Risk Factors for Sleep Bruxism in the General Population*

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Objective: **Sleep bruxism can have a significant effect on the patient's quality of life. It may also be associated with a number of disorders. However, little is known about the epidemiology of sleep bruxism and its risk factors in the general population.**
Design: **Cross-sectional telephone survey using the Sleep-EVAL knowledge based system.**
Settings: **Representative samples of three general populations (United Kingdom, Germany, and Italy) consisting of 158 million inhabitants.**
Participants: **Thirteen thousand fifty-seven subjects aged ≥ 15 years (United Kingdom, 4,972 subjects; Germany, 4,115 subjects; and Italy, 3,970 subjects).**
Intervention: **None.**
Measurements: **Clinical questionnaire on bruxism (using the *International Classification of Sleep Disorders* [ICSD] minimal set of criteria) with an investigation of associated pathologies (*ie*, sleep, breathing disorders, and psychiatric and neurologic pathologies).**
Results: **Grinding of teeth during sleep occurring at least weekly was reported by 8.2% of the subjects, and significant consequences from teeth grinding during sleep (*ie*, muscular discomfort on awakening, disturbing tooth grinding, or necessity of dental work) were found in half of these subjects. Moreover, 4.4% of the population fulfilled the criteria of ICSD sleep bruxism diagnosis. Finally, subjects with obstructive sleep apnea syndrome (odds ratio [OR], 1.8), loud snorers (OR, 1.4), subjects with moderate daytime sleepiness (OR, 1.3), heavy alcohol drinkers (OR, 1.8), caffeine drinkers (OR, 1.4), smokers (OR, 1.3), subjects with a highly stressful life (OR, 1.3), and those with anxiety (OR, 1.3) are at higher risk of reporting sleep bruxism.**
Conclusions: **Sleep bruxism is common in the general population and represents the third most frequent parasomnia. It has numerous consequences, which are not limited to dental or muscular problems. Among the associated risk factors, patients with anxiety and sleep-disordered breathing have a higher number of risk factors for sleep bruxism, and this must raise concerns about the future of these individuals. An educational effort to raise the awareness of dentists and physicians about this pathology is necessary.** ***(CHEST 2001; 119:53–61)***

Key words: bruxism; epidemiology; obstructive sleep apnea syndrome

Abbreviations: CI = confidence interval; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition; ICSD = *International Classification of Sleep Disorders*; OR = odds ratio; OSA = obstructive sleep apnea; REM = rapid eye movement

Sleep bruxism is an oral habit characterized by a rhythmic activity of the temporomandibular muscles that causes a forced contact between dental surfaces during sleep. It is accompanied by tooth clenching or grinding that can be loud enough to be heard by the bed partner. Sleep bruxism has been linked to craniomandibular disorders including headaches, temporomandibular joint discomfort and muscle aches, premature loss of teeth due to excessive attrition and mobility, and sleep disruption of the individual as well as of the bed partner.[1–7] A Canadian study[8] reported an 8% prevalence of tooth grinding during sleep in 2,019 respondents. The Finnish twin cohort study,[9] which was composed of 1,298 monozygotic and 2,419 dizygotic twin pairs aged 33 to 60 years, reported tooth grinding at least once a week in 3.7% of the women and 3.8% of the men. Another study[10] found a rate of 10% of tooth grinding in 534 individuals living in the Kansas City, MO,

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metropolitan area. A longitudinal study, performed from childhood to young adulthood with 293 subjects, showed that the report of sleep tooth grinding symptoms increased with age and occurred frequently in about 10% of the sample. However, the affected subjects rarely sought treatment.[11] There were also substantial genetic factors found in both children and adults.[12,13] A psychological stress component may play a role, but not all tooth grinders have emotional problems,[14] and smoking may increase the likelihood of tooth grinding during sleep.[15,16] Finally, the association of sleep bruxism with other pathologies, such as breathing disorders, was seldom investigated.

