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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-h 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-h 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

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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-h 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 h 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.

Conflict of interest statement

No conflict of interest, financial or otherwise, is declared by the authors.

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References

[1] Lobbezoo F, Ahlberg J, Glaros AG, et al. Bruxism defined and graded: an international consensus. J Oral Rehabil 2013;40:2–4.
[2] Rompré PH, Daigle-Landry D, Guitard F, Montplaisir JY, Lavigne GJ. Identification of a sleep bruxism subgroup with a higher risk of pain. J Dent Res 2007;86:837–42.
[3] Lavigne GJ, Huynh N, Kato T, Okura K, Adachi K, Yao D, et al. Genesis of sleep bruxism: motor and autonomic-cardiac interactions. Arch Oral Biol 2007;52:381–4.
[4] İnan R, Şenel GB, Yavlal F, Karadeniz D, Gündüz A, Kızıltan ME. Sleep bruxism is related to decreased inhibitory control of trigeminal motoneurons, but not with reticulobulbar system. Neurol Sci 2016 [Epub ahead of print].
[5] Lobbezoo F, Naeije M. Dental implications of some common movement disorders: a concise review. Arch Oral Biol 2007;52:395–8.
[6] Manfredini D, Lobbezoo F. Relationship between bruxism and temporomandibular disorders: a systematic review of literature from 1998 to 2008. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010;109:e26–50.
[7] Serra-Negra JM, Paiva SM, Auad SM, Ramos-Jorge ML, Pordeus IA. Signs, symptoms, parafunctions and associated factors of parent-reported sleep bruxism in children: a case-control study. Braz Dent J 2012;23:746–52.
[8] Manfredini D, Poggio CE, Lobbezoo F. Is bruxism a risk factor for dental implants? A systematic review of the literature. Clin Implant Dent Relat Res 2014;16:460–9.
[9] Yachida W, Arima T, Castrillon EE, Baad-Hansen L, Ohata N, Svensson P. Diagnostic validity of self-reported measures of sleep bruxism using an ambulatorysingle-channel EMG device. J Prosthodont Res 2016;60:250–7.
[10] Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. J Orofac Pain 2013;27:99–110.
[11] Oporto 5th GH, Bornhardt T, Iturriaga V, Salazar LA. Genetic polymorphisms in the serotonergic system are associated with circadian manifestations of bruxism. J Oral Rehabil 2016;43:805–12.
[12] Manfredini D, Lobbezoo F. Role of psychosocial factors in the etiology of bruxism. J Orofac Pain 2009;23:153–66.
[13] Serra-Negra JM, Ramos-Jorge ML, Flores-Mendoza CE, Paiva SM, Pordeus IA. Influence of psychosocial factors on the development of sleep bruxism among children. Int J Paediatr Dent 2009;19(5):309–17.
[14] Serra-Negra JM, Paiva SM, Flores-Mendoza CE, Ramos-Jorge ML, Pordeus IA. Association among stress, personality traits, and sleep bruxism in children. Pediatr Dent 2012;34:e30–4.
[15] Ahlberg J, Lobbezoo F, Ahlberg K, et al. Self-reported bruxism mirrors anxiety and stress in adults. Med Oral Patol Oral Cir Bucal 2013;18:e7–e11.
[16] Manfredini D, Arreghini A, Lombardo L, et al. Assessment of anxiety and coping features in bruxers: a portable electromyographic and electrocardiographic study. J Oral Facial Pain Headache 2016;30:249–54.
[17] Simor P, Zavecz Z, Pálosi V, Török C, Köteles F. The influence of sleep complaints on the association between chronotype and negative emotionality in young adults. Chronobiol Int 2015;32:1–10.
[18] Antypa N, Vogelzangs N, Meesters Y, Schoevers R, Penninx BW. Chronotype associations with depression and anxiety disorders in a large cohort study. Depress Anxiety 2016;33:75–83.
[19] Bei B, Wiley JF, Trinder J, Manber R. Beyond the mean: a systematic review on the correlates of daily intraindividual variability of sleep/wake patterns. Sleep Med Rev 2016;28:108–24.
[20] Wittmann M, Dinich J, Merrow M, Roenneberg T. Social jetlag: misalignment of biological and social time. Chronobiol Int 2006;23:497–509.
[21] Boudreau P, Dumont GA, Boivin DB. Circadian adaptation to night shift work influences sleep, performance, mood and the autonomic modulation of the heart. PLoS ONE 2013;8:e70813.
[22] Wilking M, Ndiaye M, Mukhtar H, Ahmad N. Circadian rhythm connections to oxidative stress: implications for human health. Antioxid Redox Signal 2013;19:192–208.
[23] Russo PM, Leone L, Penolazzi B, Natale V. Circadian preference and the big five: the role of impulsivity and sensation seeking. Chronobiol Int 2012;29:1121–6.
[24] Levandovski R, Dantas G, Fernandes LC, et al. Depression scores associate with chronotype and social jetlag in a rural population. Chronobiol Int 2011;28:771–8.
[25] von Schantz M, Taporoski TP, Harimoto ARVR, et al. Distribution and heritability of diurnal preference (chronotype) in a rural Brazilian family-based cohort, the Baependi study. Sci Rep 2015;5:e9214.

