



# Relationship between malocclusion and bruxism in children and adolescents: a review

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## Abstract

*A review of the literature on the relationship between malocclusion and bruxism is presented. Statistically significant correlations were found between different types of morphologic malocclusion such as Class II and III molar relationship, deep bite, overjet, and dental wear or grinding. The types of functional malocclusion correlated with dental wear or bruxofacets were mediotrusion interferences, anterior-posterior and vertical distance between retruded position and intercuspal position, lateral shift of the mandible together with nonfunctional side interferences. However, all studies that reported significant correlations were cross-sectional, which implies that the relationship between malocclusion and bruxism was investigated at a certain point of time. The results were not confirmed by the two longitudinal studies. Besides, the correlations were found in different age groups. Finally, the reported correlations cannot have biological significance since the biological plausibility of the causal hypothesis cannot be inferred. On the basis of this study, malocclusion does not increase the probability of bruxism, and therefore early treatment of occlusal conditions to prevent bruxism is not scientifically justified. (Pediatr Dent 17:7-12, 1995)*

The etiology of bruxism has been attributed to systemic factors such as intestinal parasites, subclinical nutritional deficiencies, allergies, and endocrine disorders;<sup>1,2</sup> to local factors, especially malocclusion;<sup>3,4</sup> and to psychological factors.<sup>5-7</sup> It has been reported that bruxism is an initiating factor of craniomandibular dysfunction in adults.<sup>8</sup> Also, studies<sup>9-16</sup> conducted on children and adolescents reported significant correlations between this parafunction and signs and symptoms of craniomandibular dysfunction. It would be useful, therefore, to know whether the relationship between malocclusion and bruxism is strong enough to prevent bruxism development by early treatment of occlusal conditions. The purpose of this paper was to review the literature on the relationship between malocclusion and bruxism and to discuss their causal relationship.

## Literature review

### Definition of bruxism

In all reviewed studies bruxism was defined as non-functional movements of the mandible with or without audible sound occurring during the day or night.

### Indicators of bruxism

In diagnosing bruxism, the reviewed studies used either a clinical examination, an interview/questionnaire, or both. The clinical indicators of diagnosing this parafunction were the presence of dental wear/attrition and bruxofacets. The historical indicator of bruxism was grinding or clenching reported by the subject or parent during the interview or on the questionnaire.

### Studies to link bruxism and malocclusion

Two types of epidemiologic studies — cross-sectional and longitudinal — have been conducted to investigate the relationship between bruxism and malocclusion.

#### 1. Cross-sectional studies

The majority of the reviewed studies is cross-sectional.<sup>10-12, 17-22</sup> In general, a cross-sectional study investigates the relationship between the characteristic and the disease for a certain period of time, which depends on the nature and the pathogenesis of the disease under investigation. Thus, the information obtained by the reviewed studies regarding bruxism occurred at the time the study was conducted or at some time in the past. Besides, it should be pointed out that bruxism varies with age.<sup>23</sup> On the other hand, it has been reported that malocclusion changes during growth and development<sup>24</sup> and that occlusal interferences are not consistent over time.<sup>25</sup> Therefore, the major limitation of this type of study is that the derivation of inferences depends upon a temporal sequence between malocclusion and bruxism.

#### 2. Longitudinal studies

Two of the reviewed studies are longitudinal.<sup>26,27</sup> A major source of difficulty in carrying out a longitudinal study is to maintain a follow-up of the selected group. In both studies 238 of 402 subjects (59%) were traced.

## Factors related to bruxism

Morphologic and functional malocclusion were the factors considered to be related to bruxism and investigated in the reviewed studies. These studies are presented separately for each type of malocclusion as follows:

### 1. Morphologic malocclusion

Lindqvist<sup>17</sup> conducted a study on 196 children aged 10–13 years to investigate existing differences in the prevalence of morphologic malocclusion between children with and without bruxism. The recorded types of morphologic malocclusion were Class I, II, and III molar relationship, overjet, and overbite. Bruxism was diagnosed by the presence of atypical facets on the permanent teeth. The results showed no statistically significant differences in any type of malocclusion between children with and without recorded facets.

