Bruxism in twins

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A twin investigation was carried out to elucidate the influence of heredity in the development of bruxism. The material consisted of 117 pairs of twins of four age classes, average age 12.1 years, in the county of Västerbotten. Zygosity was determined using blood group serological methods. Bruxism was diagnosed by recording bruxo facets. Occlusal interferences and palpation tenderness in certain masticatory muscles were also recorded.
The results show that monozygotic twins have a statistically significant higher frequency of the same facet pattern than do dizygotic twins. It was not established that heredity influences the occurrence of occlusal interferences or muscle tenderness. The study supports the hypothesis that hereditary factors are important to the genesis and pattern of bruxism.

Key-words: Bruxism; child, twins

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Bruxism occurs frequently in both adults and children, but its etiology has not been satisfactorily demonstrated. *Townend* (1959) drew attention to the possible connection of heredity with wear facets on teeth, and found in one pair of monozygotic twins the same pattern in the primary dentition. Several of the monozygotic pairs of twins studied by *Horowitz* (1963) showed similar abrasion patterns — suggesting genetic influence. *Abe & Shimakawa* (1966), using the questionnaire method, established a statistically significant connection between audible teeth-grinding in 3-year old children and in their parents when they were of the same age. By the same method, *Reding, Rubright & Zimmerman* (1966) found that 3- to 17-year old children who ground their teeth had a statistically significant greater frequency of blood relatives who also ground their teeth than control group children. *Olkinuora* (1972) found a hereditary tendency to bruxism in adults labelled »non-strain bruxists» compared with »strain bruxists».

The author has previously studied the occurrence of bruxism in children and also its connection with occlusal interferences, emotional disturbances and bite force (*Lindqvist*, 1971, 1972, 1973; *Lindqvist & Ringqvist*, 1973). The aim of the present investigation was to record the occurrence of bruxo facets in twins, and then to compare the monozygotic and dizygotic groups. Further, the presence of occlusal interferences and the frequency of muscle tenderness on palpation of certain muscle

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groups was placed in relation to the zygosity.

MATERIALS AND METHODS

Collection of twin data

The records of all twins born in 1957—1960 and living in the county of Västerbotten at the time of the investigation were obtained from the County Administration's information centre. The mean age of the twins was 12.1 (10.8—14.1) years. The total number of pairs was 127. Of these two pairs had moved out of the county. Two pairs were mentally retarded; the investigation could not be carried out in a standardised way on these children. Five pairs were not willing to participate in the investigation.

Zygosity was determined by means of serological examination, and blood samples were obtained from 115 pairs. Three pairs were not willing to undergo a blood test; of these, one pair of girl twins was excluded from the investigation but the other pairs, each consisting of a boy and a girl, were included. Thus 117 pairs took part in the investigation.

Each parent or guardian gave details of the twins' place of birth and told whether the twins were believed to be monozygotic or dizygotic. Both twins in each pair had been brought up in the same family and, except in five cases, had attended the same school class.

Serological typing

The serological analysis was performed by the National Forensic Laboratory in Stockholm. The blood group serological typing of the blood samples included the red blood cell antigens, isozyme systems and the serum groups. Methods used in the analyses were direct agglutination, agglutination inhibition, gel diffusion and immunoelectrophoresis in accordance with the standards applied to forensic serological material in determining paternity which meant that each blood group test was made at least twice.

Distribution of monozygotic and dizygotic twins

Table I shows the distribution of monozygotic and dizygotic twins according to the year of birth. The distribution between pairs of twins according to sex at birth male-male : male-female : female-female has empirically been given as 1 : 1 : 1 (*Townend*, 1959). The sex-distribution in the material was 41 : 46 : 40, which corresponds quite well with the theoretically anticipated distribution. On the basis of *Essen-Möller*'s (1941) calculations that about 40 % of all single-sex twins are monozygotic, the anticipated number of monozygotic pairs was 32. The number of 28 monozygotic pairs in this material did not constitute a statistically significant discrepancy.

