

## Cervical Pain on Awakening in the Morning Andbruxing Behavior Types: A Comparison Study And Preliminary Results.

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### Abstract

**Introduction:** Intense forces during sleep bruxing behavior may negatively affect both adjacent and distant anatomic structures including the cervical area.

**Aim:** Evaluate the frequency of morningawakening with cervical pain in different bruxing behavior subgroups ,and compare severity of bruxing behavior in those bruxers with or without a report of morning awakening with cervical pain.

**Material and Methods:** History of signs and symptoms, self-report and clinical examination were used to evaluate 282 mixed, 103 sleep, 61 diurnal bruxers with temporomandibular disorders, 28 bruxers without TMDs and 32 non bruxers without temporomandibular disorders. A questionnaire as part of a comprehensive method to assess diurnal, mixed and sleep bruxers was also used to determine the presence of morning awakening with cervical pain. Kruskal-Wallis statistics was used to evaluate age differences and scores in bruxing behavior when subgroups with and without cervical pain on awakening in the morning were compared. Fisher's exact test was used to evaluate genre differences in five groups.

**Results:** There were no age differences when all subgroups were compared (Kruskal-Wallis' statistics  $p=0.70$ ). Females predominated in the experimental and control subgroups. However, statistical significant differences were observed only when the mixed and diurnal subgroups ( $p<0.001$ ), mixed bruxers andbruxers without TMDs ( $p<0.0001$ ); mixedbruxers and non bruxers/non TMDs ( $p<0.0001$ ), Sleep bruxers and diurnal bruxers ( $p<0.004$ ), Sleep bruxers and bruxers without Temporomandibular disorders ( $p<0.0001$ ), Sleepbruxers and non bruxers / non Temporomandibular disorders ( $p<0.0001$ ), were compared. Regarding the frequencies of morning awakening with cervical pain, higher frequencies were observed only when the subgroups mixed and diurnal bruxers ( $p<0.0001$ ); mixed bruxers and bruxers without temporomandibular disorders ( $p<0.0001$ ); mixed bruxers and non bruxersnon temporomandibular disorders ( $p<0.01$ ); Sleep bruxersand diurnal bruxers ( $p<0.0001$ ); Sleep bruxersand bruxers without temporomandibular disorders ( $p<0.001$ ) and diurnal bruxers and non bruxers and non temporomandibular disorders, were contrasted ( $p=0.05$ ).

**Conclusions:** Morning awakening with headache is found more frequently in mixed and sleep bruxers with temporomandibular disorders. Future studies should evaluate the mechanisms associated with morning awakening with cervical pain in mixed and sleep bruxers.

**Keywords:** Sleep and diurnal bruxism. Temporomandibular Disorders. Morning awakening with cervical pain.

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### I. Introduction

Temporomandibular disorders (TMDs) is a set of collective terms frequently used in Dentistry and Orofacial Pain (OFP) to describe signs and symptoms indicating pathologic alterations in muscles, joint and associated stomatognathic structures, usually of musculoskeletal origin. TMDs may be part of an interdisciplinary group of somatoform syndromes defined as somatic and dysfunctional, characterized by similar mechanisms, etiologies and psychosocial impairment<sup>[1]</sup>. Common signs and symptoms in TMDs patients include a complaint of pain, impaired jaw movements, different types of joint noises, tenderness to palpation and headache<sup>[2]</sup>. Cervical pain is a common reason to seek medical treatment and its prevalence is very high in the general population. Neck pain refractory to conventional treatment may need the evaluation by different medical

specialists including orthopedists, rheumatologists, neurologists, physical therapists, OFP experts and many others<sup>[3]</sup>. Bruxing behavior (BB) not only affects the masticatory muscles, but also all the muscles of the cranio-facial complex, shoulders and neck structures innervated by the trigemino-cervical complex, formed by the upper cervical and trigeminal cranial nerves<sup>[4]</sup>. One of the axes to perform eccentric movements of the mandible and the cervical column is found in the occiput<sup>[5]</sup>. Such a relationship causes the jaw positions and movements to directly influence the activity of the cervical muscles. From a clinical standpoint, this means that if the activity of the masticatory muscles increases, reaching a pathological level and abnormal alterations in jaw positions, movements and loading, occur in the masticatory system, the cervical structures will concomitantly be affected.

