

# Bruxism: is it a new sign of the cardiovascular diseases?

Z. ATILGAN<sup>1</sup>, R. BUYUKKAYA<sup>2</sup>, F. YAMAN<sup>3</sup>, G. TEK BAS<sup>2</sup>, S. ATILGAN<sup>3</sup>,  
A. GUNAY<sup>4</sup>, Y. PALANCI<sup>5</sup>, S. GUVEN<sup>6</sup>

<sup>1</sup>Department of Cardiology, Medicine Faculty, Dicle University (Turkey)

<sup>2</sup>Department of Radiology, Medicine Faculty, Dicle University (Turkey)

<sup>3</sup>Department of Oral and Maxillofacial Surgery, Dentistry Faculty, Dicle University (Turkey)

<sup>4</sup>Department of Periodontology, Dentistry Faculty, Dicle University (Turkey)

<sup>5</sup>Department of Public Health, Medicine Faculty, Dicle University (Turkey)

<sup>6</sup>Department of Prosthodontics, Dentistry Faculty, Dicle University (Turkey)

**Abstract.** – *Aim:* To determine the relationship between bruxism and cardiovascular diseases.

**Materials and Methods:** 120 patients who referred to the Dentistry Faculty with the complaint of bruxism were selected. All patients gave informed consent for participation in the study. All of the patients were examined and bruxism was classified. And also these were examined by B-mode ultrasound to measure the Intima Media Thickness (IMT) at the far wall of the common carotid artery. A wide range of vascular risk factors including age, gender, body mass index, and previous history were surveyed. Spearman correlation analysis was performed to ascertain quantitative comparison, Mann-Whitney U and Kruskal-Wallis test were used for comparison of means

**Results:** There were 66 (55%) male and 54 (45%) female patients, with a female to male ratio of 1/1.2. The mean age was  $35.6 \pm 1.25$  years (range 18-65 years). In the analysis of bruxism classification and IMT there was a statistical significance between bruxism classification subgroup 1, 2, 3 and IMT. There was no statistical significance between bruxism classification Subgroup 4 and IMT due to the small number of the patients (n=12).

**Conclusions:** Stressful situations can cause both bruxism and cardiovascular disease such as coronary artery diseases, hypertension, arrhythmias, cardiomyopathy. The statistical analysis supported this hypothesis. However, we need to new studies with large number of samples to confirm this hypothesis. Clearly, future studies in this field will need to take into consideration the influence of the following variables: age, use of medication or drugs, smoking habits, and other sleep disorders.

*Key Words:*

Bruxism, Cardiovascular diseases, Stress, Anxiety.

## Introduction

Bruxism (from the Greek βρυγμός (*brugmós*), “gnashing of teeth”) is characterized by the grinding of the teeth and is typically accompanied by the clenching of the jaw. It is an oral parafunctional activity that occurs in most humans at some time in their lives. In most people, bruxism is mild enough not to be a health problem<sup>1-3</sup>. While bruxism may be a diurnal or nocturnal activity, it is bruxism during sleep that causes the majority of health issues and can even occur during short naps. Bruxism is one of the most common sleep disorders<sup>1-3</sup>. The origin of bruxism has not been fully clear or explained. It seems that it obeys to multiple etiopathogenical factors. Among them, there are two which outstand above the others: mental factor, occlusal interferences<sup>4,5</sup>. Psychological or mental factors work as potentiators of the symptoms (*contributing factors*). They are: anxiety and stress. Stressful situations can potentiate this habit in a specific manner and also relaxing situations can reduce such habit in an occasional manner<sup>4,5</sup>. Coronary artery disease, which progresses gradually and leads to coronary heart disease, is still the leading cause of illness and death in some countries. Mortality has decreased during the last decades although morbidity has not. However, overall mortality remains high, because coronary artery disease mortality has increased in the world<sup>6</sup>. The pathological process responsible for coronary artery disease is atherosclerosis. Atherosclerosis develops slowly and gradually, and various genetic, environmental, and life style risk factors may contribute to its progression<sup>7</sup>. The introduction of the ultrasound technique has made it pos-

sible to estimate early asymptomatic atherosclerosis by way of the intima media thickness (IMT). The method is accepted as a valid and precise measure of early nonsymptomatic atherosclerosis, although small changes in the IMT can be an expression of changes in the muscles in the vessel wall rather than of atherosclerosis<sup>8-10</sup>. Numerous studies have shown a connection between IMT measured on the *arteria carotidis communis* and manifest ischemic heart disease as well as an association with risk factors for ischemic heart disease<sup>11-14</sup>. A given IMT is an expression of the total effect of all the risk factors that a person has been exposed to until the time of examination<sup>7</sup>. Stress is one of the fundamental factors in the pathogenesis of the atherosclerosis. Both acute and chronic stress have been shown to be associated with atherosclerosis<sup>15</sup>. Stress and anxiety are etiological factor of both cardiovascular disease and bruxism. As a result of the stress level bruxism and cardiovascular diseases can occur at the same time. We hypothesized that the bruxism classification may point out cardiovascular disease.