Of the 117 pairs of twins included in the investigation, 106 were born in hospitals in Västerbotten and 4 in adjoining counties. The other 7 pairs were born in Skövde, Västerås, Stockholm and Gävle (Sweden), Vasa and Uleåborg (Finland), and Hamburg (W. Germany).

Five pairs were thought by their parents or guardians to be monozygotic, but were dizygotic according to the blood group serological diagnostics. Three investigators compared colour photographs (profile and full-face) and dental casts from these five pairs and unanimously considered them dizygotic.

Diagnosis

Bruxism was diagnosed by recording bruxo facets (atypical facets) on the

Table I. *Distribution of monozygotic (MZ) and dizygotic (DZ) pairs of twins according to year of birth and sex*

	MZ		DZ			
	Male	Female	Male	Female	Male-Female	Total
Born in 1957						
Blood-test	0	7	7	4	7	25
No blood-test				2		2
Born in 1958						
Blood-test	1	4	7	3	13	28
No blood-test			1		2	3
Moved			1		1	2
Born in 1959						
Blood-test	1	3	10	7	9	30
No blood-test				2	1	3
Born in 1960						
Blood-test	7	5	5	3	12	32
No blood-test			1		1	2
	9	19	32	21	46	127

permanent teeth using *Lindqvist*'s (1971) method (Figs. 1, 2, & 3). The facets were compared within the pairs of twins. They were recorded both clinically and on plaster models made from alginate impressions. By recording from the models it was possible to obtain a more definite impression of the location and size of the facets, especially those on the molars. The size of the molar facets was recorded within each pair and they were judged as large when at least one cusp was reduced in height to a large flat surface (Fig. 4). The result of the serological typing was not known to the examiner either at the time of the clinical examination or when the data were obtained from the models.

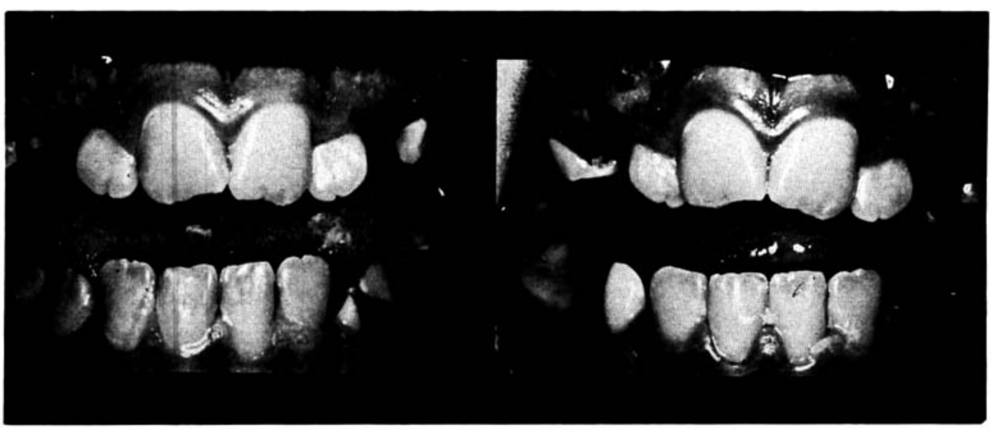

Fig. 1. Frontal view. Similar pattern of abrasion of the incisors can be seen. Monozygotic twins.

