

## Is there a relationship between depression and diurnal, sleep and mixed bruxing behavior?: A comparison study

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### Abstract

**Introduction:** Bruxing behavior is a severe clinical disorder and various types have been described in the current literature.

**Goals:** Evaluate scores in depression in diurnal, sleep and mixed bruxing behavior subgroups with Craniomandibular disorders.

**Methods:** Clinical examination of muscles and joints, history of the chief complaint, palpation of joint and muscles, comprehensive questionnaires, biomechanical tests, classification of the type of bruxing behavior and the Beck Depression Inventory were used to gather data. Craniomandibular Disorders and Bruxing Behavior subjects were allocated to subgroups presenting with diurnal, sleep and mixed bruxing behavior and scores in depression were compared. Subjects with CMDs and no Bruxing Behavior and those with no Bruxing Behavior and no craniomandibular disorders were used as controls subgroups.

**Outcome:** Most subjects in all subgroups were females. Age was not statistically different when experimental and control subgroups were compared (Kruskal-Wallis' statistics  $p=0,22$ ). Means in depression were about 8,2 (SD=8,0, range 0--37) in the diurnal Bruxing Behavior subgroup; 12,8 (SD=9,6, range 0--42) in the Sleep Bruxing Behavior subgroup; 16,1 (SD=7,4, range 6--33) in the mixed Bruxing subgroup; 13,9 (SD=9,5, range 0--41) in the CMDs without Bruxing Behavior subgroup, and 6,1 (SD=5,5, range 0--19) in the No Craniomandibular Disorders no Bruxing Behavior subgroup. Regarding depression, there was a statistically and significant difference when the subgroups were compared (Kruskal-Wallis statistics  $p<0,0001$ ). However, statistically significant differences were observed only when some subgroups were compared: CMDs and no Bruxing Behavior Subgroup versus No CMDs no Bruxing Behavior subgroup ( $p<0,01$ ); CMDs + Sleep Bruxing Behavior subgroup versus No CMDs no Bruxing Behavior subgroup ( $p<0,05$ ); CMDs + Mixed Bruxing Behavior subgroup versus No CMDs no Bruxing Behavior subgroup ( $p<0,001$ ); CMDs + Diurnal Bruxing Behavior subgroup versus CMDs no Bruxing Behavior subgroup ( $p<0,05$ ); CMDs + Mixed Bruxing Behavior subgroup versus CMDs + Diurnal Bruxing Behavior subgroup ( $p<0,001$ ).

**Conclusion:** Depression was not severe in the diurnal bruxing behavior subgroup indicating less severe psychopathology. The mixed Bruxing Behavior subgroup demonstrated the highest scores in depression suggesting that such a subgroup is more impaired by psychopathology including depression, somatization and probably stress.

**Keywords:** Bruxism., Depression., Diurnal, Sleep, Mixed Bruxism. Craniomandibular Disorders

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### I. Introduction

Craniomandibular disorders (CMDs) is a collective term used in Medicine and Dentistry to define a set of signs and symptoms involving dysfunction of the masticatory muscles, temporomandibular joints (TMJs), and adjacent related anatomic structures of the stomatognathic system. CMDs are usually characterized by a complaint of pain, joint noises, limitation of jaw movements, tenderness to palpation of joint and muscles, and headache of musculoskeletal origin<sup>[1]</sup>. Bruxing Behavior (BB), is a complex and common oral jaw habit associated with involuntary rhythmic or spasmodic nonfunctional gnashing, grinding, or clenching of the teeth which may result in pathologic trauma over many components of the stomatognathic system<sup>[2]</sup>. BB is also defined as excessive grinding, clenching or rubbing of teeth during nonfunctional movements of the masticatory system occurring both at night or during the day<sup>[3]</sup>.