**Sleep bruxism** (SB) has been defined in the current literature as a stereotyped mandibular activity during sleep characterized by both teeth grinding and clenching. This definition includes a broad spectrum of non functional behaviors of the masticatory system including clenching, bracing, tooth gnashing and grinding, nail biting, tongue, cheek and lip biting<sup>[6]</sup>. BB is usually classified as diurnal, nocturnal and mixed and all of them may cause a wide range of masticatory disorders including pain in anatomic structures adjacent and far from the masticatory system. BB is considered as a parafunctional behavior as it falls outside the functional activities of the stomatognathic system. Bruxism can be classified as awake bruxism, occurring in the waking time and sleep bruxism characterized by tooth grinding with phasic (rhythmic), tonic or sustained, or mixed muscle contraction<sup>[7]</sup>. It has been reported that only 20 percent of the adult population report clenching or daytime bruxism<sup>[8]</sup>. Sleep-related bruxism, grinding and clenching of teeth is classified as a sleep-related movement disorder by the International Classification of Sleep Disorders and coding manual<sup>[9]</sup>. BB not only affects the masticatory muscles, but also all the muscles of the cranio-facial complex, shoulders and neck as they are innervated by the trigemino-cervical complex which includes cervical and trigeminal nerves acting together<sup>[10]</sup>. Regarding etiology and pathophysiology, daytime clenching is thought to represent a different clinical entity as compared to sleep and mixed BB. This behavior is mainly reactive and may be induced by increased stress or anxiety and is found in 20% of the general population<sup>[11]</sup>. Because only 8% of adults of the general population are aware of teeth grinding during sleep<sup>[11]</sup>, others complementary diagnostic tools including information from friends, partners or roommates about BB, awakening with masseter, TMJ, temporalis muscle pain and or difficulties to open the mouth in the morning, should be used for diagnostic purposes in prevalence studies. Bruxers are thought to apply strong forces on the teeth and other structures adjacent and distant to the masticatory system, thus, causing TMJ pain, headaches and cervical headache. However, the relationship between sleep bruxism and cervical pain is still obscure. There is paucity of data about the relationships between BB types and cervical pain. Consequently, this investigation was designed to test the following hypothesis: 1. Sleep and mixed bruxers demonstrate a higher frequency of cervical pain on awakening in the morning as compared with diurnal bruxers and non bruxers controls; 2. Mixed bruxism involves both diurnal and sleep bruxism and thus, the frequency of cervical pain on awakening in the morning is expected to be higher; 3. Severe and extreme BB predominate in SB and mixed bruxers (MB) as compared with diurnal bruxers (DB).

## II. Material and Methods

### 2.1 Sample

The Center of Orofacial Pain at UNIRG University keeps records of all patients evaluated regarding complaints of TMDs, Orofacial Pain and Bruxing Behavior. All patients are evaluated comprehensively including the application of psychological tests for anxiety, depression, somatization and other psychological disorders. Clinical evaluation follows the principles of Helsinki declaration and all patients sign a formal consent. Criteria to include patients as presenting TMDs and BB has been explained and published elsewhere. In the current investigation, all those records presenting with complete information about mixed BB (n=282), Sleep BB (n=103), Diurnal BB (n=61), BB with TMDs, and those without TMDs and no BB, were retrieved and evaluated carefully searching for information about morning awakening with cervical pain. Awakening with cervical, facial, head, bone, and tooth pain is one of the questions in the comprehensive evaluation of diurnal and nocturnal BB. Only patients reporting frequent or very frequent cervical pain were recorded as presenting morning awakening with cervical pain, and thus, were included in the current study. Criteria to include patients in subgroups of TMDs: At least two signs or symptom of TMD published previously<sup>[12]</sup>. Criteria to include patients in subgroups of bruxing behavior: Presence of at least 3 signs and symptoms of nocturnal or waking bruxing behavior published previously<sup>[12]</sup>. Criteria for exclusion from any subgroup: Absence of signs and symptoms of TMDs and BB, presence of severe psychological disorders, cognitive difficulties to respond to the questionnaires, and patient's unwillingness to allow the researcher or the Dental School to use their material for research purposes.

## 2.2 Procedure

All records presenting with comprehensive information about sleep BB, mixed BB, diurnal BB, BB with or without cervical pain and no BB and no TMDs to form another control group, were retrieved to form separate subgroups for comparison reasons. Those records presenting with complete information about sleep, diurnal BB and TMDs were allocated to the mixed group, those presenting information exclusively about Sleep BB and TMDs were allocated to the Sleep subgroup, those demonstrating only diurnal bruxism and TMDs formed the “Diurnal” subgroup, and those with no BB and no TMDs constituted a “pure” control group. Signs and symptoms of BB and the method to classify bruxers in mild moderate, severe and extreme have been described in a previous investigation<sup>[12]</sup>. Those mixed bruxers with cervical pain (MB+ CP+ =137), mixed bruxers with no cervical pain (MB+ CP- =145), sleep bruxers with cervical pain (SB+ CP+ =40) and those sleep bruxers without cervical pain (SB+ CP- =63), were separated forming different subgroups with the purpose of assessing and compare the severity of BB.

