Bite force in children with bruxism

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The bite force of 51 twelve-year-old bruxists was compared with that of a control group of the same age, in order to establish whether bruxism affects bite force and whether there is any connection between the degree of tooth abrasion and bite force. Criteria for bruxism were bruxo facets in the bite and, in the same children, teeth-grinding at the time of examination. No differences in bite force values for bruxists and non-bruxists were found for either very light bite or maximum bite. One group with dentine facets had a higher bite force value for very light bite than the children with enamel facets. Otherwise there was no difference between the various facet groups regarding the bite force produced.

Key-words: Bite force; bruxism; child

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By bruxism is meant grinding and/or clenching of the teeth without functional intent. Bruxism may occur in both the intercuspal position (centric bruxism) and the eccentric positions (eccentric bruxism) and it often causes atypical abrasion of the teeth (facets) (*Eschler*, 1961; *Ramfjord & Ash*, 1971). An increased activity of the masticatory muscles in bruxism has been described (*Eschler*, 1961; *Ramfjord & Ash*, 1971). Increased bite force after masticatory training was shown by *Friel* (1924), *Worner* (1939), *Brekhus et al.* (1941) and *Yurkstas* (1953). *Ahlgren et al.* (1969) indicate in a report of three cases with hypertrophy of the masseter muscle that hypertrophy, hyperfunction and bruxism are interrelated. It thus appeared to be of interest to study a larger material to discover whether bruxism causes a change of bite force and whether there is any connection between the degree of dental abrasion and the subject's bite force. In this material a comparative analysis was made of the different bite force values of children with and without bruxism.

MATERIAL AND METHOD

The material consisted of 50 boys and 46 girls, aged about 12, from four different schools in Umeå. Bruxo facets in the bite were used as a criterion for the occurrence of bruxism (eccentric bruxism). By bruxo facets in children are meant enamel facets in the extreme occlusal position or dentine facets in the protruding position. Extreme occlusal position means that the occlusion is located more than 3.5 mm from the intercuspal position. The children with bruxo facets were divided

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Table I. *Means ($\bar{x}$) and standard deviations ($S.D._k$) for some anthropometric data on the bruxist and the control group, both consisting of 12-year-old boys and girls. The differences between the bruxist and the control group are not statistically significant*

Variable		Bruxists				Control group			
		Boys n=30		Girls n=21		Boys n=20		Girls n=25	
		$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$
Height	cm	152.1	6.5	151.8	6.7	149.7	5.8	155.4	6.0
Weight	kg	42.7	7.1	43.2	7.3	40.6	6.5	45.4	9.1
Wrist width	cm	50.8	2.9	47.2	3.1	48.4	2.9	47.7	2.8

into three sub-groups. Group 1 consisted of children with dentine facets in edge-to-edge occlusion with a shift up to 3.4 mm from the mid-line; group 2 consisted of children with enamel facets in the extreme lateral occlusal position and group 3 of children who had both enamel facets in the extreme occlusal position and dentine facets in edge-to-edge occlusion (*Lindqvist*, 1971). Bruxo facets were present in 30 boys and 21 girls of the 96 children, of whom fourteen (6 boys and 8 girls) were teeth-grinders according to the parents, i. e. they could be heard grinding their teeth during the night. Children with bruxo facets were termed »bruxists». The 20 boys and 25 girls without bruxo facets were used as the control group. There was no history of pain in the jaw muscles or mandibular joints in any of the children. In order to characterise the material, height, weight and wrist width were recorded. There were no differences between the two groups in regard to these data (Table I).

The equipment used was according to *Linderholm & Wennström* (1970). Bite force was recorded using the method described by *Linderholm et al.* (1971). The bite force was thus measured on the first molars. The apparatus was calibrated with known weights before and after each test. Before the recordings were taken the children familiarised themselves with the apparatus by making preliminary trials. Their first attempts consisted of light and heavy bites. They were then asked to bite with varying strength according to detailed verbal instructions, viz: very light bite (the children were told to bite as lightly as possible), light bite, heavy bite and maximum bite. Three series of recordings were made on the right and left sides respectively, with a pause of about 15 seconds between each series. The first and third tests were carried out in the following order: very light bite, light bite, heavy bite and maximum bite. The second series was performed in the opposite order (maximum bite, heavy bite etc.). Values for bite force on right and left sides were not significantly different. The mean values of the six recordings for very light, light and heavy bites were used to express very light, light and heavy bite forces respectively. The highest single value was taken as representative of maximum bite force.

The methodological error of a single recording of bite force at a given level was estimated as the coefficient of variation (v).

$$v = \frac{\sqrt{\Sigma \text{ variances for six recordings}}}{\Sigma \text{ means for six recordings}} \times 100$$

Summation was extended over 20 subjects chosen at random. Both bruxists

Table II. *Means ($\bar{x}$) and standard deviations ($S.D._k$) for different levels of bite force (kg) in teeth-grinders and bruxists*

	Bruxists					
	Teeth-grinders n=14		Not teeth-grinders n=37		Control group n=45	
	$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$
Very light bite	2.9	2.6	2.3	2.5	2.0	1.5
Light bite	7.9	5.3	6.1	4.5	6.3	3.7
Heavy bite	24.1	10.5	19.4	8.1	22.2	9.1
Maximum bite	50.5	8.2	45.5	9.5	45.8	11.0

and non-bruxists were included in the group. The coefficient of variation was 14.1 per cent for very light bite force, 17.2 per cent for light, 7.7 per cent for heavy bite force and 3.9 per cent for maximal bite force.

The coefficients of variation were large for submaximal bite force levels. Only one submaximal level, very light bite force, has therefore been analysed together with the maximum bite level.