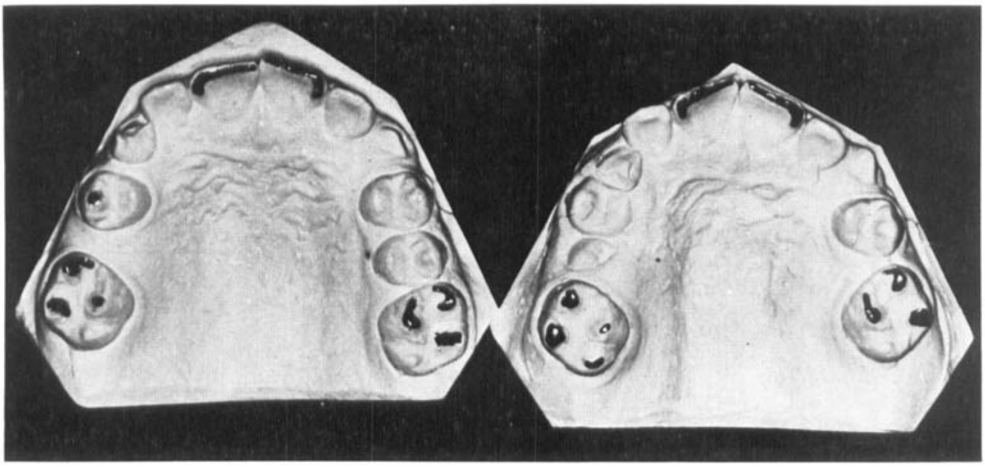

Fig. 2. Occlusal view, study models of the upper jaw. Monozygotic twins.

The canine was noted as being present when it occluded with the antagonist in the intercuspal position. *Lindqvist* (1971) demonstrated that school children with canine teeth in occlusion had certain types of bruxo facets significantly more often than those whose canines had not yet erupted. The data from the present study were compared to the earlier data.

Two types of occlusal interferences were recorded. Lateral slide in moving from the retruded contact position to the intercuspal position was recorded as interference if the slide was $\geqslant$0.5 mm. Non-functional side contacts were recorded as occlusal interferences if they limited the occlusal contacts to the non-functional side (*Ramfjord*, 1961; *Krogh-Poulsen* & *Olsson*, 1968).

Musculus masseter and m. pterygoideus lateralis were also palpated in 114 pairs, using a method described by *Carlsson* & *Helkimo* (1972). Tenderness on palpation was recorded when the patient reported that the palpation was painful. The remaining three pairs were excluded

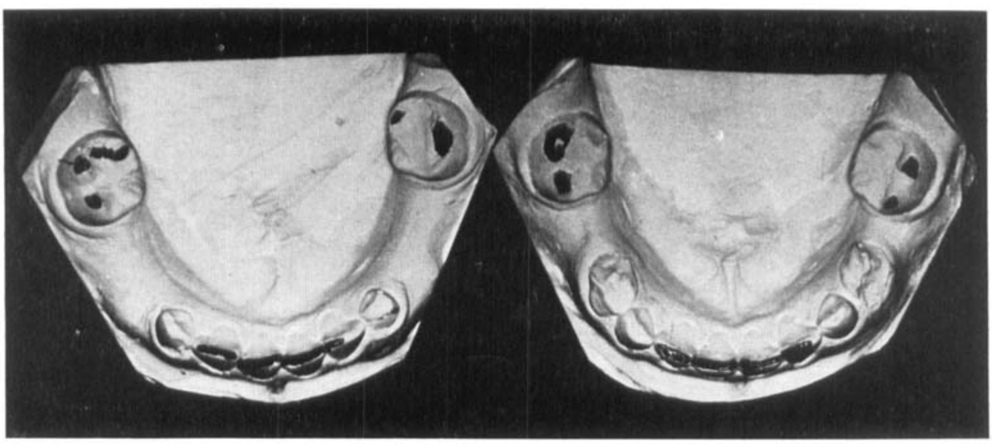

Fig. 3. Occlusal view, study models of the lower jaw. Monozygotic twins.

