

Frequency of jutting the jaw forward in subjects with different bruxing behavior types and craniomandibular disorders.

Bruno Ricardo Simião¹ Omar Franklin Molina² Marcus Sobreira Peixoto² Ed Wilson César³ Mauricio Augusto Fregonesi¹ Almir Borges Franco³ Maria A. Sobreiro²

¹Department of Prosthetic Dentistry, University of Gurupi, Gurupi-TO, Brazil

²Department of Orthodontics and Orofacial Pain, University of Gurupi, Gurupi-TO, Brazil.

³Department of Restorative Dentistry, Gurupi University, Gurupi-TO, Brazil.

Corresponding Author: Omar Franklin Molina

Abstract

Introduction: Oral jaw habits constitute certain behaviors which in some cases are very harmful to some anatomic components of the stomatognathic system.

Goals: Evaluate the frequency of jutting the jaw forward in subjects with different types of bruxing behavior, test the hypothesis that such behavior is observed more frequently in subjects with mixed bruxing behavior.

Methods: History of the chief complaint, clinical examination, palpation of the temporomandibular joints and masticatory muscles, questionnaires, a specific questionnaire for bruxing behavior, evaluation of oral jaw habits and self-report were used to assess 107 subjects with Craniomandibular disorders and diurnal, nocturnal or mixed bruxing behavior. Forty subjects without CMDs and without bruxing behavior were used as a comparison subgroup. Experimental subjects were classified as those presenting Craniomandibular Disorders and diurnal bruxism, Craniomandibular Disorders and sleep bruxism and Craniomandibular disorders and mixed bruxing behavior. Criteria for craniomandibular disorders were also used based on widely accepted clinical criteria. Kruskal-Wallis statistics, Chi-squared for independence and trends and Fisher's exact test were used to analyze data.

Outcome: Mean age was about 35,6 (SD=14,2, range 17-73) in the diurnal bruxing behavior subgroup with craniomandibular disorders; 35,5 (SD=12,5, range 17-61) in the sleep bruxing behavior subgroup with craniomandibular disorders, 32,6 (SD=11,4, range 17-59) in the mixed bruxing behavior subgroup with craniomandibular disorders and 34,9 (SD=14,2, range 16-68) in the control subgroup with neither craniomandibular disorders nor bruxing behavior. Kruskal-Wallis statistics ($p=0,64$) showed that there was no statistically significant difference when age was compared in different subgroups.

The frequency of jutting the jaw forward was about $37/107=34,6\%$ in the total experimental group as compared with $4/40=10\%$ in the control group. Fisher's exact test ($p=0,003$) showed that the difference was statistically significant. Regarding frequency of jutting the jaw forward when diurnal, sleep, mixed and controls were compared, Fisher's exact test showed that statistical significance was present only in some pairs of groups as follows: sleep bruxing behavior versus controls ($p=0,007$); mixed bruxers versus controls ($p=0,0005$) and mixed bruxers versus diurnal bruxers ($p=0,02$). Chi-squared for independence test ($p=0,002$) demonstrated that the subgroups were independent. Chi-squared for trends ($p=0,0002$), indicated that there was a statistically and significant trend for an increase in the frequency of jutting the jaw forward from the control group to the diurnal bruxing behavior subgroup, to the sleep subgroup and then to the mixed bruxing behavior subgroup.

Conclusions: A higher frequency of jutting the jaw forward was observed in the CMDs subgroup. The frequency of this behavior increased from the control to the diurnal, sleep and mixed bruxing behavior subgroup. Because mixed bruxing behavior is very destructive, and the frequency of jutting the jaw forward was very high in this subgroup, such behavior may be related to more severe forms of internal derangement of the TMJs.

Keywords: Craniomandibular Disorders. Bruxing Behavior. Jutting the jaw forward. Oral jaw habits.

Date of Submission: 15-07-2020

Date of Acceptance: 31-07-2020

I. Introduction

Craniomandibular Disorders (CMDs) are collective terms used in Medicine and Dentistry to describe a set of common signs and symptoms involving the masticatory muscles, temporomandibular joints (TMJs), tendons and ligaments and adjacent anatomic structures usually of musculoskeletal origin and characterized by