Wigdorowicz-Makowerowa et al.<sup>18</sup> examined 2,100 school children 10 to 15 years old to study the relationship between malocclusion and bruxism. The type of malocclusion was not defined in the study. Bruxism was diagnosed by wear facets or pathologic abrasion of the teeth, tension of the masticatory muscles, cicatricial

thickening of the buccal mucosa near the occlusal surfaces of the posterior teeth, and impressions of teeth on the tongue or lips. Statistically significant differences were found in the prevalence of bruxism between children with and without malocclusion.

Egermark-Eriksson<sup>19</sup> investigated the relationship between bruxism and morphologic malocclusion on 402 children aged 7, 11, and 15 years. Bruxism was recorded in the presence of dental wear or attrition in both primary and permanent teeth and as clenching or grinding reported at an interview. The following types of morphologic malocclusion were reported at the mandible in intercuspal position: Class I, II, and III relationship at the canine and molar regions, inversion of incisors, crossbite, scissors bite, lateral open bite, extreme maxillary overjet, frontal open bite, and deep bite. The results showed significant negative correlation between dental wear and deep bite. No other correlation was reported.

Nilner<sup>11</sup> studied the relationship between morphologic malocclusion and bruxism on 440 children aged 7–14 years. The types of morphologic malocclusion recorded in this study were Class I, II, and III molar relationship, anterior and posterior crossbites,

**TABLE 1. STUDIES ON THE RELATIONSHIP BETWEEN MORPHOLOGIC MALOCCLUSION AND BRUXISM**

Investigator	Sample size		Age (Yrs)	Correlations		
	M	F		Type of malocclusion	Bruxism	P-value
Lindqvist 1971	89	107	10–13	No statistically significant difference in the type of malocclusion between children with and without facets		> 0.05
Wigdorowicz-Makowerowa et al. 1979	2,100		10–15	Malocclusion	A group of symptoms	< 0.05
Egermark-Eriksson 1982	136		7	Deep bite	Dental wear	> 0.05
	131		11			
	135		15			
Nilner 1983a	222	218	7–14	Class II and III molar relationship	Severe dental wear	< 0.05
Nilner 1983b	147	162	15–18	Deep bite	Frontal dental wear	< 0.01
Brandt 1985	673	669	6–17	Overjet/overbite Right molar relationship	Grinding	0.01 < P < 0.05
Gunn et al. 1988	67	84	6–18	Overjet, overbite Class II and III molar relationship	Grinding	> 0.05
Egermark-Eriksson et al. 1990	66		11	Scissors bite Anterior openbite Post normal occlusion	Grinding Clenching	0.06*
	53		15			
	119		20			

\* Indicates the value of R<sup>2</sup>.

anterior and lateral open bite, overjet, and deep bite. Bruxism was diagnosed by an interview and by the presence of dental wear classified in a scale according to its severity. Statistically significant correlations were found between Class II and III molar relationship and severe dental wear. Using the same methodology, the previous investigator<sup>12</sup> examined the relationship between morphologic malocclusion and bruxism on 309 adolescents. Significant correlation was reported between deep bite and frontal dental wear.

Brandt<sup>20</sup> examined 1,342 children and adolescents aged 6–17 years to study the association between morphologic malocclusion and bruxism. The recorded types of malocclusion were overjet, overbite, open bite, Class I, II, and III molar relationship, and posterior crossbite, while bruxism was identified as tooth grinding reported at an interview. The results showed statistically significant association between right molar relationship, overjet, overbite, and tooth grinding.

Gunn et al.<sup>21</sup> investigated the relationship between morphologic malocclusion and tooth grinding using Brandt's methodology on 151 migrant children aged 6–18 years. No statistically significant correlations were found between any type of morphologic malocclusion and tooth grinding.