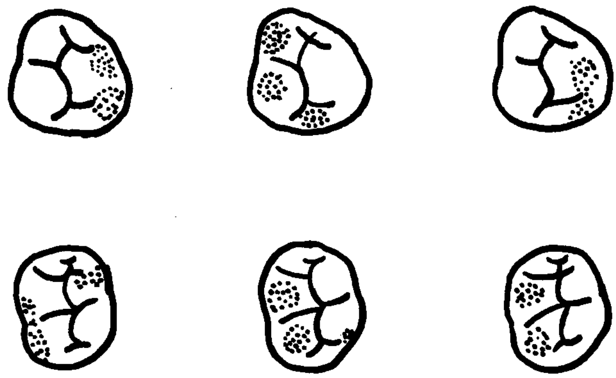

Fig. 4. Examples of molar facets.

because of incomplete data or lack of cooperation.

In order to compare the material with other twin materials, overjet and overbite were measured on the models according to *Lundström*'s method (1948). Each child's height and weight were recorded at the time of examination.

Environmental factors have been shown to be correlated to the occurrence of bruxo facets (*Lindqvist*, 1972). Therefore the individual twins were grouped according to whether they lived in a densely or sparsely populated area and compared with regard to the occurrence of bruxo facets. The county of Västerbotten has many sparsely populated areas.

RESULTS

Distribution of variables in the material

Bruxo facets were recorded in 54 % of the total material. There was an almost statistically significant difference in the distribution of facets between boys (61 %) and girls (47 %) (Table II).

Bruxo facets were found in 65 % of the children whose canine teeth had erupted and were in occlusion, as against 45 % in whom this was not the case. The difference was statistically significant (Table III). The cusps of the molars were reduced in height through the full thickness of the enamel only in teeth in which there were dental fillings. Of the children with recorded bruxo facets, 34 % had large molar facets and those without had 11 %. Seventy-five per cent of these had occlusal interferences and palpation tenderness, or palpation tenderness only. The difference in occurrence of muscle tenderness between the groups with and without bruxo facets was highly significant.

None of the children had subjective symptoms of functional disorders of the masticatory system.

Table II. *Presence of bruxo facets in boys and girls*

	Boys	Girls	Total
Recorded bruxo facets	73	54	127
No recorded bruxo facets	46	61	107
	119	115	234

$\chi^2 = 4.87,\ 0.01 < p < 0.05$

Table III. *Presence of bruxo facets in children without and with erupted canine teeth*

	Facets	No facets	Total
No canines	55	68	123
Canines	72	39	111
	127	107	234

$\chi^2 = 9.54,\ 0.001 < p < 0.01$

Table IV. *Distribution of subjects according to presence of bruxo facets, muscle tenderness and occlusal interferences*

	No facets	Facets	Total
Muscle tenderness only	14	26	40
Occlusal interferences only	27	25	52
Muscle tenderness and occlusal interferences	10	12	22
No muscle tenderness or occlusal interferences	56	58	114
	107	121	228

Table V. *Localization of muscle tenderness in m. masseter and m. pterygoideus lateralis in subjects with and without bruxo facets*

	Facets	No facets	Total
Unilateral symptoms, one muscle group	11	13	24
Unilateral symptoms, two muscle groups	1	2	3
Bilateral symptoms in the same muscle group	3	2	5
Bilateral symptoms in different muscle groups	23	7	30
	38	24	62

The occurrence of observed symptoms is reported in Table IV. Occlusal interferences were diagnosed in a total of 32 % of the children. In no case was non-functional side interference recorded if lateral movement was less than 3 mm. Occlusal interferences together with muscle tenderness on palpation was found in 10 % of the children. There was no statistically significant difference in the frequency of occlusal interferences between facet and non-facet groups, nor did the number of children with muscle tenderness on palpation differ significantly in the two groups.

Muscle tenderness was recorded in a total of 27 % of the 228 children examined. There was no statistically established difference between the sexes in the frequency of diagnosed muscle tenderness.

The distribution of diagnosed tenderness in the two muscle groups examined can be seen in Table V. The number of cases with unilateral symptoms in a muscle group was much greater than those with bilateral symptoms, both in the facet and the non-facet groups. The number of subjects with bilateral symptoms in different muscle groups, e.g. right masseter and left pterygoideus lateralis, was greater in the facet group ($p<0.001$).