The present study aimed to document the prevalence of sleep bruxism, the associated risk factors, and its possible link to other health-related and sleep-related issues in the general population.

Materials and Methods

Sample

Three representative samples of subjects aged ≥ 15 years were drawn from the noninstitutionalized population of the United Kingdom, Germany, and Italy. The targeted population represented 158,690,862 inhabitants. Each sample was drawn using a two-stage sampling design. During the first stage, official census data of each country were used to divide the population according to its geographical distribution. Telephone numbers were then randomly pulled according to this stratification. In the second stage, a controlled selection method was applied to maintain the representation of the sample according to age and gender, as well as to limit the within-sampling unit noncoverage error. The Kish method[17] was used to this end and served to select one respondent per household. The interviewers collected the ages and genders of all eligible household members. Use of the Sleep-EVAL system[18–20] designated which member would be interviewed by means of one of the eight Kish tables (previously assigned to the household with respect to the proportions prescribed by Kish[17]). If the member chosen refused to participate, the household was dropped and was replaced by another, and the process repeated.

Ethics and research committees at the Imperial College (London, UK), the Regensburg University (Germany), and the San Rafaele Hospital (Italy) approved the study. The surveys were conducted with the help of the British Poll Service, Teleperformance, and Grandi Numeri, which were legally authorized to conduct studies in the general population.

Exclusion Criteria

Interviewers explained the goals of the study to potential participants and obtained their verbal consent before the interview began. Individuals with insufficient fluency in the national language, with a hearing or speech impairment, or with an illness precluding the feasibility of an interview, were excluded.

Participation Rates

The participation rate was calculated based on the number of completed interviews divided by the number of eligible telephone numbers, which included all residential telephone numbers that did not meet any of the exclusion criteria. In the United Kingdom, 4,972 of 6,249 eligible subjects agreed to participate in the study (participation rate, 79.6%). In Germany, 4,115 of 6,047 eligible subjects participated (participation rate, 68.1%), and in Italy 3,970 of 4,442 eligible subjects participated (participation rate, 89.4%). An extensive description of the methodology can be found elsewhere.[21]

Instrument

Lay interviewers performed the telephone interviews with the help of the Sleep-EVAL expert system.[18–20] The task of the interviewers was to read to the subjects the questions displayed on the computer screen and to enter the answers in the Sleep-EVAL system. This software is a nonmonotonic, level-2 expert system endowed with a "causal reasoning" mode. It is specially designed to conduct epidemiologic studies on sleep, sleep habits, and mental disorders in the general population and is designed to direct both the epidemiologic study as well as the administration of the questionnaire. Interviews typically began with a standard questionnaire. It consisted of sociodemographic information, sleep/wake schedule, physical health queries, and questions related to sleep and mental disease symptoms. Once the answers were collected, the system looked for a series of plausible diagnostic hypotheses (*ie*, the causal reasoning process). Further questioning and deductions of the consequences of each answer allowed the system to confirm or reject these hypotheses (nonmonotonic, level-2 feature). The system contained all questions required for entire diagnostic descriptions according to the *International Classification of Sleep Disorders* (ICSD)[22] and the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (DSM-IV),[23] classifications. The differential diagnosis process was based on a series of key rules allowing or prohibiting the co-occurrence of two diagnoses in accordance with ICSD and DSM-IV prescriptions. The interview ended once all diagnostic possibilities were exhausted.[20] The Sleep-EVAL system was tested within several designs. The latest validation study was conducted at the Stanford University Sleep Disorders Center (Palo Alto, CA) and at the Regensburg University Sleep Disorders Center (Germany). The validation study consisted of 105 patients interviewed twice: once by a physician using the Sleep-EVAL system and once by a senior sleep specialist. All of the interviewers were blinded to the diagnosis made by the Sleep-EVAL system. The Sleep-EVAL diagnoses were later compared to those of the sleep specialists using polysomnographic recordings to confirm their diagnoses. A κ of 0.93 was obtained between the Sleep-EVAL system and the sleep specialists on obstructive sleep apnea syndrome (OSAS).[24]

The duration of interviews ranged from 10 to 333 min (mean ± SD, 40 ± 20 min). The longest interviews involved subjects with sleep disorders associated with mental disorders. Interviews were completed over two or more sessions if the duration of the interview exceeded 60 min.