## Materials and Methods

The study protocol was approved by the Dicle University Institutional Review Board, and written informed consent was obtained from all subjects. This study was performed between November 2009 and August 2010. 120 patients who referred to the Dentistry Faculty with the complaint of bruxism were selected. All of the patients were examined and bruxism was classified.

### Bruxism Classification

Wearing away of the tooth surface is generally regarded as the most important clinical sign of bruxism. Although there is no universally accepted scale for measuring the degree of tooth wear, a Dutch study<sup>16</sup> reported on a five-point scale that appears to be a reliable instrument for diagnosing bruxism. The five points are as follows:

- 0 = No wear.
- 1 = Visible wear within the tooth enamel.
- 2 = Visible wear with dentine exposure and loss of crown height.
- 3 = Loss of crown height between 1/3 and 2/3.
- 4 = Loss of crown height greater than 2/3.

And also these were examined by B-mode ultrasound to measure the Intima Media Thickness (IMT) at the far wall of the common carotid artery (CCA). A wide range of vascular risk factors including age, gender, body mass index, and previous history were surveyed.

### Carotid B-mode Ultrasonography and Intima-Media Thickness Assessment

Intima-media thickness of the bilateral common carotid arteries was performed on Toshiba Applio (Toshiba, Tokyo, Japan) ultrasonography machine with using 7-10 mHz multifrequency linear array transducers. Subjects were studied in the supine position. Each common carotid artery was evaluated with the subject's head turned slightly to the contralateral side. The field depth, gain, and near and far field gain controls were optimized to enable visualization of the far wall of the common carotid artery. All images were interpreted real time and cine-loop recording by a 9 years experienced radiologist. Images were also visually inspected for plaque, defined as a focal area of arterial wall thickening >1.5 times that of the surrounding arterial wall. Mean CIMT (average of the right and left common carotid artery CIMT) was assessed.

### Statistical Analysis

Spearman correlation analysis was performed to ascertain quantitative comparison, Mann-Whitney U and Kruskal-Wallis test were used for comparison of means (Statistical Package for Social Sciences, Version 11.5, SPSS Inc., Chicago, IL, USA).

## Results

There were 66 (55%) male and 54 (45%) female patients, with a female to male ratio of 1/1.2. The mean age was  $35.6 \pm 1.25$  years (range 18-65 years) (Table I). Bruxism classification group's demographic data are summarized in Table I.

All comparison samples are shown in Table II. In the analysis of bruxism classification and IMT there was a statistical significance between bruxism classification subgroup 1, 2, 3 and IMT. There was no statistical significance between bruxism classification subgroup 4 and IMT due to the small number of the patients (n=12).

**Table I.** Sample demographic data of subgroups.

Demographic data	Bruxism	Bruxism	Bruxism	Bruxism	Total
	Classification 1	Classification 2	Classification 3	Classification 4	
Mean age	30.9 ± 7.6	34.9 ± 25.1	39.52 ± 25.1	41.2 ± 27.4	35.6 ± 24.9
Women n (%)	17 (54.8%)	17 (35.4%)	15 (51.7%)	5 (41.7%)	54 (45%)
Men n (%)	14 (35.2%)	31 (64.6%)	14 (48.3%)	7 (58.3%)	66 (55%)

And also there were correlation between bruxism and age (Figure 1), between bruxism and BMI (Figure 2), bruxism and IMT (Figure 3).

### Discussion

During the past 50 years, cardiovascular disease has become one of the greatest killers in the developed countries. Morbidity and mortality due to cardiovascular disease are still high, and also the medical cost of cardiovascular disease treatment continues to rise steadily (e.g. a coronary-artery bypass graft procedure costs \$ 50,000)<sup>17,18</sup>.