Comparisons between monozygotic and dizygotic groups

Height, overjet and overbite showed

Table VI. *Intra-pair variations in height, weight, overjet and overbite in monozygotic (MZ) and dizygotic (DZ) pairs of twins*

	MZ			DZ				Significance
	n_M	$\bar{x}_M$	$S^2_{I,M}$	n_D	$\bar{x}_D$	$S^2_{I,D}$	F	
Height	27	149.70	3.09	44	150.90	35.51	11.50	$p < 0.001$
Weight	27	40.00	13.66	44	39.10	20.49	1.50	$p > 0.05$
Overjet	27	2.39	0.35	43	3.02	1.87	5.40	$p < 0.001$
Overbite	27	3.78	0.46	43	3.56	1.32	2.90	$p < 0.01$

S^2_I, Mean intra-pair variance $= \frac{\Sigma d^2_i}{2n}$ $\quad d_i$ = difference in the i-th pair $\quad F = \frac{S^2_{I,D}}{S^2_{I,M}}$

Table VII. *The frequency of bruxo facets in the individual monozygotic (MZ) and dizygotic (DZ) twins*

	MZ	DZ	Total
Bruxo facets	29	98	127
No bruxo facets	27	80	107
	56	178	234

$\chi^2 = 0.18$ n.s.

Table VIII. *Distribution of monozygotic (MZ) and dizygotic (DZ) pairs of twins with and without bruxo facets*

	MZ	DZ	Total
Similar type of intra-pair bruxo facets	11	10	21
Dissimilar intra-pair bruxo facets	3	20	23
One twin with bruxo facets, one without	1	38	39
Absence of bruxo facets	13	21	34
	28	89	117

significantly greater intra-pair variation in the dizygotic than in the monozygotic group (Table VI). Regarding weight, however, there was no statistically significant difference.

There was no statistically significant difference in the frequency of bruxo facets between monozygotic and dizygotic twins (Table VII). The different combinations between twin type and bruxo facets are shown in Table VIII. Of the 39 pairs where one twin had bruxo facets and one was without, the sex distribution was as follows: twin boys — 10 pairs; twin girls — 11 pairs; boy and girl — 18 pairs.

A difference between the groups was noticed when the monozygotic and dizygotic pairs were divided as follows: in one group recorded bruxo facets were present or absent in both twins of each pair, and in the other group only one twin of each pair had bruxo facets (Table IX). It was established that in the monozygotic group there were more pairs with the same degree of intra-pair abrasion than in the dizygotic group.

The 83 pairs where one twin or both had

Table IX. *Comparison between monozygotic (MZ) and dizygotic (DZ) pairs of twins according to presence of bruxo facets*

	MZ	DZ	Total	
Both twins with or without bruxo facets	27	51	78	$\chi^2 = 14.67$ $p < 0.001$
One twin with bruxo facets, one without	1	38	39	
	28	89	117	
Both twins with bruxo facets	14	30	44	$\chi^2 = 11.95$ $p < 0.001$
One twin with bruxo facets, one without	1	38	39	
	15	68	83	
Same type of facet in co-twins	11	10	21	$\chi^2 = 11.37$ $p < 0.001$
Dissimilar facet pattern in co-twins	17	79	96	
	28	89	117	

Table X. *Comparison between monozygotic (MZ) and dizygotic (DZ) pairs of twins according to muscle tenderness and occlusal interferences*

	MZ	DZ	Total	
Muscle tenderness in both twins of a pair	4	8	12	$\chi^2 = 0.22$ n.s.
One twin with muscle tenderness, one without	10	28	38	
	14	36	50	
Occlusal interferences in both twins of a pair	4	9	13	$\chi^2 = 0.02$ n.s.
One twin with occlusal interferences, one without	14	35	49	
	18	44	62	

recorded bruxo facets were extracted from the material. These were then re-divided so that one group comprised the pairs where both twins had some form of bruxo facets, and the other consisted of pairs where one twin had recorded bruxo facets and the other had none (Table IX). In the monozygotic group there was a greater number of pairs where both twins had some form of recorded bruxo facet; the difference between the groups was statistically highly significant.