Diurnal BB or daytime tooth clenching is BB occurring more frequently during the day usually associated with some psychological factors including work stress and anxiety<sup>[4]</sup>. Diurnal BB is considered a psychologically different phenomena as compared with sleep bruxism. Diurnal BB is mainly reactive, may be induced or exaggerated by stress or anxiety and is reported with some frequency by the general population<sup>[5]</sup>. Sleep BB is a very destructive oral jaw behavior occurring mainly during the night and usually associated with many signs and symptoms occurring early in the morning based on patients' report. Sleep BB is frequently associated with many other sleep disorders<sup>[6]</sup>. Nocturnal BB is a very complex motor and neurophysiological oral behavior thought to occur more frequently during transition from deep to light sleep and also during Rapid Eyes Movement sleep<sup>[7]</sup>. Mixed BB is the combination of both diurnal and nocturnal BB. There is a whole body of literature about "sleep bruxism". However, it has been observed clinically that some of these so called "sleep bruxers" also report clenching the teeth during the day. Kato and Lavigne<sup>[5]</sup> studied the neurophysiology of sleep BB. Their investigation indicates that those with sleep BB frequently report awake bruxism, suggesting that there may be a high prevalence of mixed bruxism in those subject labeled as "sleep bruxers".

Depression is a common psychological or psychiatric disorder observed more frequently in clinical populations and is recognized by the presence of depressed mood painful feelings, bad humor, anguish, pain attacks and tendency to isolation among others<sup>[8]</sup>. Depression is now recognized as a frequent psychological disorder in CMDs individuals including in those presenting with clinical complaints associated with diurnal and nocturnal BB. Excessive stress and depression occur frequently in individuals presenting with BB, CMDs and muscle disorders in the stomatognathic system<sup>[9]</sup>. Studies reveal that CMDs and BB Individuals are more predisposed to present signs and symptoms of anxiety, stress, psychosomatic disorders including depression and somatization<sup>[10]</sup>. Many studies<sup>[10,11]</sup> about the classification of BB have been carried out and many papers about the role of psychological factors in BB including anxiety, stress, somatization and depression have been published. However, there is scarcity of studies about depression, somatization and anxiety in awake, sleep and mixed bruxers when evaluated separately. Because the current literature indicates that diurnal and sleep BB are psychologically two different phenomena and there is scarcity of psychological data about diurnal BB, this study was designed to:

1. Evaluate scores in depression using the BDI in diurnal, sleep and mixed BB subgroups;
2. Test the hypothesis that diurnal bruxers demonstrate low scores in depression
3. Test the hypothesis that the combination of diurnal and nocturnal BB would be associated with the highest scores in depression.

## **II. Material and Methods**

### **Sample**

This investigation retrospectively evaluated a large sample of individuals presenting with clinical characteristics of CMDs and BB. Such individuals were referred consecutively to a Dental Medicine unit specialized in the diagnosis and management of CMDs and BB. Clinical examination, questionnaires, history of the chief complaint, palpation of the TMJs and masticatory muscles, biomechanical and psychological tests were used to gather data. All clinical charts were examined retrospectively to separate those presenting diurnal, sleep, mixed bruxism and no bruxism or no CMDs. Once examination and analysis of clinical charts were completed, subjects with or without clinical characteristics of BB and CMDs were allocated to subgroups as follows: Diurnal bruxers with CMDs (n=50), Sleep bruxers with CMDs (n=50), mixed bruxers with CMDs (n=50). Two control subgroups were used: Those with CMDs but no BB (n=30) and those with no CMDs and no BB (n=30).

**Inclusion criteria for CMDs:** A complaint of facial and or TMJ pain, difficulties to perform normal jaw movements, tenderness to palpation of the masticatory muscles and TMJs, joint noises and headache referred from the TMJ and masticatory muscles.

**Inclusion criteria for diurnal bruxism:** Self-report of clenching the teeth during the day, fatigue of the masticatory muscles during the day, no report of grinding or clenching the teeth at night.

**Inclusion criteria for sleep bruxism:** Self-report of grinding or clenching the teeth during the night, friends, relatives or others reporting patient's bruxism at night, patients' report of awakening with pain and or difficulties to perform normal jaw movements.

**Inclusion criteria for mixed bruxing behavior:** Patient's report about clenching the teeth during the day and grinding the teeth at night, patients' friends or relatives report about grinding the teeth at night, patient's report about awakening with pain, joint noises and/or difficulties to perform normal jaw movements early in the morning. A report that he or she catches himself or herself grinding the teeth at night.