a complaint of pain, some types of joint noises, tenderness to palpation, difficulties to perform normal jaw movements and headache of musculoskeletal origin^[1]. Bruxing Behavior (BB) is a complex motor, neurophysiological and psychological disorder or oral jaw behavior characterized by clenching, gnashing and grinding the teeth occurring both at daytime and nighttime usually associated with some type of trauma over many components of the masticatory system^[2]. Although many types of BB have been described in the literature, the classification of diurnal nocturnal or mixed BB is more frequently accepted and used^[3]. As mentioned before, BB is also a pathologic oral jaw habit which sometimes occurs together with jutting the jaw forward. Oral jaw habits including jutting the jaw forward constitute motor behaviors that are repeated regularly which tend to occur unconsciously constituting frequent etiological or associated factors for signs and symptoms of CMDs and malformation of craniofacial structures^[4]. BB is usually classified as diurnal, nocturnal and mixed. There are reasons to believe that mixed BB is more destructive as compared to the other two types^[5]. Because there is paucity of information about jutting the jaw forward in CMDs and BB individuals, this investigation was designed to:

1. Evaluate the frequency of jutting the jaw forward in a sample of CMD subjects presenting with sign and symptoms of BB.
2. Test the hypothesis that mixed BB is more destructive to the orofacial structures, thus, subjects with this behavior are expected to jut the jaw forward more frequently to mechanically protect the joints and prevent further trauma and pain.
3. Test the hypothesis that the frequency of jutting the jaw forward increases from the non CMDs non BB subgroup to the diurnal, seep and mixed BB subgroup.

II. Material and Methods

Sample

One hundred and seven subjects (94 females and 13 males) were referred consecutively to the University of Gurupi, Division of Orofacial Pain in the period 2012-2019. History of the chief clinical complaint, clinical examination of the masticatory system, a comprehensive questionnaire and self-report were used to gather information about signs and symptoms of CMDs and presence and type of BB. A simple and short questionnaire was also used to obtain information about known oral jaw behaviors including jutting the jaw forward. Biomechanical tests were also used to assess the presence of internal derangements of the TMJs. Palpation of joint and muscles, and some psychological tests were used to gather additional data about myofascial pain, anxiety, depression and hostility. All clinical charts of those subjects evaluated previously and presenting information about CMDs, BB, facial, TMJ pain or headache, internal derangements of the TMJ and oral jaw behaviors were retrieved and evaluated retrospectively to assess the prevalence of jutting the jaw forward. During retrospective evaluation, experimental subjects were allocated to the subgroups as follows: CMDs + diurnal BB and oral jaw behaviors (n=27); CMDs + sleep BB and oral jaw behavior (n=40) and CMDs + mixed BB and Oral jaw behaviors (n=40). Control subjects (n=40, 10 males and 30 females), were those referred over the same period of time without demonstrating neither sign and symptoms of CMDs nor signs and symptoms of BB.

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

Inclusion criteria for Diurnal BB: 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 nocturnal BB: Self-report of grinding or clenching the teeth at night, friends, relatives or others reporting patients' BB during the night, patient's report of awakening with facial and or TMJ pain, difficulties to perform normal jaw movements early on awakening in the morning.

Inclusion criteria for mixed BB: Self-report of clenching the teeth during the day, fatigue of the masticatory muscles during the day, patient's history of catching himself or herself grinding or clenching the teeth at night, noises of grinding the teeth at night, indicating BB according to friends and/or relatives' report. Facial and/or TMJ pain and difficulties to perform normal jaw movements early in the morning.

Inclusion criteria for Jutting the jaw forward: Subject's report of catching himself or herself jutting the jaw directly forward or forward and laterally with or without contacting any anterior and upper teeth at the end of the protrusive movement. Any jaw movement of this type reported occasionally, frequently or very frequently was scored as present.

Exclusion criteria for the experimental and control subjects: Subjects with motor disorders, cognitive impairment, some form of epilepsy including Parkinson's disease and severe psychological and psychiatric disorders were not evaluated comprehensively and thus, were not included in the current investigation.

III. Statistical analysis

Kruskal-Wallis statistics was used to assess statistically significant differences when mean age was compared in different subgroups. Fisher's exact test was used to evaluate statistically significant differences regarding prevalence of jutting the jaw forward. Chi-squared statistics was used to test for independence in the subgroups. Chi-squared for trends was utilized to evaluate a trend for a higher frequency of jutting the jaw forward from the control to the diurnal, sleep and mixed BB subgroups. Significance was accepted if $p < 0,05$.

