

Association of self-reported bruxism with temporomandibular disorders - Northern Finland

Birth Cohort (NFBC) 1966 study

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Abstract

Objective: To investigate the prevalence of self-reported bruxism and its association with temporomandibular disorders (TMD). Hypothesis was that self-reported bruxism is associated with TMD.

Methods: The data were gathered from 1,962 subjects, who participated in a field study in 2012–13 including a questionnaire concerning bruxism and TMD symptoms as well as clinical sub-diagnoses of TMD using the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). Statistical method was chi-square test. Bonferroni correction was made and a p-value of <0.003 was considered as significant.

Results: The prevalence of self-reported bruxism was 39.6%; 34.0% in men and 44.5% in women. Those who reported sleep bruxism (SB) or awake bruxism (AB) had significantly more pain-related TMD symptoms and signs as compared to those not reporting bruxism.

Conclusions: The prevalence of self-reported bruxism is high among middle-aged adults and it is associated with TMD pain-related symptoms and signs, as well as TMD diagnoses.

Key Words: Bruxism, Temporomandibular disorders, Cohort study, Prevalence

Introduction

Bruxism is an oral condition characterized by repetitive jaw-muscle activity like bracing or thrusting of the mandible and/or clenching or grinding of the teeth.¹ Bruxism can occur both awake (awake bruxism, AB) and during sleep (sleep bruxism, SB), and these are considered different behaviors.² Bruxism can be diagnosed at different levels: ‘possible’, ‘probable’ and ‘definite’.¹ Self-

reported bruxism denotes possible bruxism. The diagnosis of 'definite' bruxism requires the use of electromyography for AB or polysomnography for SB.

Bruxism is a frequent phenomenon in the population. The prevalence of SB has shown to vary between 8% and 55%³⁻⁷, whereas the prevalence of AB has been reported to vary from 2% to 38%.³⁻⁵ In general, the prevalence of SB has a tendency to decrease with aging.⁸⁻¹⁰

A systematic review by Machado E et al. (2014)¹⁰ did not find any differences between genders in the prevalence of bruxism, but some studies^{5,8,11} have shown the prevalence to be higher among women than men, and that women have a peak in the age group 45–54 years, after which the prevalence decreases again.⁹

Several studies have shown associations between bruxism and temporomandibular disorders (TMD).^{5,7,12,13} According to a questionnaire survey of 4403 university students in Finland SB was associated with TMD symptoms in both genders, whereas AB was associated with pain-related TMD symptoms only in women.⁵ There is a positive association of both SB and AB with TMD, and especially between SB and myofascial pain, arthralgia and joint pathology, such as disc displacements.¹³ On the other hand, Manfredini and Lobbezoo (2010) found that the association between bruxism and TMD is controversial as both have complex etiology and diagnostic methods differ between studies.¹² However, they observed that studies on self-reported or clinically assessed diagnosis of bruxism indicated a positive association with TMD pain, and that experimental, sustained jaw clenching may cause acute muscle tenderness.

The Northern Finland Birth Cohort 1966 (NFBC 1966) is a population-based, unselected sample of live births in 1966 (n = 12,231) in the Oulu and Lapland provinces in Finland. A follow-up study in 2012–2013 included questionnaires concerning general and dental health and clinical medical and

dental examinations. The aims of this study were to investigate the prevalence of self-reported AB and SB and their association with TMD in 46-year-old subjects in the NFBC 1966. Based on the previous studies, it can be hypothesized that self-reported AB and SB are prevalent among 46-year-olds, and that they are associated with TMD.

Materials and methods

The NFBC 1966 is a research program concerning subjects born in 1966 in the provinces of Oulu and Lapland in Finland (n=12,231, <http://www oulu.fi/nfbc/>).¹⁴

The cohort subjects were called for the follow-up study in 2012–2013. The subjects gave written consent for the study, had the right to refuse to give information concerning themselves at any time, and participation was voluntary. The study was approved by the Ethical Committee of the Northern Ostrobothnia Hospital District (74/2011).

