proposed standards of diagnosis, which became widely accepted. The updated 2014 version of the International Classification of Sleep Disorders established the following criteria required for a sleep bruxism diagnosis: a report of regular or frequent tooth grinding sounds occurring during sleep, along with either pathological tooth wear, transient morning jaw muscle pain, fatigue, temporal headaches, jaw locking upon awakening, or more than one mentioned symptom.[33]

Sleep bruxism is "a masticatory muscles activity"[3] therefore for the assessment of masticatory muscles methods like electromyography (EMG),[34] magnetic resonance imaging (MRI) [35] and ultrasound (USD) [36] are being employed. EMG can be used for muscle examination, [34] MRI for quantification of overall muscle activity [35] and USD to detect muscle's increased thickness.[36]

The most objective method of diagnosing SB is polysomnography (PSG) used with video and audio recordings.[27] A polysomnogram obtains information on a patient's physiological parameters such as the electrical activity of the brain, heart, muscle response to nerve stimulation, oxygen saturation and respiratory condition, to establish reasons for sleep disorders.[37] The high cost, complexity, and low availability of PSG, nonetheless, create challenges in wider application of polysomnography to broad research.[38] The need for more reliable method than clinical diagnosis and less complicated and

costly than PSG has been advocated. Research suggests that electromyography (EMG) might be the answer since the portable EMG devices enable the examination of the masseter muscles to be carried out at home during sleep. EMG devices present satisfactory results and are well-suited for home use.[34] An example of an EMG device is Bruxoff, (Bioelettronica, Turin, Italy), which has been deemed a highly sensitive and specific diagnostic tool[39] (sensitivity of 0.923 and a specificity of 0.916 [40]). Bruxoff results have also shown a distinct correlation with PSG readings.[39] A new diagnostic method – DIABRUX uses a 0.50-mm thick sheet of biocompatible Terlux® 2802 HD and compatible software to assess the intensity of SB. As reported by the authors of a 2022 study, DIABRUX provides accurate results and is comfortable to use.[34]

Differential diagnosis

Bruxism can often coexist with temporomandibular disorders (TMD), however SB ought to be considered as a complex motor behaviour, whereas TMD should be associated with clinical pain, dysfunction of TMJ or muscles.[32] While diagnosing SB, other nocturnal, faciomandibular activities should also be taken into consideration, including faciomandibular myoclonus, respiratory disturbances, abnormal swallowing, gastroesophageal reflux, night terrors, confusional arousals, epilepsy and dyskinetic jaw movements (tremors).[41] Additionally, disorders, which on physical examination show symptoms similar to bruxism include non-epileptic paroxysmal seizures or Parkinson's disease.[42]

The lack of verified criteria for SB in children causes confusion amongst clinicians.[27] Therefore, SB can be graded (as decided by a 2013 international consensus). Self-reported sleep bruxism is described as "possible", while a self-report along with clinical inspection renders SB "probable". "Definite" sleep bruxism, on the other hand, requires a self-report, clinical examination as well as a polysomnographic recording for a final diagnosis.[1] The difference between patients with SB and patients with other sleep disorders is the duration and intensity of muscle spasms. The muscle contractions in patients with SB significantly differ from those in other disorders.[27]

Treatment of SB in children

It is considered a basic principle that bruxism is always a sign of another condition. Until the condition is diagnosed, however, treatment is mainly symptomatic aiming to control the consequences of bruxism.[43]

Primary methods

The main methods of treating SB include physiotherapy, kinesiotherapy, massage, infrared therapy and low-level laser therapy.[27] Some studies also suggest low-level laser for stimulating acupoints.[44]

Dental methods

Treatment of bruxism should aim to resolve its cause while repairing the damages it has created.[45] Orthodontic treatment is performed in order to expand the palate. The use of occlusal appliances can be employed as well in order to protect the teeth during sleep.[27]

Pharmacological methods

Furthermore, pharmacological treatment including hydroxyzine was proved effective while flurazepam and *Melissa officinalis* were deemed to be less potent.[46] The effectiveness of diazepam was also questioned.[47]

Literature suggests multidisciplinary approach in treatment of SB in children.[48] General paediatric doctors are obliged to screen children for signs of SB.[49] Additionally, other medical professionals like otolaryngologists and orofacial pain specialists, as well as pediatric psychiatrists and psychologists, should be involved in the treatment of SB.[50]

Conclusions

SB is a condition consisting of masticatory muscle activity during sleep. The origin of SB is not fully understood, though it is most likely multifactorial and complex with research leaning into central factors being the cause of its occurrence.

The association between SB and stress has been evaluated over the years with studies linking SB to feelings of anxiety, worry, stress and sleep disorders experienced by children. The quoted data, however, was based mostly on information from questionnaires filled by the patients' parents, which can be problematic considering its credibility. The gold standard of diagnosing SB includes an examination using polysomnography, and results show a discrepancy with the parents' report. Therefore, information based on polysomnography research is needed with parents' report acting as an additional method required for the correct detection of SB. Diagnostic techniques for SB also include EMG and DIABRUX devices. Additionally, procedures performed to assess instrumental activity of the masticatory muscles comprise EMG, MRI and USG.

The information regarding SB in children is believed to be particularly selective and the issue understudied. More research involving SB and its correlation with stress, anxiety and child's personality traits is therefore required to declare a definite association or lack thereof. Studies using PSG tests on children are especially sought-after due to their scarcity in the medical literature. Standardized diagnostic methods, proper design and a significant number of participants are substantial for the results of future studies. Additionally, different medical professionals are required to screen children for SB in order to ensure a multidisciplinary approach to SB diagnosis and treatment.

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