RESULTS

Very light bite force

Mean values for very light bite force were 2.9 kg for the 14 teeth-grinders and 2.3 kg for the remaining bruxists. The difference was not statistically significant (Table II). Teeth-grinders are therefore included in the bruxist group.

Very light bite force was 3.3 kg and 2.6 kg for the boys in the bruxist and control group respectively. Corresponding values for girls were 1.3 kg and 1.6 kg. There were no statistically significant differences between the bruxist and control group (Table III). On the other hand, there was a statistically significant difference $p<0.01$ between boys and girls in the bruxist group — 3.3 kg and 1.3 kg respectively. There was also a difference in the control group — 2.6 kg for boys and 1.6 kg for girls. This difference was

Table III. *Means ($\bar{x}$) and standard deviations ($S.D._k$) for bite force value (kg) at very light bite and maximum bite in boys and girls with bruxism, including teeth-grinders, and control group*

	Bruxists		Control group	
Boys	n=30		n=20	
	$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$
Very light bite	3.3	2.9	2.6	1.4
Maximum bite	48.3	9.7	44.7	13.2
Girls	n=21		n=25	
Very light bite	1.3	0.8	1.6	1.4
Maximum bite	45.0	8.7	46.6	8.7

Table IV. *Means ($\bar{x}$) and standard deviations ($S.D._k$) for bite force (kg) at very light and maximum bite from bruxists with dentine facets in the protruding position (group 1), enamel facets in extreme lateral shift (group 2) and both dentine facets in protruding position and enamel facets in extreme lateral shift (group 3)*

Boys	1 n=11		2 n=9		3 n=10	
	$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$	$\bar{x}$	$S.D._k$
Very light bite	4.9	3.2	2.8	2.9	2.2	1.7
Maximum bite	47.2	7.2	46.7	10.0	50.8	11.1
Girls	n=5		n=11		n=5	
Very light bite	1.8	0.7	1.0	0.5	1.3	1.1
Maximum bite	47.0	4.8	43.3	10.7	46.6	5.8
Boys and girls	n=16		n=20		n=15	
Very light bite	3.9	3.0	1.8	2.0	1.9	1.6
Maximum bite	47.1	6.6	44.9	10.5	49.4	9.8

probably statistically significant ($p<0.05$) (Table III).

Bite force values for the group of boys with dentine facets only (group 1) were probably significantly higher than for the boys with both types of facets $p<0.05$ (group 3). No other significant differences were found between the facet groups, either for boys or girls, or between the groups if the values for boys and girls were combined (Table IV).

Maximum bite force

The maximum bite force was 51 kg for the 14 teeth-grinding children and 46 kg for the control group. The difference was not statistically significant ($p>0.05$). The maximum bite force of the other bruxists was not significantly different from that of the control group (Table II), nor did the separate mean values for boys and girls (48 kg and 45 kg respectively) differ significantly from corresponding values in the control group (45 kg and 47 kg respectively) (Table III). When the bruxist group was divided into sub-groups 1, 2 and 3 (see above), the mean values for maximum bite force did not differ significantly (Table IV). There was no significant difference in maximum bite force values between boys and girls.

DISCUSSION

The bruxist group in this study consisted of children with bruxo facets in the extreme occlusal position as well as children who according to their parents ground their teeth at night. The increased activity of the masticatory muscles described in cases of bruxism (*Eschler*, 1961; *Ramfjord & Ash*, 1971) may have the same effect on bite force as masticatory training. The effect of training on bite force has been reported in a number of studies (*Friel*, 1924; *Worner*, 1939; *Brekhus et al.*, 1941; *Yurkstas*, 1953). *Brekhus et al.* (1941), for example, found an average increase in bite force of 10 kg in both men and women after chewing paraffin wax an

hour a day for 30 days. Two weeks after the termination of masticatory training the bite force had fallen to around the original values.

According to *Ramfjord & Ash* (1971) the parodontium of bruxists probably has reduced sensitivity to touch. Together with the increased muscle activity, this could be expected to produce higher maximum values and also affect the very light bite force level of bruxists. The degree of abrasion and the location of the bruxo facets may serve to indicate the frequency of bruxism or the degree of bite force during bruxism. Thus a relation between the degree of abrasion and bite force would be expected. In agreement with the results of *Linderholm et al.* (1971), there was no significant difference in maximum bite force values between boys and girls.

Apart from a probably significant difference in very light bite force between two facet groups, there was no statistically significant difference in bite force either among the bruxists or between the bruxists and the control groups. Thus no definite connection was demonstrated between the degree of tooth abrasion and bite force or between bite force and bruxism. The findings were not in agreement with those of *Ahlgren et al.* (1969). The patients in Ahlgren's material, however, had extreme hyperactivity and hypertrophy of the masseter muscle, which was not the case in our material.

Bruxo facets were taken as criteria for bruxism. However, the presence of bruxo facets does not always mean that the subject is a bruxist at the time of examination. Bruxism can occur periodically (*Ramfjord & Ash*, 1971). It is possible, for example, that the facets were caused by grinding while the tooth became adjusted to the occlusal plane and that bruxism later ceased. In analogy with observations made by *Brekhus et al.* (1941), according to whom bite force decreased after the termination of masticatory training, any increase in bite force at the time of grinding should have been reduced when grinding ceased. Yet the fourteen children who, according to their parents, ground their teeth at the time of this study showed no statistically significant difference in values from the other children. The increased muscle activity seen in bruxism (*Eschler*, 1961; *Ramfjord & Ash*, 1971) is evidently not sufficient to have any training effect on the degree of bite force. The results of this study thus provide no evidence that bruxism in the eccentric occlusal positions affects the degree of bite force.

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