Subjects with a known postal address received two questionnaires to be filled in at home before the clinical examinations. The questionnaires included 1) the subjects' background information, lifestyle and health, and 2) economy, work and mental resources. Questionnaire 1 (response rate 66.5%, n=6,868) included the following two questions related to TMD symptoms which have shown to be valid for screening TMD pain¹⁵:

1. Do you have pain in your temples, temporomandibular joints, face or jaw? (Answer options were: no / once a week / more often, dichotomized as no pain / pain)
2. Do you have pain when you open your mouth wide or chew? (Answer options were: no / once a week / more often, dichotomized as no pain / pain)

Subjects living in the Oulu region (range 100 kilometers) (n=3,150) were invited to attend the clinical dental and medical examinations. A total of 1,964 subjects (61.7%) attended the examinations performed at the Institute of Dentistry, University of Oulu. Due to refusal of two subjects the total number of subjects in the analyses was 1,962 (1,050 women, 912 men). On the day of the clinical examination, the subjects filled in the questionnaire which included questions about dental health (response rate 97.3%, n=1,909 [1,020 women, 889 men]). The subjective report of SB and AB bruxism was based on two questions:

1. Have you noticed or have you been told that you grind your teeth or bite your teeth tightly together when you are sleeping?
2. Have you noticed or have you been told that you grind your teeth or bite your teeth tightly together when you are awake?

Clinical examination

Six calibrated dentists (examiners) performed the standardized clinical dental examinations. A clinical stomatognathic examination¹⁶ was performed according to the modified protocol of DC/TMD presented in the Symposium at the International Association for Dental Research Conference in 2010.¹⁷ The TMD signs assessed were limited mouth opening (< 40 mm), clicking and crepitus of the TMJs, and pain on palpation of the masticatory muscles and TMJs. TMD diagnoses based on the modified DC/TMD protocol¹⁷ were myalgia, arthralgia, disc displacement with reduction, disc displacement without reduction, and degenerative joint disease. The detailed description of the diagnoses has been reported in the study of Jussila et al. (2017).¹⁶

Statistical analyses

The prevalence of self-reported bruxism was reported by gender and presence of TMD symptoms and signs, and by TMD sub-diagnoses. Associations between self-reported bruxism and TMD symptoms, signs and sub-diagnoses were evaluated using chi-square tests. Bonferroni correction was made for multiple comparisons. The number of comparisons was 19, and therefore only p-values less than $0.05/19$ (number of pairwise comparisons-1) = 0.003 were considered as significant.

Results

The prevalence of self-reported bruxism was 39.6% (SB 37.5% and AB 10.1%); 34.0% in men (32.1 % SB and 6.7 % AB) and 44.5% in women (42.2 % SB and 13.1 % AB) (Table 1). Women showed significantly higher prevalence of both SB and AB. The sum of AB and SB data is higher than total because some subjects are having both SB and AB (Table 1).

Subjects who reported SB or AB had significantly more TMD signs than those not reporting bruxism (Table 1). Both SB and AB associated significantly with pain on palpation in masticatory muscles and in TMJs. Self-reported AB associated significantly with crepitus in TMJ. Pain-related TMD symptoms were significantly associated with SB and AB (Table 1).

Myalgia and arthralgia were significantly associated with SB and AB in women. Disc displacement with reduction associated with SB and AB in women (Table 2).

Discussion

In this study sample consisting of 46-year-old cohort subjects, the prevalence of self-reported bruxism was 39.6%. The prevalence of SB was 37.5%, whereas the prevalence of AB was lower (10.1%). The prevalence levels are in accordance with other population-based studies¹⁸, also when considering the lower prevalence of AB compared to SB.⁵ Recent studies concerning the prevalence of bruxism in younger age groups are based on questionnaires and on student samples.^{3,9,19} A study

by Bracci et al (2018)²⁰ investigated AB in healthy Italian dental students using a real time smartphone application (BruxApp) and there was no significant difference between genders.