**Inclusion criteria for the first control subgroup:** Presence of characteristics of only CMDs but no BB.

**Inclusion criteria for the second control subgroup:** Absence of clinical characteristics of both BB and CMDs.

**Exclusion criteria for experimental subjects and control ones:** Severe psychiatric or psychological disorders, cognitive impairment and/or difficulties to respond properly to questionnaires, severe motor disorders including Parkinson's Disease and/or speech difficulties.

### III. Measures

**Depression:** The Beck Depression Inventory (BDI) is a robust psychological and psychiatric measure used widely to assess characteristics of depression in clinical and research settings. Such measure is a 21-item self-reported questionnaire usually answered in 5-10 minutes in which questions are hierarchically arranged from normal (0 score) to mild, severe or worst (1,2,3 scores). The instrument has excellent reliability and good correlation with depression and anxiety disorders. In the current research, patients and controls responded completely to the instrument.

### IV. Statistical analysis

Kruskal-Wallis and Dunn's statistics was used to evaluate statistically significant differences in age and depression in different subgroups. Statistical significance was accepted if  $p < 0,05$ .

### V. Outcome

There were 40 females (80%) and 10 males (20%) in the diurnal BB subgroup; 45 females (90%) and 5 males (10%) in the Sleep BB subgroup; 42 females (84%) and 8 males (16%) in the Mixed BB subgroup; 26 females (86,7%) and 4 males (13,3%) in the CMDs No BB subgroup and 22 females (73,3%) and 8 males (26,7%) in the No CMDs and No BB subgroup. There was overrepresentation of females in the subgroups of CMDs and BB individuals and even in controls ones seeking consultations for diagnosis and treatment.

Mean age was about 30,5 (SD=11,0, range 16-64) in the CMDs + Diurnal BB subgroup; 35,4 (SD=12,9, range 17-66) in the CMDs + Sleep BB subgroup; 33,4 (SD=12,0, range 17-61) in the CMDs and Mixed BB subgroup; 32,5 (SD=12,6, range 17-70) in the CMDs no BB subgroup and 36,4 (SD=14,5, range 13-68) in the No CMDs no BB subgroup. Age differences were not statistically significant (Kruskal-Wallis statistics  $p=0,22$ ).

Means in depression were about 8,2 (SD=8,0, range 0--37); 12,8 (SD=9,6, range 0--42); 16,1 (SD=7,4, range 6-33); 13,9 (SD=9,5, range 0--41) and 6,1 (SD=5,5, range 0--19) in the CMDs and Diurnal BB, CMDs and Sleep BB, CMDs and Mixed BB subgroup, CMDs and no BB subgroup and No CMDs and No BB subgroup, respectively. There was a statistically and significant difference in depression when the subgroups were compared (Kruskal-Wallis and Dunn's statistics  $p < 0,0001$ ). However, statistically significant differences were observed in only some pairs of subgroups: CMDs No BB subgroup versus No CMDs No BB subgroup ( $p < 0,01$ ); CMDs and Sleep BB subgroup versus No CMDs No BB subgroup ( $p < 0,05$ ); CMDs ; mixed BB subgroup versus no CMDs No BB subgroup ( $p < 0,001$ ); CMDs and diurnal BB subgroup versus CMDs no BB subgroup ( $p < 0,05$ ); CMDs and Mixed BB subgroup versus CMDs and diurnal BB subgroup ( $p < 0,001$ ).

### VI. Discussion

Depression in different BB subgroups

Diurnal bruxers demonstrated very low scores whereas mixed bruxers presented with the highest scores in depression. Although the difference was not statistically significant mixed bruxers demonstrated higher scores in depression as compared with sleep bruxers. Such findings substantiate the point of view that sleep and diurnal bruxism are two completely different psychological phenomena. Sleep and mixed bruxers were the subgroups demonstrating the highest scores in depression. This outcome is substantiated by one investigation<sup>[12]</sup> in a very small subgroup of destructive bruxers reporting that all subjects presented with signs of depression. Further, one investigation<sup>[4]</sup> studied the association between sleep bruxism and depression levels and found that CMDs subjects reported higher levels of depression. Bayar and associates<sup>[13]</sup> evaluated sleep bruxers, awake bruxers and sleep and awake bruxism. Researchers reported that mixed bruxers endorsed the highest scores in psychopathology which includes anxiety, depression and somatization. In a similar investigation<sup>[14]</sup>, patients with combined awake and sleep bruxism showed higher scores in anxiety, depression and hostility when compared with nonbruxers. Regarding the low depression scores observed in diurnal bruxers, it seems that Diurnal bruxers are less likely to present higher scores in depression as they are less affected by psychopathology. Reinforcing this point of view, in one investigation<sup>[15]</sup> diurnal bruxers demonstrated lower scores in painful sites indicating less somatization as compared with sleep bruxers. Somatization and greater number of painful sites in the masticatory system are associated with higher scores in depression.