The best and safest way to ensure a “disease-free world” is by preventing diseases. It is always good to diagnose a disease in its early stage rather than to let it advanced stages, where it becomes very difficult to cure them. The first clinical manifestation of cardiovascular disease often arises in a stage of well-advanced atherosclerosis. However, arterial vessel wall changes occur during a presumably long subclinical lap phase

characterized by endothelial dysfunction and gradual thickening of intima<sup>19</sup>. Coronary artery disease, the most common form of cardiovascular disease, is the leading cause of death in all over the world<sup>17,18</sup>. Researchers have found certain factors that play an important role in a person’s chances of developing heart disease. These are called risk factors.

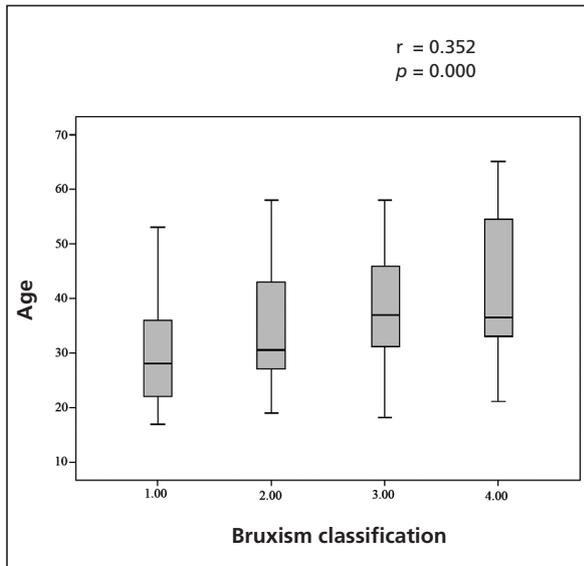
Risk factors have two categories: major and contributing. Major risk factors are those that have been proven to increase your risk of heart disease. Contributing risk factors are those that doctors think can lead to an increased risk of heart disease, but their exact role has not been cleared<sup>20,21</sup>.

Stress is considered a contributing risk factor for heart disease because its effects on the heart are not completely understood. Also, the effects of emotional stress, behavior habits, and socio-economic status on the risk of heart disease and heart attack have not been proven. That is because we all deal with stress differently: how much and in what way stress affects us varies from person to person<sup>20-22</sup>.

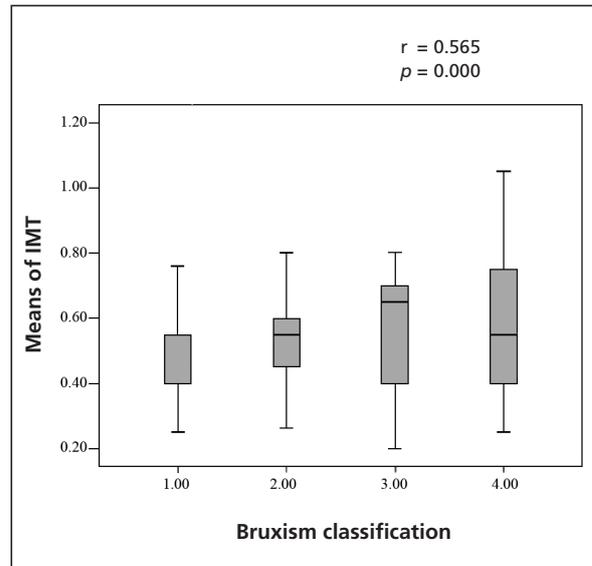
**Table II.** The comparison between BMI and IMT.

	Bruxism classification 1 (n = 31)	Bruxism classification 2 (n = 48)	Bruxism classification 3 (n = 29)	Bruxism classification 4 (n = 12)	Kruskal Wallis test p	Mann-Whitney U p
BMI	23.27 ± 4.31	25.12 ± 3.98	25.01 ± 3.70	27.41 ± 5.01	.012	.026 <sup>†</sup> .017 <sup>‡</sup> .007 <sup>§</sup> .813 <sup>  </sup> .106 <sup>¶</sup> .083 <sup>#</sup>
Means of IMT	0.46 ± 0.10	0.52 ± 0.13	0.57 ± 0.18	0.60 ± 0.26	.021	.014 <sup>†</sup> .011 <sup>‡</sup> .133 <sup>§</sup> .075 <sup>  </sup> .588 <sup>¶</sup> .943 <sup>#</sup>