Variables

Sleep bruxism was studied in relation to the following four main classes of variables: (1) sociodemographic information; (2) other sleep variables (*eg*, sleep/wake schedule, hypnagogic and hypnopompic hallucinations, snoring, nocturnal awakenings, violent or injurious behaviors during sleep, sleep talking, restlessness on awakening, morning headaches, mouth dryness, automatic behaviors in the daytime, daytime sleepiness, and ICSD sleep disorder diagnoses); (3) the use of psychoactive substances (*eg*, tobacco, alcohol, caffeine, or medications for sleep, depression,

and anxiety); and (4) psychological and psychiatric variables (*eg*, life stress, hallucinations, and DSM-IV mental disorder diagnoses).

The ICSD[22] suggests the following as minimal criteria for sleep bruxism: (1) the presence of teeth grinding during sleep; and (2) at least one of the following associated features: abnormal tooth wear, muscular discomfort, or sound associated with the tooth grinding.

The following questions were related directly to the minimal criteria for the diagnosis:

- According to you, or your bed partner, do you grind your teeth during your sleep? (Answers: 6 to 7 nights a week; 4 to 5 nights a week; 2 to 3 nights a week; once a week; 2 to 3 nights a month; < 1 night a month; never or rarely);
- Have you had dental work because you grind your teeth during your sleep? (Answers: yes, no);
- Do you have muscular discomfort in your jaw because of your teeth grinding? (Answers: always; sometimes; rarely; never; do not know); and
- Is the tooth grinding so loud that your bed partner (or individuals living with you) can hear it? (Answers: always; sometimes; rarely; never; do not know).

Subsequently, the sample was divided into the following three groups: (1) subjects who met the minimal criteria proposed by the ICSD classification for sleep bruxism (including the associated features); (2) the tooth grinding-alone group, consisting of subjects who reported tooth grinding during sleep but without associated features; and (3) the no-tooth-grinding group, including subjects who did not grind their teeth during sleep.

Data Analysis

To compensate for any potential bias from such factors as an uneven response rate across demographic groups, a weighting procedure was applied to correct for disparities in the geographical, age, and gender distribution between the sample and the population as per the national census figures for the noninstitutionalized population aged ≥ 15 years for each country. Logistic regression[25] was used to compute the odd ratios (ORs) associated with sleep tooth grinding. Logistic regressions were performed using the software (SUDAAN; Research Triangle Institute; Research Triangle Park, NC) that allows an appropriate estimate of the SEs from stratified samples by means of a Taylor series linearization method. Reported differences were significant at ≤ 0.05.

Results

Overall, 13,057 subjects were involved in the study (women, 52%; men, 48%; age range, 15 to 100 years). One hundred two subjects refused to answer questions regarding tooth grinding. Tooth grinding during sleep occurring at least weekly was reported by 8.2% of the sample. Associated features with tooth grinding were reported by 54.4% of the subjects. More specifically, 23% of subjects reported that they needed dental work because of their tooth grinding, 8.1% claimed that they had discomfort of their jaw muscles on awakening, and 23.3% said that their tooth grinding was loud enough to be heard by their bed partner. Therefore, 4.4% of the sample met the ICSD diagnostic criteria of sleep bruxism (n = 568), which constituted the subjects in the first group. The prevalence of sleep bruxism diagnosis was comparable between men (prevalence, 4.1%; 95% confidence interval [CI], 3.6 to 4.6%) and women (prevalence, 4.6%; 95% CI, 4.1 to 5.1%). The prevalence of sleep bruxism diagnosis (5.8%) was the highest in subjects between the ages of 19 and 44 years. The lowest prevalence of sleep bruxism diagnosis was found in elderly subjects (*ie*, subjects ≥ 65 years) (Table 1). The second group was composed of 491 subjects (3.8% of the sample) who reported tooth grinding during sleep but without associated features. The third group included 11,896 subjects who reported no tooth grinding during sleep.