[26] Tassino B, Horta S, Santana N, Levandovski R, Silva A. Extreme late chronotypes and social jetlag challenged by Antarctic conditions in a population of university students from Uruguay. Sleep Sci 2016;9:20–8.
[27] Liaghatdar MJ, Ashoorion V, Avizhgan M. Compare the educational achievement of medical students with different circadian rhythms in difficult courses of basic sciences. Adv Biomed Res 2016;16(5):58.
[28] Waterhouse J. Jet-lag and shift work: circadian rhythms. J R Soc Med 1999;92:398–401.
[29] Besoluk S, Onder I, Deveci I. Morningness-Eveningness preferences and academic achievement of university students. Chronobiol Int 2011;28:118–25.
[30] Adamsson M, Laike T, Morita T. Annual variation in daily light exposure and circadian change of melatonin and cortisol concentrations at a northern latitude with large seasonal differences in photoperiod length. J Physiol Anthropol 2016;36:6.
[31] Miller MA, Rothenberger SD, Hasler BP, et al. Chronotype predicts positive affect rhythms measured by ecological momentary assessment. Chronobiol Int 2015;32:376–84.
[32] Giannotti F, Cortesi F, Sebastiani T, Ottaviano S. Circadian preference, sleep and daytime behaviour in adolescence. J Sleep Res 2002;11:191–9.
[33] Russo PM, Bruni O, Lucidi F, Ferri R, Violani C. Sleep habits and circadian preference in Italian children and adolescents. J Sleep Res 2007;16:163–9.
[34] Manfredini R, Citro R, Previtali M, et al. Network investigators. Monday preference in onset of takotsubo cardiomyopathy. Am J Emerg Med 2010;28:715–9.
[35] Kabrita CS, Hajjar-Muça TA, Duffy JF. Predictors of poor sleep quality among Lebanese university students: association between evening typology, lifestyle behaviors, and sleep habits. Nat Sci Sleep 2014;13:11–8.
[36] Lundgren AM, Öhrn K, Jönsson B. Do adolescents who are night owls have a higher risk of dental caries? – a case-control study. Int J Dent Hyg 2016;14:220–5.
[37] Hsu CY, Gau SS, Shang CY, Chiu YN, Lee MB. Associations between chronotypes, psychopathology, and personality among incoming college students. Chronobiol Int 2012;29:491–501.
[38] Gau SS, Shang CY, Merikangas KR, Chiu YN, Soong WT, Cheng AT. Association between morningness-eveningness and behavioral/emotional problems among adolescents. J Biol Rhythms 2007;22:268–74.
[39] Vitale JA, Roveda E, Montaruli A, et al. Chronotype influences activity circadian rhythm and sleep: differences in sleep quality between weekdays and weekend. Chronobiol Int 2015;32:405–15.
[40] Ahlberg K, Jahkola A, Savolainen A, et al. Associations of reported bruxism with insomnia and insufficient sleep symptoms among media personnel with or without irregular shift work. Head Face Med 2008;28(4):4.
[41] Manfredini D, Fabbri A, Peretta R, Guarda-Nardini L, Lobbezoo F. Influence of psychological symptoms on home-recorded sleep-time masticatory muscle activity in healthy subjects. J Oral Rehabil 2011;38:902–11.
[42] Castroflorio T, Bargellini A, Rossini G, Cugliari G, Deregibus A, Manfredini D. Agreement between clinical and portable EMG/ECG diagnosis of sleep bruxism. J Oral Rehabil 2015;42:759–64.
[43] Stuginski-Barbosa J, Porporatti AL, Costa YM, Svensson P, Conti PC. Diagnostic validity of the use of a portable single-channel electromyography device for sleep bruxism. Sleep Breath 2016;20:695–702.
[44] Manfredini D, Bracci A, Djukic G. BruxApp: the ecological momentary assessment of awake bruxism. Minerva Stomatol 2016;65:252–5.
[45] Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. Int J Chronobiol 1976;4:97–110.
[46] Adan A, Natale V. Gender differences in morningness-eveningness preference. Chronobiol Int 2002;19:709–20.
[47] Noor ZM, Smith AJ, Smith SS, Nissen LM. A feasibility study: use of actigraph to monitor and follow-up sleep/wake patterns in individuals attending community pharmacy with sleeping disorders. J Pharm Bioallied Sci 2016;8:173–80.
[48] Durand VM, Mindell JA. Behavioral treatment of multiple childhood sleep disorders. Effects on child and family. Behav Modif 1990;14:37–49.
[49] McManus IC, Smithers E, Partridge P, Keeling A, Fleming PR. A levels and intelligence as predictors of medical careers in UK doctors: 20 year prospective study. BMJ 2003;327:139–42.
[50] Serra-Negra JM, Scarpelli AC, Tirsa-Costa D, Guimarães FH, Pordeus IA, Paiva SM. Sleep bruxism, awake bruxism and sleep quality among Brazilian dental students: a cross-sectional study. Braz Dent J 2014;25:241–7.
[51] Gong Z, Zhang J. Job burnout and psychological empowerment among Police in Mainland China. Iran J Public Health 2015;44:1014–5.
[52] Simons BS, Foltz PA, Chalupa RL, Hylden CM, Dowd TC, Johnson AE. Burnout in U.S. Military orthopaedic residents and staff physicians. Mil Med 2016;181:835–9.
[53] Rees CS, Heritage B, Osseiran-Moisson R, et al. Can we predict burnout among student nurses? An exploration of the ICWR-1 model of individual psychological resilience. Front Psychol 2016;7:1072.