## III. Data Analysis

Statistical tests deemed to be appropriate to analyze data in the current investigation included Fisher’s exact test and Kruskal-Wallis non parametric statistics followed by the use of Dunn’s test.

## IV. Results

The current investigation evaluated subgroups of mixed (n=282), sleep (n=103), and diurnal bruxers (n=61), and a subgroup of those demonstrating signs and symptoms of BB without TMDs (n=28). A subgroup with no BB and no TMDs (n=32), was also included and compared. Age was very similar in all subgroups (Kruskal-Wallis statistics  $p=0.70$ ). Females predominated in the subgroups demonstrating mixed and SB. A significant statistical difference in the frequency of females when compared to males was observed when the subgroups mixed and diurnal bruxers ( $p<0.001$ ); mixed bruxers and bruxers without TMDs ( $p<0.001$ ), mixed bruxers and non BB non TMDs ( $p<0.0001$ ); sleep bruxers and diurnal bruxers ( $p<0.004$ ); Sleep bruxers versus bruxers with no TMDs ( $p<0.001$ ); and sleep bruxers versus controls non BB and non TMDs ( $p<0.001$ ), were compared. See Table 1 for further details. **Morning awakening** with cervical pain was observed much more frequently in mixed (49%) and in sleep bruxers (38.8%) and was not a common report in diurnal bruxers (8.2%). Statistical and significant differences were observed when the subgroups mixed bruxers (49%) and diurnal bruxers (8.2%), were compared (Fisher’s exact test  $p<0.0001$ ); mixed bruxers versus bruxers without TMDs (Fisher’s exact test  $p<0.0001$ ), Mixed bruxers and non bruxers and non TMDs controls ( $p<0.01$ ); Sleep (38.8%) and diurnal bruxers ( $p<0.0001$ ); Sleep bruxers and bruxers without TMDs ( $p<0.001$ ) and diurnal bruxers compared with those with no BB and no TMDs ( $p=0.05$ ). See Table 2 for further details. A non parametric analysis of variance (ANOVA) followed by Dunn’s test was carried out in order to **compare BB** scores in those with mixed bruxism and cervical pain on awakening in the morning (MB+ CP+ =137), mixed bruxism with no cervical pain on awakening in the morning (MB+ CP- =145), sleep bruxism with cervical pain on awakening (SB+ CP+ =40) and sleep bruxism with no cervical pain on awakening (SB+ CP-, n=63). The results indicated that most comparisons yielded statistical and significant differences when the following subgroups were compared: Mixed bruxers with cervical pain and mixed bruxers with no cervical pain ( $p<0.001$ ); mixed bruxers with cervical pain versus sleep bruxers with cervical pain ( $p<0.05$ ), mixed bruxers with cervical pain and sleep bruxers with no cervical pain ( $p<0.001$ ), mixed bruxers without cervical pain versus sleep bruxers with cervical pain ( $p>0.05$ ); mixed bruxers without cervical versus sleep bruxers without cervical pain ( $p<0.001$ ); and Sleep bruxism with cervical pain versus Sleep bruxism without cervical pain ( $p<0.01$ ).

## V. Discussion

In the current investigation we **found higher frequencies of morning awakening with cervical pain in mixed and sleep bruxers**. It may be that uncontrolled occlusal forces of greater duration and frequency more commonly occur in both mixed and sleep bruxers. In many of these individuals such forces may spread and reach many components adjacent and far from the masticatory structures including those of the neck. In some individuals these occlusal forces may not be so intense but when more frequent and of longer duration they may add insult and produce damage, including inflammation, temporal headaches and cervical pain. This assumption is in accordance with one investigation<sup>[13]</sup> indicating that there is a significant correlation between frequent tooth clenching and cervical shoulders and back pain. There is a causal relationship between frequent tooth clenching and cervical, back and shoulder pain<sup>[13]</sup>. Temporal headaches mostly of the tension-type and/or myofascial headache referred from cervical structures are observed frequently in patients presenting some form of bruxism, more frequently on awakening in the morning<sup>[8]</sup>. In the masticatory system, the neck and shoulders are anatomically and physiologically connected and bruxism affects all the above described structures. It may be possible that head position and homeostasis of the cranio-cervical system could be affected when a parafunction occurs, thus, the head posture could be different in bruxers and non bruxers. Bruxism seems to be related to