Finally, Egermark-Eriksson et al.<sup>27</sup> conducted a longitudinal study to investigate the relationship between morphologic malocclusion and bruxism. Two hundred thirty-eight of 402 individuals of the original sample participated in the second examination, performed 4 to 5 years after the first examination. The criteria of diag-

nosing bruxism as well as the recorded types of morphologic malocclusion were the same as those used in their cross-sectional study.<sup>19</sup> The results showed no statistically significant correlations between any type of morphologic malocclusion and bruxism. Most of the relevant information of the reviewed studies related to morphologic malocclusion is summarized in Table 1.

## 2. Functional malocclusion

In an attempt to investigate differences in the prevalence of occlusal interferences between subjects with and without bruxism, Lindqvist<sup>22</sup> examined 78 14-year-old children. Bruxism was diagnosed by the presence of bruxofacets and a positive answer on a parental questionnaire. The 34 children who had bruxofacets and reported tooth grinding constituted the experimental group. The control group consisted of 45 children without bruxofacets who reported no tooth grinding. The types of functional malocclusion recorded in this study were lateral shift of the mandible and non-functional side interferences. The results showed significantly higher frequency of occlusal interferences in subjects with bruxism than in those without it.

The same investigator conducted a study<sup>10</sup> on 117 pairs of twins 12 years of age to investigate existing differences in the prevalence of occlusal interferences between individuals with and without bruxism. Bruxism was diagnosed by recording bruxofacets on permanent teeth clinically and on plaster models made from alginate impressions. Lateral shift of the mandible and nonfunctional side contacts were recorded as

TABLE 2. STUDIES ON THE RELATIONSHIP BETWEEN FUNCTIONAL MALOCCLUSION AND BRUXISM

Investigator	Sample size		Age (Yrs)	Correlations		
	M	F		Type of malocclusion	Bruxism	P-value
Lindqvist 1973	78		14	Statistically significant difference in the occlusal interferences between children with and without facets		< 0.05
Lindqvist 1974	117 twin pairs		12	No statistically significant difference in the occlusal interferences between children with and without facets		> 0.05
Egermark-Eriksson 1982	136		7	Anterior-posterior and vertical distance between retruded and intercuspal position	Dental wear	< 0.05
	131		11			
	135		15			
Nilner 1983a	222	218	7–14	Mediotrusion interferences	Dental wear	< 0.05
Nilner 1983b	147	162	15–18	Mediotrusion interferences	Dental wear	< 0.01
Egermark-Eriksson et al. 1987	66		11	Occlusal interferences	Dental wear	> 0.05
	53		15			
	119		20			
Gunn et al. 1988	67	84	6–18	Functional shift	Grinding	> 0.05

occlusal interferences. He found no statistically significant difference in the frequency of occlusal interferences between facet and nonfacet groups.

Egermark-Eriksson's<sup>19</sup> study examined the relationship between bruxism and functional malocclusion on 402 children aged 7, 11, and 15 years. Bruxism was recorded in the presence of dental wear or attrition in both primary and permanent teeth and as clenching or grinding reported on a questionnaire. The following types of functional malocclusion were recorded: unilateral contact in retruded position (RP), lateral deviation between retruded and intercuspal position (IP), large anterior-posterior distance between RP and IP, functional nonworking side interference (on lateral movement < 3 mm), and nonworking side interference (anywhere during the course of full lateral excursion). The results showed statistically significant correlation between retruded and intercuspal positions.

Nilner's<sup>11</sup> examination of 440 children aged 7–14 years investigated the relationship between functional malocclusion and bruxism. The types of functional malocclusion recorded in this study were interferences in the terminal hinge movement, mediotrusion interferences, and cuspid rise. Bruxism was diagnosed by an interview and by the presence of dental wear classified in a scale according to its severity. It was found that dental wear in the lateral sections was more pronounced in bites with mediotrusion interferences than in bites without them.