†Comparison of bruxism classification 1-2 ( $p < 0.05$ ), ‡Comparison of bruxism classification 1-3 ( $p < 0.05$ ), §Comparison of bruxism classification 1-4 ( $p < 0.05$ ), ||Comparison of bruxism classification 2-3 ( $p < 0.05$ ), ¶Comparison of bruxism classification 2-4 ( $p < 0.05$ ), #Comparison of bruxism classification 3-4 ( $p < 0.05$ ),



**Figure 1.** The correlation between bruxism and age.



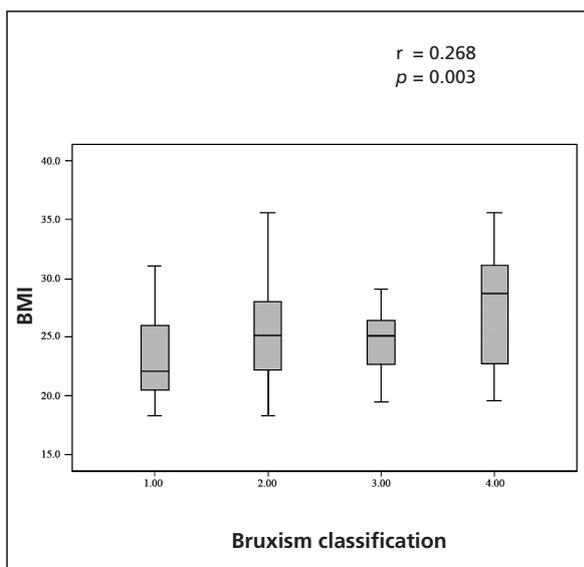
**Figure 3.** The correlation between bruxism and IMT.

Carotid artery intima-media thickness (IMT) is a widely accepted index for assessing atherosclerosis, and is known to be a risk indicator for cardiovascular and cerebro-vascular events<sup>22</sup>.

In healthy adults, IMT ranges from 0.25 to 1.5 mm, and values  $>1.0$  mm are often regarded as abnormal<sup>23-25</sup>. However, the “normal” range and “abnormal” value and even the risk factors associated with abnormal IMT might vary considerably between different populations<sup>25,26</sup>. Ultrasonographic diagnosis of increased IMT in one individual at risk of atherosclerosis might help to

stratify the risk factor, to better justify the decision to treat and to follow the efficacy of preventive therapy such as that involving the use of antihypertensive, antiplatelet, or lipid-lowering drugs<sup>27,28</sup>. As it known, bruxism is the habit of clenching and grinding the teeth. It most often occurs at night during sleep, but may also occur during the day. Bruxing when awake, along with other oral habits such as jaw or mouth posturing, cheek biting, and nail biting, often occurs without cognitive awareness, especially during periods of concentration, or stressful situations. Awake bruxism can be associated with tics (medical definition), or with a “parafunction” that is believed to be associated with life stress caused by familial responsibilities or work pressure<sup>29</sup>.

Awake bruxism is mainly associated with nervous tic and reactions to stress. The physiology and pathology of awake bruxism is unknown, although stress and anxiety are considered to be risk factors<sup>29</sup>. Bruxism during sleep is distinct from bruxism when awake and occurs in relationship to arousals. Most sleep bruxism episodes are under the transient influence of cardiac sympathetic activity (as a promoter of arousal), as shown in a rapid rise in heart rate at the onset of rhythmic masticatory muscle activity (time domain estimate of heart rate acceleration (i.e. tachycardia) or deceleration (i.e. bradycardia) during recurrent sleep arousal<sup>30-32</sup>. Whether bruxism occurs during the day when awake or at night during sleep, the occasional outcomes of tooth wear and jaw pain are familiar to most dentists and also many dentists



**Figure 2.** The correlation between bruxism and BMI.

share the opinion that bruxism, either clenching while awake or grinding during sleep, is associated with stress and anxiety<sup>29</sup>. Concomitant anxiety and hyperactivity have also been described as causes of bruxism<sup>29,33</sup>. Moreover, two studies showed that patients with bruxism had elevated levels of catecholamines in their urine in comparison to nonbruxism subjects; such findings support a link between emotional stress and bruxism. The literature demonstrates that self-report and clinical observation of tooth wear is one means of assessing bruxism in relation to the role of anxiety and stress. However, such methods have several limitations. Tooth wear has been described as a weak indicator of current bruxism and does not discriminate clenching from grinding bruxism<sup>34</sup>. But tooth wear level is indispensable method to evaluate bruxism level. Stress and anxiety are the same etiological factor of both cardiovascular disease and bruxism. So the same stressful situations can cause bruxism and cardiovascular disease such as coronary artery diseases (ischemic heart disease, acute myocardial infarction), hypertension, arrhythmias, cardiomyopathy. The statistical analysis supported this hypothesis. However, we need to new studies with large number of samples to confirm this hypothesis.

