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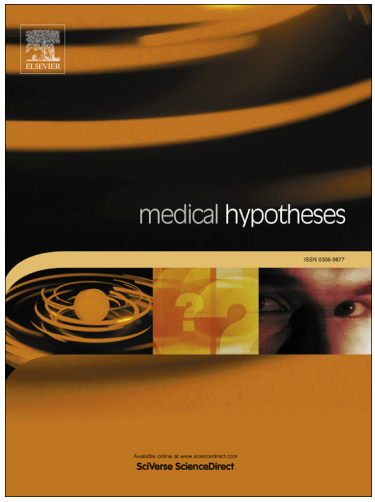

Prevalence of sleep bruxism and awake bruxism in different chronotype profiles: Hypothesis of an association

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Prevalence of sleep bruxism and awake bruxism in different chronotype profiles: Hypothesis of an association

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Abstract

Sleep (SB) and awake bruxism (AB) recognize a multifactorial etiology and have a relationship with several psychological factors. Psychological disorders have recently been associated also with the chronotype, which is the propensity for an individual to be especially active at a particular time during a 24-hour period. Based on the chronotype, the two extreme profiles are morningness and eveningness individuals. Due to the relationship that both the chronotype and bruxism have with psychological factors and the fact that performing tasks not compatible with chronotype can trigger stress, this review presents the hypothesis that the prevalence of SB and AB can differ with the various chronotype profiles. New perspectives for the study of bruxism etiology may emerge from investigations on the topic.

Introduction

Based on a recent consensus definition, bruxism is a repetitive jaw-muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible. The activity can occur during sleep (i.e., sleep bruxism [SB]) and during wakefulness (i.e., awake bruxism [AB]) [1]. This parafunction is directly related to the Central Nervous System [2-4]. The possible consequences of bruxism include jaw muscle and/or temporomandibular joint pain, headache, tooth wear, and fractures or failures of dental restorations [5-8]. However, knowledge on the clinical aspects of bruxism is still fragmented due to the diagnostic shortcomings of most investigations [9,10]. For this reason, the consensus definition also introduced a diagnostic grading,

according to which the likelihood of bruxism diagnosis validity may range from can possible to definite, based on the different approaches that can be adopted (e.g., interviews, questionnaires, clinical examination, electromyography [EMG], polysomnography [PSG], ecological momentary assessment) [1, 9].

Researchers have been working for years to obtain a more profound knowledge on the risk and associated factors of bruxism. On this purpose, evidence is growing in support of a multifactorial etiology, with genetic influence and with a potential relevance for emotional factors too [11,12]. Personality features, such as anxiety traits and stress sensitivity, are the main psychological factors associated with bruxism, both in children/adolescents and in adults [12-16]. The proposed physiopathological mechanism is that individuals with high levels of neuroticism and responsibility traits as well as anxious expectations may tend to release emotional tension by engaging in SB and/or AB activities [12,13].

Recently, psychological disorders have been associated with the chronotype [17]. There _is an influence of sleep complaints on the association between negative emotionality in young adults and chronotype [18], which is the individual propensity to sleep, stay awake, and, more in general, be active at a particular time during a 24-hour period [19]. The human body is governed by an internal "biological clock", based on which there are inter-individual differences concerning the wake-sleep rhythm and the preferred timing to perform the various activities [20,21]. The two extremes of such chronotype are morningness, viz., individuals who wake up early and sleep early, and eveningness, viz., those who wake up late in the morning and go to sleep late at night [22].

Some studies suggested that the chronotype profile may be associated with other health problems as well, such as obesity, hypertension, diabetes, and sleep/wake disorders [21,23,24]. This means that several medical professionals are interested in getting a

deeper insight into the role of chronotype profiles as a factor that may predispose or be associated with a number clinical conditions. Thus, a possible association between SB/AB and chronotype could be hypothesized as part of the multifactorial framework that explains bruxism etiology. Based on these premises, the clinical research question "Is chronotype associated with bruxism?" has been addressed by performing a systematic review of the literature and discussing the hypothetical background for such association.