Nilner, using the methodology mentioned in the previous study, investigated the relationship between functional malocclusion and bruxism on 309 adolescents.<sup>12</sup> Significant correlation was reported between dental wear in the lateral sections and mediotrusion interferences.

Egermark-Eriksson et al.<sup>26</sup> followed up 238 of 402 children of the initial sample to investigate the relationship between functional malocclusion and bruxism. Their second examination, performed 4 to 5 years after the first, studied the children at 11, 15, and 20 years old. The criteria to diagnose bruxism as well as to record functional malocclusion were the same as those used in their cross-sectional study.<sup>19</sup> The results showed no statistically significant correlations between any type of occlusal interferences and dental wear or attrition.

Finally, Gunn et al.<sup>21</sup> studied the relationship between functional malocclusion and bruxism on 151 migrant children aged 6–18 years. Functional shift of the mandible was the only recorded type of functional malocclusion. Bruxism was identified as tooth grinding by an interview. No statistically significant correlation was reported between functional shift of the mandible and tooth grinding. Most of the relevant information of the reviewed studies related to functional malocclusion is summarized in Table 2.

## Discussion

The reviewed studies investigated the causal relationship between different types of malocclusion and

bruxism. The different types of malocclusion were recorded by a clinical examination. It has been reported that this method is highly reproducible if it is done by the same investigator.<sup>28</sup> Of the reviewed studies, five<sup>10, 17, 19, 21, 22</sup> were carried out by one investigator and the majority of the rest of the studies showed acceptable interexaminer variability. Therefore, the reliability of the occlusal variables recorded in these studies should be considered high.

The diagnosis of bruxism was performed by a questionnaire or an interview and by a clinical examination using the presence or absence of bruxofacets or dental wear as criteria. The errors that are expected using a questionnaire or an interview to collect information are under-reporting or over-reporting of this parafunction.<sup>29</sup> Although bruxofacets or dental wear can be measured objectively, they may not indicate the subject's current level of bruxism.<sup>30</sup> In other words, subjects who bruxed in the past may exhibit facets, while subjects who recently began bruxing may not show signs of dental wear. Also, dental wear can be caused by many factors other than bruxism.<sup>31</sup> Nevertheless, the reliability tests of the reviewed studies showed acceptable variability.

The hypothesis tested by the reviewed studies is that malocclusion, especially occlusal interferences, can initiate and maintain forceful clenching or grinding of the teeth. Statistically significant correlations were found between different types of morphologic malocclusion such as Class II and III molar relationship, deep bite, overjet, and dental wear or grinding (Table 1). Mediotrusion interferences, anterior-posterior and vertical distance between retruded and intercuspal positions, and lateral shift of the mandible together with nonfunctional side interferences were the types of functional malocclusion correlated with dental wear or bruxofacets (Table 2). To ascertain the meaning of these correlations regarding the causal relationship between malocclusion and bruxism, the following factors should be taken into consideration.

First, significant correlations were found in different age groups, and the type of malocclusion correlated with bruxism was not the same in all studies. Therefore, the results of the reviewed studies are inconsistent.

Second, a causal hypothesis is substantiated if a pathogenetic mechanism can be elucidated. The pathogenetic mechanism stated for the hypothesis tested in these studies is that a sensory input derived from the periodontal mechanoreceptors by stimulation from occlusal discrepancies is capable of causing bruxism.<sup>5</sup> This mechanism, however, implies an activation of the jaw closing muscles. The question that comes up then is whether a sensory input, arising from the periodontal mechanoreceptors, can activate the jaw closing muscles to produce a prolonged period of forceful teeth clenching or grinding. Evidence from neurophysiologic studies<sup>5</sup> suggests that the effect of a mechanical stimulation of the teeth is to reduce or inhibit jaw-closing