Sleep Disorders

Snoring, breathing pauses during sleep, and OSA syndrome were reported significantly more frequently in the sleep bruxism group and the tooth grinding-alone group than in the rest of the sample (Table 2).

Other parasomnia symptoms (*ie*, sleep talking and violent or injurious behaviors during sleep [$p < 0.0001$], sleep paralysis [$p < 0.05$], hypnagogic hallucinations [$p < 0.0001$], and hypnopompic hallucinations [$p < 0.05$]) were also more frequently reported by the sleep bruxism and the tooth grinding-alone groups than by the subjects who did not experience tooth grinding during sleep (Table 2).

The following three symptoms were reported significantly more frequently in the sleep bruxism group than in the rest of the sample (the tooth grinding-alone group being comparable to the no-tooth-grinding group): subjective sense of choking and blocked breathing during sleep; nocturnal awakenings; and morning headaches (Table 2). Finally, dry mouth on awakening was reported significantly more frequently in the no-tooth-grinding group than

Table 1—*Prevalence of Sleep Bruxism by Gender and Age Groups*

		Sleep Bruxism Diagnosis		Tooth Grinding Alone	
Groups	n	%	95% CI	%	95% CI
Gender					
Female	6,736	4.6	4.1–5.1	4.2	3.7–4.7
Male	6,219	4.1	3.6–4.6	3.4	2.9–3.9
Age					
15–18 yr	790	2.2	1.2–3.2	3.3	2.1–4.5
19–24 yr	1,444	5.8	4.6–7.0	3.4	2.5–4.3*
25–44 yr	4,586	5.8	5.1–6.5*	4.7	4.1–5.3*
45–64 yr	3,730	4.7	4.0–5.4*	4.1	3.5–4.7*
≥ 65 yr	2,405	1.1	0.7–1.5	1.9	1.4–2.4

*$p < 0.05$ with the lowest figure.

Table 2—*Reported Sleep Disorders and Symptoms by Groups

Variables	Sleep Bruxism Diagnosis (n = 568)	Tooth Grinding Alone (n = 491)	No Tooth Grinding (n = 11,896)	χ^2/p Value
Any breathing problem during sleep	48.0	43.3	34.8	52.052/< 0.0001
Snoring (not loud)	32.7	31.9	26.8	42.357/< 0.0001
Loud snoring	9.8	7.2	5.2	
Subjective sense of choking and blocked breathing during sleep	5.6†	3.2	2.6	15.306/< 0.005
Breathing pauses during sleep	6.9	5.5	3.1	25.044/< 0.0001
OSA syndrome	4.8	3.4	1.4	33.773/< 0.0001
Sleep talking	26.6	22.7	12.8	103.297/< 0.0001
Violent or injurious behaviors during sleep	4.3	3.7	1.8	20.777/< 0.0001
Sleep paralysis	5.7	5.6	3.7	9.161/< 0.05
Automatic behaviors during the daytime	28.2	21.1	12.5	61.082/< 0.0001
Dry mouth on awakening	33.7	41.0	50.0	72.138/< 0.0001
Nocturnal awakenings	29.0†	24.3	20.8	23.125/< 0.0001
Morning headaches	6.4†	4.9	4.0	7.941/< 0.05
Hypnagogic hallucinations	33.6	38.7	23.9	72.241/< 0.0001
Hypnopompic hallucinations	9.5	9.1	6.4	11.611/< 0.005

*Values given as %, unless otherwise indicated.
†Only the sleep bruxism diagnosis group significantly differs from the no-tooth-grinding group.

in the two groups with tooth grinding during sleep ($p < 0.0001$). Sleeping position was not related to tooth grinding during sleep.