## Conclusions

Clearly, future studies in this field will need to take into consideration the influence of the following variables: age, anxiety, use of medication or drugs (central nervous system stimulant), smoking habits, and other sleep disorders. To prove the hypothesis, we recognize that it is very difficult to isolate the role of stress and anxiety from concomitant changes in autonomic and motor excitability and a state of altered physiological vigilance. Heterogeneity in psychosocial and biological markers may concur to prevent a clear, simple and valid description of the causative relationship among stress, anxiety, bruxism and cardiovascular disease.

## References

- 1) CARLSSON GE, EGERMARK I, MAGNUSSON T. Predictors of bruxism, other oral parafunctions tooth wear over a 20-year follow-up period. *J Orofac Pain* 2003; 17: 50-57.
- 2) OHAYON MM, LI KK, GUILLEMINAULT C. Risk factors for sleep bruxism in the general population. *Chest* 2001; 119: 53-61.
- 3) VAN SELMS MKA, LOBBEZOO F, WICKS DJ, HAMBURGER HL, NAEIJE M. Craniomandibular pain, oral parafunctions, and psychological stress in a longitudinal case study. *J Oral Rehabil* 2004; 31: 738-745.
- 4) SATO S, SLAVICEK R. Bruxism as a stress management function of the masticatory organ. *Bull Kanagawa Dent Coll* 2001; 29: 101-110.
- 5) T. KAMPE, T. TAGDAE. G. BADER, G. EDMANT, S. KARLSSON. Reported symptoms and clinical finding in a group of subjects with longstanding bruxism behavior. *J Oral Rehabil* 1997; 24: 581-587.
- 6) LEVI F, LUCCHINI F, NEGRI E, LA VECCHIA C. Trends in mortality from cardiovascular and cerebrovascular diseases in Europe and other areas of the world. *Heart* 2002; 88: 119-124.
- 7) WOOD D. Joint European Societies Task Force. Established and emerging cardiovascular risk factors. *Am Heart J* 2001; 141: 49-57.
- 8) BOOTS ML, HOFFMAN A, GROBBEE D. Common carotid intima-media thickness and lower extremity arterial atherosclerosis. The Edinburgh Artery Study. *Stroke* 1997; 28: 348-353.
- 9) KANTERS SDJM, ALGRA A, VAN LEEUWEN MS, BANGA JD. Reproducibility of in vivo carotid intima-media thickness measurements: a review. *Stroke* 1997; 28: 665-671.
- 10) SCHMIDT C, WENDELHAG I. How can the variability in ultrasound measurement of intima-media thickness be reduced? Studies of interobserver variability in carotid and femoral arteries. *Clin Physiol* 1999; 19: 44-45.
- 11) LYNCH J, KAPLAN GA, SALONEN R, COHEN RD, SALONEN JT. Socioeconomic status and carotid atherosclerosis. *Circulation* 1995; 92: 1786-1792.
- 12) CROUSE JR, GOLDBOURT U, EVANS G, PINSKY J, SHARRETT AR, SORLIE P, RILEY W, HEISS G. Risk factors and segment-specific carotid arterial enlargement in the atherosclerosis risk in communities (ARIC) cohort. *Stroke* 1996; 27: 69-75.
- 13) SALONEN JT, SALONEN R. Ultrasound B-mode imaging in observational studies of atherosclerotic progression. *Circulation* 1993; 87: II-56-II-65.
- 14) HEISS G, SHARRETT AR, BARNES R, CHAMBLESS LE, SZKLO M, ALZOLA C. Carotid atherosclerosis measured by B-mode ultrasound in populations: Associations with cardiovascular risk factors in the ARIC study. *Am J Epidemiol* 1991; 134: 250-256.
- 15) HINTSANEN M, KIVIMÄKI M, ELOVAINIO M, PULKKIRÄBACK L, KESKIVAARA P, JUONALA M, RAITAKARI OT, KELTIKANGAS-JÄRVINEN L. Job strain and early atherosclerosis: The Cardiovascular Risk in Young Finns study. *Psychosom Med* 2005; 67: 740-747.
- 16) LOBBEZOO F, GROENINK WJ, KRANENDONK AA, AARTMAN IH, NAEIJE M. A reliability study of clinical occlusal tooth wear measurements. *J Oral Rehabil* 2002; 29: 881-882.