IV. Outcome

Mean age in the diurnal BB subgroup was about 35,6 (SD=14,2, range 17--73); 35,5 (SD=12,5 range 17-61) in the sleep BB subgroup; 32,6 (SD=11,4, range 17-59) in the mixed BB subgroup and 34,9 (SD=14,2, range 16-68) in the control subgroup. Kruskal-Wallis statistics showed that there was no statistically significant difference when the subgroups were compared ($p=0,64$). The frequency of jutting the jaw forward in the whole group of CMDs and BB subjects was about $37/107=34,6\%$; $5/27=18,5\%$ in the diurnal BB subgroup; $14/40=35\%$ in the sleep BB subgroup; $18/40=45\%$ in the mixed BB subgroup and $4/40=10\%$ in the Non CMD non BB subgroup. Thus, the highest frequency of jutting the jaw forward was observed in the mixed BB subgroup (45%). Chi-squared for independence ($p=0,002$) showed that the subgroups were relatively independent. Fisher's exact test showed that there were some statistically significant differences in the comparison of the frequency of jutting the jaw forward in some groups as follows: sleep BB versus controls ($p=0,007$); mixed BB versus controls ($p=0,0005$); mixed BB versus diurnal BB ($p=0,02$). Because Chi-squared for trends yielded a $p\text{-value}=0,0002$, the hypothesis that the frequency of jutting the jaw forward would increase from the less dysfunctional subgroup (Non CMDs non BB) to the most dysfunctional subgroup (mixed BB) was supported.

V. Discussion

The frequency of jutting the jaw forward was higher in the CMDs group as compared with the control one. The frequency of self-reported jutting the jaw forward was higher in any subgroup of subjects presenting with some type of BB and CMDs (diurnal, nocturnal or mixed BB). Several explanations are useful to explain this higher frequency of such oral jaw habit in the subgroup with CMDs and BB:

1. Oral jaw habits have been correlated with both CMDs and anxiety in many studies. Because CMDs and BB individuals are characterized by higher levels of anxiety, they are expected to present with higher frequency of a diversity of oral jaw habits including jutting the jaw forward. In line with this assumption, one investigation^[6] reported higher scores in anxiety in a group of children presenting with CMDs. Multiple etiologic factors may be responsible for the development of oral jaw behaviors including stress and anxiety which are more prevalent in contemporary life^[4]. A similar investigation^[7] evaluated severity of anxiety in CMDs subjects with mild, moderate, severe and extreme BB and reported that all subgroups demonstrated anxiety which increased from the mild to the moderate severe and extreme subgroups with BB. Molina and associates^[8] evaluated oral jaw behaviors in subjects with CMDs and BB when compared with a control subgroup. Researchers reported higher frequency of all oral jaw behaviors including jutting the jaw forward in the experimental group with CMDs.

2. There may be a higher prevalence of severe and destructive BB in the sample of CMDs individuals with higher frequency of oral jaw behaviors. Jutting the jaw forward may be observed more frequently in these individuals. Such subgroups of bruxers may cause severer damage to the internal structures of the TMJ including inflammation and disk displacement, thus encouraging some biomechanical and positional changes in the mandible so as to prevent severer pain and disk obstruction. In line with this point of view, one investigation^[7] reported that BB in CMDs individuals may vary in frequency and intensity. Thus, there may be subgroups presenting with severe and extreme BB. Oral jaw behaviors including BB and jutting the jaw forward may lead to pain, dysfunction, increased muscle activity and severe damage to the components of the masticatory system. Jutting the jaw forward may be a biomechanical response to anxiety and severer damage to the TMJs. In line with these points of view, one investigation^[9] asserts that protruding the jaw may be a destructive oral behavior causing damage to muscles and TMJs.

The subgroup with clinical characteristics of mixed BB demonstrated the highest frequency of jutting the jaw forward.

Because mixed BB is the combination of diurnal and sleep BB, we assume that such combination is more **destructive** to the components of the masticatory system including muscles and joints. If so, jutting the jaw forward is the behavior adopted by some CMDs patients to minimize **pain** and discomfort in the TMJs. Mixed BB is more likely to induce pain, inflammation and **positional changes in the joint disk**. **If so, the displaced disk may function as a biomechanical barrier not allowing a functional rest position of the mandible**. Thus, jutting the jaw forward is also a conscious or unconscious behavior adopted to provide