Caffeine, Alcohol, and Tobacco Consumption

Subjects in the sleep bruxism diagnosis group and the tooth grinding-alone group were found to drink alcohol at bedtime significantly more often than the no-tooth-grinding group ($p < 0.005$) (Table 3). They also reported drinking one glass of alcohol or more during the day more frequently ($p < 0.0001$), drinking at least six cups of coffee daily ($p < 0.0001$), and smoking daily ($p < 0.0001$) more frequently than the no-tooth-grinding group (Table 3).

Medical and Dental Consultation in the Previous 12 Months

A greater number of subjects in the sleep bruxism diagnosis group had had medical consultations in the year prior to the interview (76.4%) than had subjects in the no-tooth-grinding group (60.6%; $p < 0.005$); and 64.2% of the subjects in the tooth grinding-alone group had consulted a physician. Among the subjects who had had medical consultations, those who had received a sleep bruxism diagnosis had consulted a physician on average 5.6 times, which was significantly higher than in subjects with tooth grinding alone (average, 4.5 consultations) and subjects with no tooth grinding (average, 4.4 consultations) ($p < 0.05$ [Student-Newman-Keuls test]). About 4% of the sample reported that they had consulted a dentist or an orthodontist in the 12 months prior to the interview, with more subjects in the sleep bruxism diagnosis group having consulted a dentist (5.1%) than those in the tooth grinding-alone group (3.6%) and in the no-tooth-grinding group (2.9%; $p < 0.05$).

Psychiatric Disorders

Associations with DSM-IV mental disorders also were investigated. We found significant associations with mood, anxiety, adjustment disorders, and hallucinatory phenomena. More specifically, a greater number of subjects in the sleep bruxism diagnosis group had DSM-IV adjustment disorders and DSM-IV bipolar disorders than did those in the no-tooth-grinding group (Table 4). DSM-IV anxiety disorders and depressive disorders were more frequent in the sleep bruxism diagnosis and tooth grinding-alone groups than in the no-tooth-grinding group ($p < 0.0001$) (Table 4).

Gustatory hallucinations were more frequently reported in the sleep bruxism diagnosis group than in the no-tooth-grinding group (Table 4).

Multivariate Models

Variables were introduced into a multivariate model to control for possible confounding effects of these variables on the observed significant associations. A first model was calculated comparing subjects in the sleep

Table 3—*Consumption of Coffee, Alcohol, and Tobacco by Groups

Variables	Sleep Bruxism Diagnosis (n = 568)	Tooth Grinding Alone (n = 491)	No Tooth Grinding (n = 11,896)	χ^2/p Value
Drinking alcohol at bedtime	5.4	5.1	3.1	12.508/< 0.005
Daily intake of alcohol				
0 glasses	85.3	86.3	91.2	33.400/< 0.0001
1 or 2 glasses	7.9	7.7	5.4	
≥ 3 glasses	6.8	6.0	3.4	
Daily caffeine intake				
0 cups	18.5	14.3	21.8	58.790/< 0.0001
1 or 2 cups	26.1	26.1	27.2	
3 to 5 cups	30.8	35.6	35.3	
≥ 6 cups	24.6	24.0	15.7	
Daily smoking				
0 cigarettes	64.6	71.1	76.7	46.350/< 0.0001
≤ 20 cigarettes	28.9	24.1	19.1	
> 20 cigarettes	6.5	4.8	4.2	

* Values given as %, unless otherwise indicated.