Evaluation of the idea

Evidence

As a first step, a systematic search in PubMed, Scopus, Web of Science, SciELO, and Google Scholar databases was performed on December 27, 2016, combining the MeSh and keyword terms (chronotype OR circadian rhythms OR circadian rhythm OR circadian cycle OR circadian rhythm) AND (bruxism OR sleep bruxism OR awake bruxism). No time, language, or article type limits were set. Forty-five manuscripts were found.

As a second step, the literature search was extended to the full citation lists identified by the term "chronotype" in the above databases. In addition, the search was also expanded to the related article lists and to the authors' personal collections. The leading author (JMSN) screened the abstracts of the full list of citations to identify potential articles for full-text retrieval. Any decision about the inclusion/exclusion in the review was made by consensus with the two supervisors (DM; FL).

Empirical Data

The first search step did not identify any citation. Thus, the search was extended to the full citation lists identified by the term "chronotype" alone, which provided 523 and 795 citations in the PubMed and Scopus databases, respectively. Examination of the titles and abstracts (TiAb) led to the exclusion of all papers: none had a study design specifically aimed at addressing the clinical research question or discussing its potential plausibility. The articles dealt with the time of day when bruxism occurred (day/night), and the term "circadian" was always used to indicate whether the bruxism occurred during the day (awake bruxism) or during the night (sleep bruxism). On the contrary, the objective of this search was to find articles on the different chronotype profiles associated with sleep bruxism and/or awake bruxism. Therefore, all articles were excluded.

Thus, because of the absence of relevant literature on the topic, a background for the hypothesis of an association between bruxism and chronotype is provided below.

The hypothesis

The physiological control of neurovegetative functions is under biochemical regulation, with repeated cycles of hormones, enzymes, and substances release over a 24-hour span [25,26]. Such endogenous biological regulation may be influenced by, or may adapt to exogenous factors due to lifestyle (e.g., work and social activities) and environment (e.g., place of living) [25]. Several factors, such as social duties and personality traits, may interact with the individual genetic background to influence the smooth function of the internal biological clock, determining the chronotype [27]. Reorganization of the human biological block (i.e., entrainment) occurs every time an individual is exposed to extreme changes in his/her own internal clock, especially as far as the light/dark cycle is concerned. A typical example of entrainment is the jet-lag, [28] and there are emerging

suggestions that performing activities outside of the morningness/eveningness chronotype profile requires an extra effort to carry on the tasks and may result in the so-called social jet-lag [29,30]. This means, that an individual with an eveningness profile experiences difficulties in focusing on daytime activities as well as a morningness-profiled subject may have troubles while running nightly tasks [20,24,28,31]. The literature is plenty of examples of the influence of chronotype on academic performance, as in the case of eveningness students potentially experiencing academic failure in difficult courses, which require high cognitive performance in the morning [27].

The relationship between chronotype profiles and behavioral health issues has been described by many authors [32-36] and, as far as bruxism is concerned, there is some background for hypothesizing a twofold possible relationship with chronotype: 1. Bruxism may be associated with a certain chronotype profile; 2. Bruxism may be triggered by social "jet-lag", viz., high demand to perform activities in moments that do not respect an individual's chronotype.

The first scenario may find support in the psychosocial features as well as the different sleep quality of patients with different chronotypes. The eveningness profile has been associated with neuroticism [37] and, more in general, it has been considered as a potential indicator of behavioral/emotional problems, especially during adolescence [38]. In addition, eveningness individuals may have a disrupted sleep or sleep deficit during the weekdays, due to the social and working demands, and usually recover during the weekend [39]. Given the association of bruxism with insufficient sleep [40] and with personality features that may be common to the eveningness chronotypes a different prevalence of bruxism in individuals with different chronotype can be thus hypothesized. This hypothesis may also support findings that most jaw-muscle activities

in subjects with anxiety traits occur in the first hours of sleep, as if they experience difficulties releasing the tension accumulated during the daily activities [41].