more biomechanical comfort decreasing anxiety. This assumption is reinforced by the fact that patients who jut the jaw forward usually state on initial interview during the diagnostic process that they jut the jaw to decrease pain and anxiety, feel more comfort in the joint and sometimes to decrease the frequency of joint noises. Chronic inflammation and displacement of the TMJ disk may occur in cases of severer BB which in turn induces jutting the jaw forward in some CMDs individuals. Maintenance of an induced jaw posture for a considerable duration of time could lead to local fatigue and deterioration of joint position^[10]. Oral jaw behaviors become more destructive by frequent repetition and include finger sucking, nail biting and protruding the mandible^[9]. One investigation^[11] evaluating subjects who engaged in different common oral jaw behaviors including jutting the jaw forward, jutting the jaw to one side cupping the chin in one hand and tooth clenching, reported that all these oral jaw behaviors induced localized head and face pain. The assumption that there is a relationship between destructive mixed BB, pain and disk displacement in the TMJ is partially supported by one investigation^[12] reporting that a jaw thrust maneuver during general anesthesia can lead to persistent jaw pain in the postoperative period. Mixed BB is a destructive oral jaw behavior more likely to induce more progressive internal joint derangements in the TMJ. As the severity and duration of internal derangements of the TMJ increases, many other concurrent disorders or mechanisms may play a role increasing the likelihood for the development of disk displacement, pain and inflammation^[13]. In long-term stages of articular disk displacement morphological and dimensional changes of different parts of the articular disk may also happen which may be symptomatic but as time passes, clinical signs and symptoms including functional impairment ensue^[14]. To a certain extent, jutting the jaw forward may reflect real or potential anatomical changes in the TMJs, more specifically in the joint disk.

The frequency of jutting the jaw forward increased from the control to the diurnal, sleep and mixed BB subgroup following an order of BB severity. This outcome provides an additional clue indicating that severer BB is more likely to induce pain, inflammation and disk displacement in the TMJ, and thus, encouraging a protective positional change in the mandible so as to minimize pain and discomfort. Further, the outcome in the current research provides additional support to the notion that more severe BB is more destructive for the components of the masticatory system. This point of view is echoed by one investigation^[15] reporting that some parafunctional habits constitute risk factors for the development of signs and symptoms of muscle and joint disorders. More severe BB may overload some components of the masticatory system causing more frequency of joint pain, inflammation and disk displacement. These disorders are more likely to induce jutting the jaw forward in order to protect internal structures of the TMJ. In one investigation^[8] in mild, moderate and severe CMDs and BB subjects, researchers reported that the frequency of many oral jaw behaviors increased with the severity of BB. Although mixed BB is the combination of diurnal and nocturnal BB, nocturnal BB is more destructive to the TMJs and masticatory muscles. Some oral jaw behaviors in children and adolescents including jaw propulsion are considered very deleterious to any component of the masticator system^[16]. Any sustained anterior mandibular position, more specifically jutting the jaw forward at night produces strain and increased muscular activity as the mandible is kept forward for a long period of time^[16]. Increased tension, pain and discomfort in TMJ and protrusive muscles reduce the tolerance for pain^[17] and may induce the development of jutting the jaw forward. To summarize, more severe BB (mixed BB) may cause more intense pain, inflammation and disk displacement and induce jaw trusting, more frequently in CMDs subjects.

VI. Conclusion

This investigation was carried out to study the frequency of jutting the jaw forward in three subsets of subjects with CMDs and BB. The outcome seems to support the notion that oral jaw habits including jutting the jaw forward occur very frequently in CMDs individuals. Jutting the jaw forward was observed more frequently in the mixed BB subgroup which is considered a severer form of BB. Although additional clinical investigation is needed to replicate the outcome in the current study, it seems clear to us that jutting the jaw forward is directly linked to anxiety and more severe type of internal derangements of the TMJ, more specifically, pain, inflammation and disk displacement. The fact that jutting the jaw forward was observed more frequently in the mixed BB subgroup, corroborates this point of view.

References

- [1]. Kafas P, Dalabiras S, Handoon Z. Chronic temporomandibular joint dysfunction: an area of debate. *Hard Tissue* 2012; 10: 1-9.
- [2]. The Academy of Prosthodontics. The Glossary of Prosthodontic Terms. *J Prost Dent* 2005; 94: 10-29.
- [3]. Molina OF, Gaio DC, Cury MD, Gimenez SR, Salomão EC, Pinesci E. Uma análise crítica dos sistemas de classificação sobre o bruxismo. *JBA* 2002;2: 61-69.
- [4]. Shah AF, Batra M, Sudeep CB, Gupta M, Kumar K. Oral habits and their implications *Annals Medicus* 2014; 1: 179-86.
- [5]. Molina OF, Rank R, Simião BR, Junior FD, Peixoto MS, Ogawa W, Soares FL. Cervical pain on awakening in the morning and bruxing behavior types: A comparison study and preliminary results. *J Dent Med Sci* 2018; 78: 17: 67-72.