bruxism diagnosis group to the no-tooth-grinding group; a second model also was calculated comparing subjects in the tooth grinding-alone group to those in the no-tooth-grinding group. Since no important difference emerged from the two models, we decided for the final model to combine the sleep bruxism diagnosis group and the tooth grinding-alone group as one group for analysis. The list of significant variables introduced into the model can be found in Table 5. The results of the logistic regression (adjusted ORs) indicated that age, drinking alcohol in the daytime, being a heavy coffee drinker, smoking, snoring, reporting of moderate daytime sleepiness, having disrupted sleep, having hypnagogic hallucinations, talking during sleep, having violent or injurious behaviors during sleep, having OSA syndrome, having automatic behaviors during the daytime, having a highly stressful life, and having a DSM-IV anxiety disorder diagnosis were positively associated with the report of tooth grinding during sleep.

Discussion

Tooth grinding during sleep is classified as being in the parasomnia group of sleep disorders by the ICSD. It occurs usually in non-rapid eye movement sleep (REM) sleep stages, mostly in stage 2 sleep, and during sleep-stage shifts.[26,27] However, it can also occur during REM sleep and, in that case, is associated with facial and dental pain more frequently.[28] In this European representative sample of population in the United Kingdom, Germany, and Italy (13,057 subjects, representative of 158,690,862 inhabitants aged ≥ 15 years), we found that tooth grinding during sleep occurred at least weekly in 8.2% of the sample. This is comparable to the findings of other studies in Canada[8] and in the metropolitan area of Kansas City, MO.[10] To our knowledge, this is the first epidemiologic study of the general population applying the minimal criteria for sleep bruxism proposed by the ICSD. According to the ICSD criteria, half of our tooth grinders (54.4%) met the diagnosis of sleep bruxism and were adversely affected by their tooth grinding, with reports of muscular discomfort, disturbance of a partner's sleep, or a need for dental treatment. This represents a prevalence of 4.4% of the whole sample, thus ranking this diagnosis as the third most common parasomnia (after sleep talking and primary snoring). We found that the prevalence of sleep bruxism diagnosis was unrelated to gender and decreased significantly with age, with the highest prevalence being observed in the 19-to-44-year group.

Limitations

The first problem is the possible underreporting of the phenomenon in individuals living alone, since no one can witness their symptoms (approximately 20% of the sample). The second problem relates to elderly subjects, since here the proportion of edentulous individuals can be considerable, therefore resulting in a decrease in the prevalence of tooth grinding during sleep. The third problem is the absence of an examination, notably dental examinations and polysomographic recordings. Although such measures are desirable, they are not frequently incorporated into community-based epidemiologic studies because they would substantially raise the costs of the surveys, thus posing important logistic problems. Furthermore, epidemiology does not rely

Table 4—*Mental Disorders by Groups

Disorders	Sleep Bruxism Diagnosis† (n = 568)	Tooth Grinding Alone (n = 491)	No Tooth Grinding (n = 11,896)	χ^2/p Value
DSM-IV anxiety disorders	14.1	10.2	6.6	44.823/< 0.0001
DSM-IV depressive disorders	6.9	5.9	3.3	23.922/< 0.0001
DSM-IV bipolar disorders	6.7†	1.8	2.3	32.311/< 0.0001
DSM-IV adjustment disorder	3.5†	1.3	1.7	9.138/< 0.01
Gustatory hallucinations				
Never	85.9†	88.8	90.5	13.355/< .005
At least once per month	12.0	10.0	8.2	
At least once per week	2.1	1.2	1.3	

*Values given as %, unless otherwise indicated.
†Only the sleep bruxism diagnosis group significantly differs from the no-tooth grinding group.

on a case-by-case analysis as in clinical studies: *prevalence* is defined as an estimate of a disease as a whole in a given population and in a given time. The requirement is to have a set of criteria for the disease that can be translated into a questionnaire to be used on a large scale. The ICSD proposed such criteria for sleep bruxism that do not require a dental or a clinical examination. Thus, while such data would be useful, self-reports and interview-based measures remain the most widely used measures in community surveys.