Because scores in depression were very low in diurnal bruxers as compared to sleep and mixed BB subgroups, this outcome is congruent with other investigations indicating that sleep and diurnal bruxism are

two different psychopathological disorders<sup>[14]</sup>. It may be that diurnal bruxers are less affected by psychopathological disorders as compared to sleep and mixed bruxers. It may also be that stress, anxiety, pressures or frustrations of the daily life are more important key etiological factors triggering clenching of the teeth during the day, but such factors not necessarily result in depression. This point of view is shared by one investigation<sup>[16]</sup> suggesting that stress experienced by many subjects was associated more with diurnal than with sleep or mixed BB. Further, such stress was considered as a risk factor for diurnal bruxism<sup>[16]</sup>. Awake bruxism is mainly reactive, is induced or exaggerated<sup>[5]</sup> by stress and anxiety and is reported very frequently by the general population. Awake bruxism is linked to life stress caused by familial responsibility, work pressure and other factors<sup>[17]</sup>. It is very likely that loading on muscles and TMJs during diurnal bruxism is not so intense to cause widespread facial, headache and neck pain. Somatization if present in diurnal bruxers is likely to be not so intense and or frequent in as compared with sleep and mixed bruxers. Because depression usually occurs together with somatization, the absence of depression implies less intense somatization in diurnal bruxers. Congruent with this point of view, one investigation<sup>[9]</sup> asserts that the most dangerous form of BB is nocturnal bruxism which has a psychological, emotional and occlusal origin. Nocturnal bruxism is more destructive as compared with diurnal bruxism. Thus, being diurnal bruxism a more subtle form of psychopathology, such a behavior is less likely to induce pain distributed over a larger area in the face, head and neck. Pain may be more restricted to a smaller anatomic area and is less likely to induce and or to be associated with depression. In line with this point of view, Rao and colleagues' investigation<sup>[16]</sup> indicates that bruxism while awake is associated with stress and anxiety caused by family responsibilities or work pressure. In one investigation<sup>[18]</sup> researchers reported that diurnal and nocturnal bruxism are two different psychophysiological phenomena characterized by different etiologies and mechanisms. Diurnal bruxism is more likely to be a phenomenon associated with daily stress and anxiety rather than with a psychosomatic disorder. Substantiating in part this point of view, one investigation<sup>[15]</sup> in three types of bruxers reported that diurnal bruxers demonstrated the lowest scores in pain sites in the face, head and neck on awakening in the morning as compared with sleep and mixed bruxers. Such lower number of painful sites is less likely to induce or to be related with depression.

Scores in depression were high in those subjects presenting CMDs without BB as compared with those with diurnal bruxism and with those subjects with no CMDs and no BB. Such subgroup was formed only by subjects presenting with signs and symptoms of CMDs. This group was very different from those experimental subgroups in which subjects demonstrate signs and symptoms of CMD and some type of BB. Because CMDs signs and symptoms are usually caused by BB, at first sight such data seem to be contradictory. However, there is a plausible explanation to explain such high scores in depression. Because signs and symptoms of CMDs are to a certain extent associated with somatization trends and BB itself is considered a form of somatization disorder, it seems apparent that some degree of somatization was present in subjects in this subgroup even when BB was absent. Somatization usually occurs together with depression, and this association may undoubtedly explain the higher scores of depression in this subgroup. Subjects in this subgroup were not bruxers. However, they were seeking medical or dental assistance for "unexplained physical symptoms" including facial, head or neck pain.