[6]. Karibe H, Shimau K, Okamoto A, Kawakami T, Kato Y, Warita-Naoi S. Frequency Prevalence and association of self-reported anxiety, pain, and oral parafunctional habits with temporomandibular disorders in Japanese children and adolescents: a cross-sectional survey. *BMC Oral Health* 2015;15: 1-7.

[7]. Molina OF, Sobreira MA, Tavares PG, Dib JE, Aquilino R. Anxiety in craniomandibula disorders and bruxing behavior patients *Rev Neurocienc* 2006; 14: 23-30.

[8]. Molina OF, dos Santos J, Mazzetto M, Nelson T, Nowlin T, Mainieri T. Oral jaw behaviors in TMDs and bruxism: comparison study by the severity of bruxism. *Cranio* 2001; 119: 114-22.

[9]. Suhani RD, Suhani MF, Munten A, Mesaros M, Baadea ME. Deleterious oral habits in children with hearing impairment. *Clujul Med* 2001; 88: 403-07.

[10]. Zafars H, AlghadirAH, Igbai ZA. Effect of different head-neck jaw postures on cervicocephalic kinesthetic sense. *J Musculoskeletal Neuronal Interact* 2017; 17::341--64.

[11]. Villarosa GA, Moss RA. Oral behavioral patterns as factors contributing to the development of head and facial pain. *J Prost Dent* 1985; 54: 427-30.

[12]. Nicoll JB. An unusual complication of jaw thrust. *Anesthesia* 2007; 6: 1-4.

[13]. Molina OF, Aquilino RN, Rank R, Santos ZC, Eid LM, Tavares PG. Is inflammation a mechanism in arthrogenic TMJ otalgia. *Rev Neurocienc* 2011; 19: 632-34.

[14]. ImamimoghadamM, Bagherpour A, Nasser S, Madai AS, Rezael M, Safae A. Dimensional changes of temporomandibular joint in patients affected by temporomandibular disorders: A combination of two-dimensional and three-dimensional evaluation.. *J Res Ned Dent Sci* 2018; 6: 187-93.

[15]. Yoshioka DM, Sanches ML, Kihara GT, Juliano Y, Novo F, Guimarães AS. Oral parafunctional habits associations with temporomandibular disorders. IADR General Session Poster Presentation. Foz do Iguacu, (Brazil), June 21, 2012.

[16]. Monsky RC, Castilho T, Meira R, Bobbio T, Schivinski C. Relationship between oral habits and spirometry maneuvers in children. *Rev CEFAC* 2018; 20: 37-43.

[17]. Masse JF, Bellerive A, Séries F, ST Pierre L. Prospective assessment of maximum protrusion in patients wearing a mandibular advancement device. *J Dent Sleep Med* 2018; 5: 1-16.

Table 1: Social and demographic data in Craniomandibular disorder subjects with diurnal, nocturnal and mixed BB and controls non CMDs and non BB.

CMDs AND BB SUBGROUPS								
	Diurnal BB		Sleep BB		Mixed BB		Controls	
GENRE	n	%	n	%	n	%	n	%
Females	23	85,2	36	90	35	87,5	30	75
Males	4	14,8	4	10	5	12,5	10	25
Total	27	100	40	100	40	100	40	100
AGE								
Mean	35,6		35,5		32,6		34,9*	
SD	14,2		12,5		11,4		14,2	
Range	17--73		17--61		17--59		16--68	

* Kruskal-Wallis statistics $p=0,64$ (a non significant difference).

Table 2: Frequencies of Jutting the jaw forward in the CMDs and BB group and in the subgroups presenting with diurnal, sleep and mixed BB and in the control subgroup.

ALL CMDs									
SUBJECTS									
n=107		CONTROLS n=40		DIURNAL BB n=27		SLEEP BB n=40		MIXED BB n=40	
n	%	n	%	n	%	n	%	n	%
37	34,6*	4	10**	5	18,5**	14	35**	18	45**

*Fisher's exact test to compare the whole group of CMDs and BB subjects versus 40 control subjects $p<0,003$.

** Chi-squared test for independence $p= 0,002$ For trends $p=0,0002$

Fisher's exact test Diurnal versus controls $p=0,32$; sleep versus controls $p=0,007$; mixed versus controls $p=0,0005$; sleep versus diurnal $p=0,14$; mixed versus diurnal $p=0,02$; mixed versus sleep $p=0,36$.

Bruno Ricardo Simião, et. al. "Frequency of jutting the jaw forward in subjects with different bruxing behavior types and craniomandibular disorders." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(7), 2020, pp. 19-23.