Findings

Sleep bruxism rarely occurs alone. In this study, it was associated with OSA syndrome, a disorder characterized by apnea during sleep and accompanied by daytime sleepiness or nonrestorative sleep. OSA syndrome was the highest risk factor for tooth grinding during sleep (OR, 1.8) among the associated sleep symptoms and disorders. The relationship between sleep bruxism and OSA syndrome or a sleep-disordered breathing disorder has been related to an arousal response. Indeed, tooth-grinding episodes can be accompanied by an arousal response, as evidenced by electroencephalographic bursts of alpha complex. This arousal response can be linked to OSA episodes that often are provoked by hypoxemia and breathing difficulty. The termination of the apneic event is often accompanied with a variety of mouth phenomena such as snoring, gasps, mumbling, and tooth grinding.[28] Sleep bruxism also was associated with moderate daytime sleepiness, nocturnal awakenings, and snoring. About one third of those with bruxism in our study reported being sleepy in the daytime. Sleepiness could be the result of other sleep disturbances such as nocturnal awakenings. However, in the multivariate model, daytime sleepiness appeared as an independent predictive factor for sleep bruxism. Therefore, other factors such as increased body movement activity and microarousals that are often associated with sleep bruxism[26] could be responsible for this excessive daytime sleepiness. We did not find a significant association with insomnia disorder diagnoses or with diagnoses of periodic limb movement disorder or restless leg syndrome, as was previously reported.[16]

Other significant associations were found with other parasomnias, such as sleep talking, hypnagogic or hypnopompic hallucinations, and violent or injurious behaviors during sleep, which were significantly associated with tooth grinding during sleep. The association with sleep talking has been reported[29]; however, few studies have investigated the co-occurrence of other parasomnias. An association between sleep bruxism and REM behavior disorder,[30,31] a parasomnia characterized by the occurrence of violent or injurious episodes during the REM sleep, already has been reported.

Mental disorders, mainly anxiety disorders, and other psychological variables (*ie*, highly stressful life and gustatory hallucinations) were also significantly related to tooth grinding during sleep. Anxiety disorders and stress are known factors for exacerbating sleep bruxism[32–34]; about 69% related their sleep bruxism or its aggravation to stress or anxiety.[35] The significantly higher rate of gustatory hallucinations may seem surprising at first, but the explanation may be simple. This higher rate can be associated with alloys used in dental restoration procedures, which can sometimes produce a metallic taste in patients who grind their teeth, regardless of the type of alloy.[36]

Significant associations were also found with the daily use of alcohol, tobacco, and caffeine. The quantity was significant only for caffeine. Only heavy coffee drinkers (*ie*, six cups or more) were at greater risk. These substances are known factors for increasing the risk of sleep tooth grinding.[15,16]

Despite the inconvenience created by tooth grinding during sleep in the subjects who had received a