The second scenario may find support in the concept of social "jet-lag". Social demands as well as school, work, and family activities may force individuals to exercise tasks without respect of their internal biological clock, and in spite of their personality traits. Based on that, it could be hypothesized that individuals who have to perform tasks without respecting their own chronotype may engage in an increased amount of bruxism activity in the attempt to relief from the emotional pressures or to satisfy the increased demand for focus and attention [35]. This means, that an individual with an eveningness profile can manage quite easily tasks during the evening, but he/she may have difficulties to perform tasks during the rest of the day, particularly in the morning. The main hypothesis is that focusing on certain tasks, such as performing attention-requiring assignments during school hours that are not in accordance with the individual's eveningness chronotype, may lead to AB in the form of teeth clenching or mandible bracing during wakefulness.

Therefore, there is potential support to hypothesize that the prevalence of SB and AB may be different in relation to the individual chronotype and that subjects working and/or studying according to a daily schedule that is not compatible with their own chronotype are forced into a social "jet-lag" that may predispose them to bruxism.

Future studies

Future studies should be performed to prove the above hypotheses, and their design could be complicated by the mutual interactions of chronotype and bruxism with psychosocial factors, and with stress/anxiety levels in particular. Thus, it is important that an evaluation of psychological features is included in any future study protocols,

which should adopt the best available strategies for diagnosing bruxism, evaluating chronotype profiles, and assessing psychosocial issues.

Several strategies are available to get deeper into the diagnosis of SB and AB, ranging from self-reported questionnaires for a possible diagnosis, clinical examination for a probable diagnosis, and PSG or electromyography (EMG) recordings for a definite diagnosis [1]. For research purposes, home-recording devices have been recently tested to provide an easier approach to SB diagnosis [42,43]. As for AB, the adoption of ecological momentary assessment (EMA) strategies based on media technologies looks promising to approximate a definite diagnosis [44]. As for the chronotype profile, investigations on the topic could be performed by using the specific instruments for assessing the circadian cycle [25,26,45] such as the frequently employed MEQ (Morningness/Eveningness Questionnaire), which allows profiling an individual as eveningness, intermediate, or morningness [45,46]. The use of actigraphic monitoring, viz., a wristwatch-like tool that measures the motion of the patient, can be an auxiliary approach to assess the amount of movements during 24 hours and to estimate the energy expended by individuals with different chronotype profiles [47]. As for the assessment of stress levels, salivary cortisol measurement may be the most suitable strategy to adopt in investigations on the chronotype, since the biological internal clock also controls the levels of cortisol in the human body [30]. In addition, several psychometric test can be adopted to get deeper into the presence of psychological traits influencing the bruxism-chronotype association [13,14].

Consequences of the hypothesis

Different populations should be targeted as far as age, demographics, and profession are concerned. Indeed, the accumulation of tasks and responsibilities generate stress and affect people's health at any age: preschool children may change behavior as soon as

they start facing the tasks provided by the primary school and the complex management of peer relationships [48] adolescents live the stress of a career choice [49], whilst undergraduate students have to face high-demanding University duties [50]. In addition, there are professionals, such as police officers, firefighters, and emergency caregivers, who may have variable work shifts and thus be more exposed to social "jetlag" than the average general population [51-53].

Several studies could be performed within the above populations to assess the possible association between bruxism and chronotype, thus trying to add another piece to the complex puzzle of bruxism physiopathology.

Conclusions

Bruxism is a multifaceted phenomenon that results from the interaction of several factors. Until now, the different circadian manifestations of bruxism (i.e., sleep or awake bruxism) have never been put into correlation with inter-individual differences in the chronotype, which is the predisposition to perform activities at certain hours. Based on the hypotheses discussed in this manuscript, it emerges a potential background to design investigations on the topic. Results from those studies could help getting deeper into the physiopathology of bruxism in relation to the circadian rhythm.

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