altered natural head posture and more intense dental wear<sup>[10]</sup> Mixed bruxers demonstrated a higher frequency of morning awakening with cervical pain. It may be that the combination of diurnal plus sleep bruxism, renders the cervical structures more vulnerable to tension, inflammation and pain as some anatomic structures are subjected to more frequent loading. This combination of behaviors may constitute an additional factor facilitating damage, tissue insult and the development of an inflammatory response, thus, resulting in prolonged tension, inflammation and pain on awakening in the morning. Elevation of the jaw is also assisted by the posterior cervical muscles whose contraction prevents a sudden forward movement of the head. By increasing the activity of the jaw elevators to cause powerful BB, it also increases the activity of the powerful cervical muscles in order to keep the head stabilized during bruxing activity<sup>[14]</sup>. When tooth grinding and daytime clenching occur in the same individual (mixed BB), there is a higher likelihood of reporting TMDs, chronic myofascial pain<sup>[6]</sup> and probably headache and cervical pain. Scores indicating severity of BB were used to demonstrate that higher scores would be present in individuals with mixed bruxism and morning awakening with cervical pain. Because higher scores in BB were observed in the MB+ CP+ subgroup, findings indicate that more severe BB may be linked to tissue damage, inflammation and pain on awakening in the morning and that morning awakening with cervical pain is in some way related to more severe BB. It may be that increased loading, sleep bruxism of greater intensity and longer duration are more likely to produce tissue damage, resulting in tissue stiffness, tension, inflammation, pain and changes in head and neck position. Thus, severer BB combined with other etiologic factors, may add insult to the cervical structures. This assumption is in line with one investigation<sup>[13]</sup> indicating that the physical damage and pain of parafunctional occlusion are related to the intensity, frequency and duration of sleep BB episodes and the inability of the stomatognathic system and cervical structures to withstand such forces. During nocturnal parafunctional activities, both the temporomandibular joints and the cervical structures may be used as supporting areas to withstand intense nocturnal occlusal loading. Symptoms of sleep bruxism include generalized jaw pain, back pain, headaches, dental pains, neck pain and tooth sensitivity<sup>[15]</sup>. Sleep and mixed BB may not only cause neck stiffness but the head, and thus the cervical structures, may change in position to accommodate or to be in a more stable relationship with the changing position of the mandible during episodes of nocturnal BB. Supporting this point of view, one investigation<sup>[16]</sup>, asserts that for every inch the head is forward of the shoulders, it adds approximately 10 pounds of weight to the cervical and lumbar structures. This compressive load may result in osteoarthritis and nerve entrapment. Craniofacial Pain and internal TMJ derangements may also manifest in forward head posture and the most common symptom of painful jaw joint is occipital cephalgia in 94%<sup>[17]</sup> Forward head posture is the result of painful swallowing and develops to prevent further injury. The injury described is in the absence of or in addition to a macrotrauma and is the result of repetitive jaw compression (bruxism) originated from sympathetic stimulation during sleep<sup>[17]</sup>. Bruxism seems to be related to altered natural head posture and more intense dental wear. A more anterior and downward head tilt has been found in the bruxist group more frequently than in controls<sup>[10]</sup>. Because in the current study we found a higher frequency of awakening with headache in mixed bruxers, this outcome is in line with one investigation<sup>[6]</sup> indicating that when tooth grinding and daytime clenching occur in the same individual. In the current investigation, a higher score in BB was observed in the subgroup of individuals with mixed BB and cervical pain on awakening. This outcome concurs with one study<sup>[18]</sup>, reporting that severe and extreme bruxers present with increased nociceptive input to the trigeminal system which then connects with the gray matter in the upper cervical cord at the level of C1 and C2. Such a connection may be widespread in terms of both sensory and motor reflex activity, thus leading to cervical and headache pain. Teeth grinding implies adjusting and maintaining a head-neck posture, which gives the elevator muscles fixed and stable insertion in the skull<sup>[19]</sup>. Thus, more severe bruxism like that found in those patients with nocturnal and mixed BB, necessarily implies increased neck tension, stabilization and hyper activity of the local musculature. With time, these local changes may result in cervical pain.