muscle activity. Also, Anderson and Picton<sup>32</sup> showed that the force applied to a tooth in artificially premature occlusion during chewing was less than the force taken prior to the creation of the prematurity. Christensen<sup>33</sup> reported that an interocclusal clearance was created between maxilla and mandible after an induced increase in occlusal height. Both studies failed to demonstrate increased jaw muscle activity. Furthermore, it has been reported that nocturnal bruxism can cause periodontal ligament trauma.<sup>34</sup> This implies that the protective function of mechanoreceptors is canceled in sleep during the forceful grinding or clenching of the teeth. In contrast, the pathogenetic mechanism of the causal hypothesis of the reviewed studies suggests that awareness of occlusal discrepancies during sleep is retained. This phenomenon, however cannot be explained physiologically.<sup>7</sup> Based on the above evidence, it seems unlikely that the activity of jaw closing muscles can be initiated reflexly by specific tooth contact and the resulting sensory feedback. Therefore, the pathogenetic mechanism of the tested causal hypothesis in the reviewed studies is not supported scientifically. As a result, the causal hypothesis cannot have a biological plausibility.

The causal hypothesis has been supported in the reviewed studies<sup>11, 12, 19, 26, 27</sup> by the common clinical assumption that bruxism is diminished or ceases following occlusal adjustment. This assumption is based on information provided by Ramfjord<sup>3</sup> and Posselt.<sup>4</sup> However, bruxism was not investigated directly in these studies. On the other hand, well-controlled experimental studies in adults<sup>35-37</sup> have shown that occlusal discrepancies are not etiologic factors of bruxism. Studies on children and adolescents to investigate the effect of occlusal adjustment on bruxism have not been published yet.

As mentioned earlier, the correlations between malocclusion and bruxism are not consistent. If malocclusion were a primary etiologic factor of bruxism one would expect to see consistently reported significant correlations. Also, the statistically significant correlations reported in the reviewed studies cannot have biological significance since the biological plausibility of the causal hypothesis cannot be inferred. Furthermore, extrapolating from the results of the experimental studies in adults, it is unlikely that occlusal conditions are an etiologic factor of bruxism in children and adolescents. Therefore, it seems safe to assume that malocclusion cannot increase the probability of the occurrence of bruxism.

## Conclusion

Early treatment of occlusal conditions to prevent bruxism is not supported scientifically since the statistically significant correlations reported by the reviewed studies are inconsistent and without biological significance.

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## Most child illnesses treated with over-the-counter medications

### Despite frequent ineffectiveness and risks, use of over-the-counter medication high among preschool-age children

Over-the-counter (OTC) medications continue to be an important component of health care in the United States for treating illness in preschool-age children, despite associated risks and frequent ineffectiveness, according to an article in a recent *Journal of the American Medical Association*.

Michael D. Kogan, PhD, National Center for Health Statistics, Hyattsville, Maryland, and colleagues, analyzed data from a nationally representative sample to estimate the prevalence of recent OTC medication use of preschool-age children. The sample consisted of 8,145 3-year-old children whose mothers were interviewed in person or by telephone.

The researchers found that 53.7% of the children in the sample were given some OTC medications during the 30 days prior to the survey. Seventy percent of recent child illnesses were treated with OTC medications. Among OTC medication users, the most common medications were cough or cold medicine (66.7%) and Tylenol (66.7%).

"Evidence that these (cold) medications are ineffective and may, in some circumstances, have adverse effects has apparently done little to dampen enthusiasm for their use," the authors write.

"Although the vast majority of OTC medications are used in accordance with the manufacturer's directions, the use of OTC medications may be harmful in some cases; adverse reactions and overdoses can occur. During the five-year period from 1985 through 1989, about 670,000 reports were received by poison control centers for children younger than 6 years involving either analgesic agents, cough/cold preparations, or gastrointestinal preparations."

"After adjustment for recent child illness, women who were white, more educated and had higher incomes were more likely to have given their child OTC medications. Women without health insurance were also more likely to have given OTC medications. Provider visits, but not telephone calls, were associated with a reduction in OTC medication usage," the researchers write.