In age groups corresponding to those used here, Ahlberg et al. (2013)⁸ reported the prevalence of frequent bruxism and moderate bruxism to be 6% and 16%, respectively, among 45- to 54-year-old subjects. Women showed significantly higher prevalence of both SB and AB than men. In general, studies have noted that compared to men, women report more often both bruxism^{5,7,8,13,21} and TMD^{5,21,22}. In middle age, the gender differences may be explained by neurochemical mechanisms of stress and hormonal factors. Khoury et al (2016)⁹ presented that the high frequency of bruxism and TMD might be linked with hormonal changes among middle-aged women. They also suspected that insomnia or pain could contribute to this peak. It has been suggested that TMD pain is associated with estrogen hormone levels in women.²³ Menopausal women are more likely to have TMD than non-menopausal women, which supports a role for estrogen hormone levels in TMD.²⁴ It has also been explored that women suffering from TMD may have a greater number of progesterone and estrogen receptors in temporomandibular joint (TMJ) structure.²⁵ The strong association between TMD and women can also be explained by the fact that during clinical examination, women are more sensitive to reporting pain than men.²⁶

In the present study, both SB and AB associated significantly with pain-related symptoms and signs of TMD, and with pain- and joint-related TMD diagnoses, especially among women. These findings are in line with earlier studies.^{5,7,12,27} The results are also in line with findings by Fernandes et al (2015)²⁸ observing that self-reported sleep bruxism and awake bruxism were associated with pain-related TMD in young adolescents (using RDC/TMD questionnaire). Another study by Fernandes (2012)²⁹ also discovered that sleep bruxism might be a risk factor for painful TMD (assessed using RDC/TMD), but the study could not show a causal relationship.

It has been found that the various methods used in the assessment of the bruxism give different results on the associations between TMD and bruxism.¹³ Studies based on self-reported bruxism or clinical features have shown a positive association with TMD, whereas weak association with TMD has been shown when bruxism has been diagnosed using specific diagnostic methods like polysomnography (PSG) or electromyography (EMG).^{12,30,31} In assessment of TMD, the present study relied on both questionnaires and clinical examination using a validated diagnostic protocol, DC/TMD.¹⁷ The recently confirmed complete package of DC/TMD protocol³² was not yet totally available in 2012–2013 when the present survey was formed. Consequently, definite diagnoses of TMD using DC/TMD diagnostic protocol were performed, which is a strength of current study. The strength of the study is also a large study sample of subjects of the same age. With regard to assessment of bruxism, the present study relied only on the questionnaire, which is a limitation. It should be noted that using self-report of bruxism, only the lowest grade (possible) in bruxism diagnostics can be achieved. The use of electromyography for AB or polysomnography (gold standard) for SB is required to obtain the grade of definite diagnosis of bruxism.¹

The questionnaire used included two questions about bruxism and the answers were limited to ‘Yes’ or ‘No’, which may have given rise to bias in responses. The ‘Yes’ responses may range from those who had noticed tooth grinding once to those who had found that they grind their teeth almost every day/night. In the study of Bracci et al. (2018)²⁰, there were five possibilities (relaxed jaw muscles, teeth contact, jaw clenching/bracing, teeth clenching, teeth grinding) to choose from for a behaviour at the moment when the app gave an alert. The authors concluded that this method gives more validity to self-reported AB compared to retrospective, single-observation questionnaire. The study by Ahlberg (2013)⁸ used response options on a five-point scale – “continually”, “often”, “sometimes”, “seldom” and “never” – to enquire about bruxism awareness. There were also

questions of whether the respondents had been informed about tooth grinding during sleep by their partner. The self-reported cross-sectional study about SB in Canadian population also used four different response options for bruxism awareness.⁹ These answers give more possibilities to detect those who grind their teeth regularly compared with grinding rarely. Ideally, the questionnaire should include several degrees of frequencies of bruxism, as in the validated method of Oral Behaviour Checklist (OBC) included in the recently developed Diagnostic Criteria for Temporomandibular Disorders (DC/TMD).³² However, this protocol could not be included in this study because the Finnish version of the OBC was not available at the time of the clinical examination in 2012–2013. Now when the Finnish version of the OBC is available, it should be considered in future studies.