Table 5—*Risk Factors Associated With Sleep Tooth Grinding*

Risk Factors	Crude OR	95% CI	Adjusted OR	95% CI
Age groups				
15–18 yr	1.9	1.3–2.8*	1.8	1.2–2.7†
19–24 yr	3.3	2.4–4.4*	2.8	2.0–3.8*
25–44 yr	3.8	2.9–4.9*	3.1	2.3–4.1*
45–64 yr	3.1	2.4–4.1*	2.7	2.1–3.6*
≥ 65 yr	1.0		1.0	
Daily intake of alcohol				
0 glass	1.0		1.0	
1 or 2 glasses	1.5	1.2–2.0*	1.5	1.1–1.9†
≥ 3 glasses	2.0	1.6–2.6*	1.8	1.4–2.4*
Daily caffeine intake				
0 cup	1.0		1.0	
1 or 2 cups	1.3	1.0–1.5‡	1.2	1.0–1.5
3–5 cups	1.2	1.0–1.5‡	1.1	0.9–1.4
≥ 6 cups	2.0	1.7–2.5*	1.4	1.2–1.8*
Daily smoking				
0 cigarettes	1.0		1.0	
≤ 20 cigarettes	1.6	1.4–1.8*	1.3	1.1–1.5†
> 20 cigarettes	1.6	1.2–2.0†	1.0	0.7–1.3
Snoring				
No snoring	1.0		1.0	
Snoring (not loud)	1.4	1.2–1.6*	1.2	1.0–1.4‡
Loud snoring	1.9	1.5–2.4*	1.4	1.1–1.8†
Restfulness on awakening				
Completely rested	1.0		1.0	
Rather unrested	1.5	1.2–1.9*	1.0	0.8–1.3
Completely unrested	1.3	1.1–1.6*	1.1	0.9–1.3
Daytime sleepiness				
No sleepiness	1.0		1.0	
Moderate sleepiness	1.8	1.5–2.2*	1.3	1.1–1.6†
Severe sleepiness	1.9	1.4–2.5*	1.2	0.9–1.7
Presence of§				
Nocturnal awakenings	1.4	1.2–1.6*	1.3	1.1–1.5†
Hypnagogic hallucinations	1.8	1.6–2.0*	1.3	1.1–1.5*
Hypnopompic hallucinations	1.5	1.2–1.9*	1.0	0.8–1.3
OSA syndrome	3.0	2.1–4.2*	1.8	1.2–2.6†
Sleep talking	2.3	1.9–2.6	1.7	1.4–2.0*
Violent or injurious behaviors during sleep	2.3	1.7–3.3	1.3	0.9–1.9
Dry mouth on awakening	0.6	0.5–0.7*	0.6	0.5–0.7*
Morning headaches	1.5	1.1–1.9†	1.3	0.9–1.7
Automatic behaviors during the daytime	1.9	1.5–2.2*	1.5	1.3–1.9*
Life stress				
High	2.2	1.8–2.6	1.3	1.1–1.6*
Moderate	1.3	1.2–1.6*	1.0	0.8–1.2
None	1.0		1.0	
Gustatory hallucinations				
Never	1.0		1.0	
At least once per month	1.4	1.1–1.7†	1.1	0.9–1.4
At least once per week	1.4	0.8–2.3	0.8	0.5–1.3
Presence of§				
DSM-IV adjustment disorder diagnoses	1.5	1.0–2.3	0.8	0.5–1.3
DSM-IV anxiety disorder diagnoses	2.0	1.6–2.4*	1.3	1.0–1.6‡
DSM-IV bipolar disorder diagnosis	2.0	1.5–2.7*	1.0	0.7–1.5
DSM-IV depressive disorder diagnoses	2.0	1.6–2.6*	1.1	0.8–1.5

*$p < 0.001$.
†$p < 0.01$.
‡$p < 0.05$.
§Absence of the symptoms or diagnoses is the referent category.

sleep bruxism diagnosis, only 5.1% of them had consulted a dentist or an orthodontist in the 12 months prior to the interview. This low percentage may be due to the lack of information about this symptom and its consequences on the teeth.

The results of this study raise an important concern about the risk of sleep apnea for individuals with sleep bruxism. A plausible explanation for this association could rely on the shared anatomic problems proposed by some research,[37] such as mandibular deficiency, temporomandibular abnormalities, and craniofacial abnormalities. Therefore, this association suggests that tooth grinding during sleep should be considered in patients with sleep-disordered breathing disorders. General practitioners should inquire about sleep bruxism and sleep apnea symptoms when abnormal tooth wear, damage of the structures surrounding the teeth, or hypertrophy of the muscles of mastication are identified. Similarly, dentists should ask about the symptoms of sleep-disordered breathing when dental signs of bruxism are present. When examining patients with sleep-disordered breathing disorders, sleep specialists should investigate the possibility of sleep bruxism. Finally, further research is necessary on the pathophysiologic mechanisms of this largely unknown sleep disorder.

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