- 17) MACCOBY N, FARQUHAR JW, WOOD PD, ALEXANDER J. Reducing the risk of cardiovascular disease: effects of a community-based campaign on knowledge and behavior. *J Commun Health* 1977; 3: 2.
- 18) MCGINNIS JM, FOEGE WH. Actual causes of death in the United States. *JAMA* 1993; 270: 2207-2212.
- 19) POREDOS P. Intima-media thickness: Indicator of cardiovascular risk and measure of the extent of atherosclerosis. *Vasc Med* 2004; 9: 46-54.
- 20) SUN Y, LIN CH, LU CJ, YIP PK, CHEN RC. Carotid atherosclerosis, intima media thickness and risk factors: An analysis of 1781 asymptomatic subjects in Taiwan. *Atherosclerosis* 2002; 16: 489-494.
- 21) TAYLOR AJ, BINDEMAN J, LE TP, BAUER K, BYRD C, FEUERSTEIN IM, WU H, O'MALLEY PG. Progression of calcified coronary atherosclerosis: Relationship to coronary risk factors and carotid intima-media thickness. *Atherosclerosis* 2008; 197: 339-345.
- 22) WATANABE T, YASUNARI K, NAKAMURA M, MAEDA K. Carotid artery intima-media thickness and reactive oxygen species formation by monocytes in hypertensive patients. *J Human Hypertens* 2006; 20: 336-340.
- 23) VELLER MG, FISHER CM, NICOLAIDES AN, RENTON S, GEROUKAKOS G, STAFFORD NJ, SARKER A, SZENDRO G, BELCARO G. Measurement of the ultrasonic intima-media complex thickness in normal subjects. *J Vasc Surg* 1993; 17: 19-25.
- 24) SALONEN JT, SALONEN R. Ultrasound B-mode imaging in observational studies of atherosclerotic progression. *Circulation* 1993; 87: 56-65.
- 25) HOWARD G, SHARRETT R, HEISS G, EVANS GW, CHAMBLESS LE, RILEY WA, BURKE GL. Carotid artery intimal/medial thickness distribution in general populations as evaluated by B-mode ultrasound. *Stroke* 1993; 24: 297-304.
- 26) HOMMA S, HIROSE N, ISHIDA H, ISHII T, ARAKI G. Carotid plaque and intima-media thickness assessed by B-mode ultrasonography in subjects ranging from young adults to centenarians. *Stroke* 2001; 32: 830-835.
- 27) KODAMA M, YAMASAKI Y, SAKAMOTO K, YOSHIOKA R, MATSUHISA M, KAJIMOTO Y, KOSUGI K, UEDA N, HORI M. Antiplatelet drugs attenuate progression of carotid intima-media thickness in subjects with type 2 diabetes. *Thromb Res* 2000; 97: 239-245.
- 28) EBRAHIM S. Use of B mode ultrasound of peripheral arteries as an end point in clinical trials. *Br Heart J* 1994; 72: 501-503.
- 29) LAVIGNE GJ, MANZINI C, KATO T. Sleep bruxism. Principles and practice of sleep medicine. 4th ed. Philadelphia: Elsevier Saunders 2005; pp. 946-959.
- 30) HUYNH N, KATO T, ROMPRE' PH, OKURA K, SABER M, LANFRANCHI PA, Montplaisir JY, Lavigne GJ. Sleep bruxism is associated to micro-arousals and an increase in cardiac sympathetic activity. *J Sleep Res* 2006; 15: 339-346.
- 31) SAPER CB, SCAMMELL TE, LU J. Hypothalamic regulation of sleep and circadian rhythms. *Nature* 2005; 437: 1257-1263.
- 32) MCCARLEY RW, CHOKROVERTY S. Introduction to special issue of sleep medicine. *Sleep Med.* 2007; 8: 289-290.
- 33) HARNESS DM, PELTIER B. Comparison of MMPI scores with selfreport of sleep disturbance and bruxism in the facial pain population. *Cranio* 1992; 10: 70-74.
- 34) LAVIGNE GJ, KHOURY S, ABE S, YAMAGUCHI T, RAPHAEL K. Bruxism physiology and pathology: an overview for clinicians. *J Oral Rehabil* 2008; 35: 476-494.

Copyright of European Review for Medical & Pharmacological Sciences is the property of Verduci Editore and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.