Conclusions

The prevalence of self-reported bruxism is high among middle-aged adults and it is associated with TMD pain-related symptoms and signs, as well as TMD diagnoses. Bruxism should be considered as a background factor of TMD and should be taken into account in the diagnostics and treatment of TMD patients.

Conflict of interest

The authors have no conflict of interest to declare.

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Table 1. Association of clinical signs and pain-related symptoms of temporomandibular disorders (TMD) with self-reported sleep bruxism (SB), awake bruxism (AB) and bruxism as total in subjects including in the Northern Finland Birth Cohort 1966 (NFBC 1966) (Rantakallio 1988).

	Bruxism								
	n	SB %	p	n	AB %	p	n	Total %	p
Gender									
Men	285	32.1	0.000	60	6.7	0.000	302	34.0	0.000
Women	429	42.2		133	13.1		452	44.5	
TMD signs									
Any sign	303	47.2	0.000	103	16.0	0.000	322	50.2	0.000
No sign	405	32.4		90	7.2		426	34.1	
Maximal opening									
<40 mm	29	40.8	0.548	7	9.9	0.922	31	43.7	0.473
>= 40 mm	679	37.3		186	10.2		717	39.4	
Clicking in the TMJs									
Yes	80	42.6	0.130	22	11.6	0.467	86	45.7	0.069
No	634	36.9		171	10.0		668	38.9	
Crepitus in the TMJs									
Yes	60	44.4	0.083	25	18.5	0.001	64	47.4	0.054
No	654	36.9		168	9.5		690	39.0	
Pain in masticatory muscles									
Yes	128	60.1	0.000	54	25.4	0.000	133	62.4	0.000
No	586	34.6		139	8.2		621	36.7	
Pain in TMJs									
Yes	113	57.9	0.000	43	22.1	0.000	119	61.0	0.000
No	601	35.1		150	8.8		635	37.1	
TMD symptoms									
Do you have pain in your temples, TMJs, face or jaw?*									
Yes	138	55.9	0.000	60	24.3	0.000	149	60.3	0.000
No	552	34.7		126	7.9		580	36.5	
Do you have pain when you open your mouth wide or chew?*									
Yes	65	55.6	0.000	27	23.1	0.000	70	59.8	0.000
No	624	36.3		157	9.1		658	38.3	

*Nilsson et al. 2006

Table 2. Association of diagnosis of temporomandibular disorders (TMD), according to the modified version of Diagnostic Criteria for TMD (Schiffman et al 2010), and self-reported sleep bruxism (SB) and awake bruxism (AB) in both genders in the Northern Finland Birth Cohort 1966 (NFBC 1966) (Rantakallio 1988).

	Bruxism					
	n	SB %	p	n	AB %	p
Myalgia						
Men						
Yes	9	45.0	0.210	3	15.0	0.137
No	276	31.8		57	6.6	
Women						
Yes	62	80.5	0.000	30	39.0	0.000
No	366	39.0		103	11.0	
Arthralgia						
Men						
Yes	9	50.0	0.100	3	16.7	0.075
No	274	31.7		54	6.3	
Women						
Yes	62	72.9	0.000	30	35.3	0.000
No	364	39.3		101	10.9	
Disc displacement with reduction						
Men						
Yes	22	44.9	0.045	5	10.2	0.325
No	261	31.2		55	6.6	
Women						
Yes	59	67.0	0.000	21	23.9	0.002
No	369	39.9		112	12.1	
Disc displacement without reduction						
Men						
Yes	0	0.0	0.493	0	0.0	0.788
No	284	32.0		60	6.8	
Women						
Yes	1	33.3	0.755	1	33.3	0.298
No	427	42.2		132	13.0	
Degenerative joint disease						
Men						
Yes	11	32.4	0.958	4	11.8	0.237
No	272	31.9		56	6.6	
Women						
Yes	36	54.5	0.036	9	13.6	0.902
No	391	41.4		124	13.1	