## V. Conclusions

In the current investigation, mixed and sleep bruxers with TMDs demonstrated higher frequency of morning awakening with cervical pain. Because mixed and sleep bruxers demonstrated higher scores in BB and a higher frequency of morning awakening with cervical pain, there is a dysfunctional relationship between more severe sleep or mixed BB and morning awakening with cervical pain. Further studies should be carried out to evaluate the mechanism defining more clearly this anatomical and neurophysiological relationship.

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**Table 1:** Social and demographic data in different subgroups of bruxers and non bruxers.

Subgroups	Mixed n=282	Sleep n=103	Diurnal n=61	BB+ TMDs- n=28	BB-TMDs- n=32
AGE					
Mean	34	34.8	31.9	34.7	34.5*
SD	11.8	13.2	11.4	12.3	15.4
Range	14-73	12-66	17-64	19-70	17-68
GENRE	n %	n %	n %	n %	n %
Females	263 93.3	97 94.2	48 78.7	17 60.7	20 62.5**
Males	19 6.7	6 5.8	13 21.3	11 39.3	12 37.5
Totals	282 100	103 100	61 100	28 100	32 100

\*Kruskal-Wallis statistics p=0.70 (non significant)

\*\*Mixed versus Sleep bruxers (Fisher’s exact test p=1.00); Mixed versus Diurnal bruxers (Fisher’s exact test p<0.001); mixed bruxers with no TMDs (Fisher’s exact test p<0.0001); Mixed bruxers versus Controls no BB no TMDs (Fisher’s exact test p<0.0001); Sleep BB versus Diurnal bruxers (Fisher’s exact test p<0.004); Sleep bruxers versus BB+ TMDs- (Fisher’s exact test p<0.0001); Sleep bruxers versus BB- TMDs- (Fisher’s exact test p<0.0001); Diurnal BB versus BB+ TMDs- (Fisher’s exact test p=0.12); Diurnal BB versus BB- TMDs- (Fisher’s exact test p=0.13); BB+ TMDs- versus BB- TMDs- (Fisher’s exact test p=1.0).

**Table 2:** Frequency of cervical pain on awakening in bruxers and non bruxers.

Subgroups	Mixed 282	Sleep 103	Diurnal 61	BB+TMDs- 28	BB-TMDs- 32
Cervical pain on awakening	n %	n %	n %	n %	n %
Yes	137 49	40 38.8	5 8.2	2 7.1	8 25*
No	145 51	63 61.2	56 91.8	26 92.9	24 75
Totals	282 100	103 100	61 100	28 100	32 100

\*Fisher’s exact test: Mixed versus sleep bruxers (p=0.10); Mixed versus diurnal bruxers (p<0.0001); Mixed bruxers versus BB+ TMDs- (p<0.0001); Mixed bruxers versus BB- TMDs- (p<0.01); Sleep versus diurnal bruxers (p<0.0001); sleep bruxers versus BB+ TMDs- (p<0.001); Sleep bruxers versus BB- TMDs- (p=0.20); Diurnal bruxers versus BB+ TMDs- (p=1.000); Diurnal bruxers versus BB- TMDs- (p=0.05) and BB+ TMDs- versus BB- TMDs- (p=0.08).

**Table 3:** Means in bruxing behavior in those mixed bruxers with (MB+ CP+) and without a history of awakening with cervical pain (MB+ CP-) and sleep bruxers with (SB+ CP+ and without a history of cervical pain (SB+ CP-)

Subgroups	MB+CP+ n=137	MB+CP- n=145	SB+CP+ n=40	SB+CP- n=63
Bruxing Behavior Means	15.5	13.0	13.2	10*
SD	3.5	4.2	4.3	4.2
Range	5--22	3--21	3--21	3--20

\*Kuskal-Wallis statistics,  $p < 0.0001$ : Mixed bruxers with cervical pain versus mixed bruxers with no cervical pain ( $p < 0.001$ ); Mixed bruxers with cervical pain versus sleep bruxers with cervical pain  $p < 0.05$ ; Mixed bruxers with cervical pain versus Sleep bruxers with no cervical pain ( $p < 0.001$ ); mixed bruxers without cervical cervical pain versus sleep bruxers with cervical pain ( $p > 0.05$ ); Mixed bruxers without cervical pain versus Sleep bruxers without cervical pain ( $p < 0.001$ ); sleep bruxers with cervical pain versus Sleep bruxers without cervical pain ( $p < 0.01$ ).

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