In the current study, mixed bruxers demonstrated the highest scores in depression. This outcome indicates that such subgroup of bruxers is characterized by more severe psychopathology. This assumption is echoed by one research<sup>[13]</sup> assessing the psychopathological profile of subjects with different forms of BB. Researchers reported that subjects with mixed BB endorsed the highest scores in psychopathology including depression and somatization. The outcome in the current study is further reinforced by another study<sup>[14]</sup> evaluating awake, sleep and mixed BB and reporting that patients with daytime and sleep BB (mixed BB) demonstrated higher scores in depression and hostility as compared with control nonbruxers. It is very likely that bruxism in many mixed BB individuals correspond to what researchers have aptly called "destructive, extreme or very severe BB". In this regard, Ware and Rugh<sup>[12]</sup> evaluated a very selected subgroup of destructive bruxers and reported that such patients presented with signs and symptoms of depression indicating more severe psychopathology. Mixed BB is more likely to induce pain in multiple areas of the stomatognathic system. If so, patients in these condition may become more depressed as painful sites induce depression and also because of their higher scores in somatization and depression. More intense pain and a greater number of painful anatomic areas may theoretically increase the likelihood of depression<sup>[15]</sup>.

### VII. Conclusion

Because the lowest scores in depression were observed in the subgroup of subjects presenting with diurnal BB, the outcome of this investigation expand our current knowledge about differences in psychological characteristics of diurnal, sleep and mixed bruxers. On the other hand, the highest scores in depression were observed in the mixed BB subgroup reinforcing the notion that sleep or mixed bruxers constitutes more complex subgroup in terms of psychopathology. Further studies with similar samples and using the same psychological method are needed to substantiate and if possible replicate findings in the current study.

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**Table 1:** Social and demographic data in CMDs subjects with diurnal, sleep, mixed bruxing behavior (experimental subgroups) and in those with CMDs and no bruxism, and no CMDs and No Bruxism (Control subgroups).

|         | SUBGROUPS       |     |               |     |               |     |                  |      |                   |      |
|---------|-----------------|-----|---------------|-----|---------------|-----|------------------|------|-------------------|------|
|         | Diurnal<br>n=50 |     | Sleep<br>n=50 |     | Mixed<br>n=50 |     | CMDs+BB-<br>n=30 |      | CMDs- BB-<br>n=30 |      |
| GENRE   | n               | %   | n             | %   | n             | %   | n                | %    | n                 | %    |
| Females | 40              | 80  | 45            | 90  | 42            | 84  | 26               | 86,7 | 22                | 73,3 |
| Males   | 10              | 20  | 5             | 10  | 8             | 16  | 4                | 13,3 | 8                 | 26,7 |
| Totals  | 50              | 100 | 50            | 100 | 50            | 100 | 30               | 100  | 30                | 100  |
| AGE     |                 |     |               |     |               |     |                  |      |                   |      |
| Mean    | 30,5            |     | 35,4          |     | 33,4          |     | 32,5             |      | 36,4*             |      |
| SD      | 11,0            |     | 12,9          |     | 12,0          |     | 12,6             |      | 14,5              |      |
| Range   | 16-64           |     | 17-66         |     | 17-61         |     | 17-70            |      | 13-68             |      |

\* Kruskal-Wallis' statistics p=0,22 (a statistically non significant difference)

**Table 2:** Means, Standard Deviation and Range in depression in CMDs and diurnal bruxers (n=50); CMD and sleep bruxers (n=50); CMDs and mixed bruxers (n=50); CMDs with no BB (n=30) and no CMDs and No BB (n=30), subgroups.

| DEPRESSION<br>(BDI) | SUBGROUPS  |          |          |          |          |
|---------------------|------------|----------|----------|----------|----------|
|                     | Diurnal BB | Sleep BB | Mixed BB | CMDs+BB- | CMDs-BB- |
| Mean                | 8,2        | 12,8     | 16,1     | 13,9     | 6,1*     |
| SD                  | 8,0        | 9,6      | 7,4      | 9,5      | 5,5      |
| Range               | 0--37      | 0-42     | 6--33    | 0--41    | 0--19    |

\* Kruskal-Wallis' statistics  $p < 0,0001$ : CMDs+ BB- versus No CMDs No BB ( $p < 0,01$ ); sleep BB versus No CMDs No BB ( $p < 0,05$ ); mixed BB versus No CMDs No BB ( $p < 0,001$ ); diurnal BB versus CMDs+ BB- ( $p < 0,05$ ); mixed BB versus diurnal BB ( $p < 0,001$ ).

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