In comparing the group where both twins of a pair had the same type of bruxo facets with the other group where the intra-pair facet pattern was not the same, it was statistically established that a similar facet pattern was more common in the monozygotic pairs (Table IX).

When monozygotic and dizygotic pairs were compared for the existence of occlusal interferences and palpation tenderness, no statistically significant difference was obtained (Table X). In the two groups there were similar frequencies of pairs of one twin with occlusal interferences or palpation tenderness and one without.

Of the dizygotic twins, those from sparsely populated areas had an almost significantly higher frequency of recorded

Table XI. *Distribution of bruxo facets among individual monozygotic (MZ) and dizygotic (DZ) twins according to residence in sparsely or densely populated areas*

	Country-side	Town	Total	
		DZ		
Bruxo facets	75	23	98	$\chi^2 = 6.45$ $0.001 < p < 0.01$
No bruxo facets	47	33	80	
	122	56	178	
		MZ		
Bruxo facets	23	6	29	$\chi^2 = 0.02$ n.s.
No bruxo facets	21	6	27	
	44	12	56	

bruxo facets as those from densely populated areas. The distribution among the monozygotic twins showed no difference in this respect (Table XI).

DISCUSSION

Of the 127 pairs of twins 117 pairs participated in the investigation. The material can be considered representative of a population of corresponding age and geographical similarity (cf. *Allen, Harvald & Shields*, 1967).

Zygosity is most reliably determined using blood group serological typing or, even more reliably, using typing in combination with other methods (*Friberg et al.*, 1959; *Kraus, Wise & Frei*, 1959; *Leonhardt*, 1962; *Lundström*, 1963; *Keene*, 1968). Diagnostic certainty can never be 100 %, as both technical errors and extremely rare biological deviations such as mutations may influence the results. In the case of twins, serological typing demonstrates dizygosity when differences in the blood group are discovered. The absence of such differences in a large number of such variables, as was the case in the present study, indicates monozygosity with over 90 % certainty (*Broman*, 1973). Since each pair of twins lived in the same home and, except in five cases, attended the same school class, the intra-pair differences due to environmental factors seemed to be equal for monozygotic and dizygotic twins. A greater intra-pair variability among dizygotic twins could therefore be attributed to genetic factors. The variability calculable from the differences in dizygotic twins is, however, smaller than the variability in a population (*Dahlberg*, 1942).

The distribution of bruxo facets in the material is not statistically significantly different from that obtained by *Lindqvist* (1971), and the greater frequency of bruxo facets in children whose canine teeth have erupted to occlusion is in agreement with the results of that study. The twins are thus comparable to non-twin children of the same age in regard to the presence of bruxo facets with the exception that the frequency of bruxo facets in the boys was almost significantly higher than that in the girls in this twin group (Table II). There was, however, no statistically established difference between the sexes in the frequency of muscle tenderness.

It is difficult to make a direct comparison between the size of the molar facets, since there are different types of molar abrasion and it is difficult to determine the kind of movement and the degree of bite force that causes a certain facet size. The size of an abrasion facet is also dependent on other factors such as the hardness of the enamel, the food and the consistency and rate of flow of the saliva (*Begg*, 1954; *Shore*, 1959; *Reichborn-Kjennerud*, 1973).

The frequency of occlusal interferences, 33 % in the material, agreed statistically with that found by *Lindqvist* (1973) in a control material consisting of 14-year old children without recorded bruxo facets.

Palpation tenderness in one or more muscle groups was diagnosed in 27 % of the material. To make the examination as brief as possible, palpation of the masticatory muscles was limited to one elevator and one depressor, masseter and pterygoideus lateralis. The author has not been able to find any epidemiologic investigation giving details of the frequency of muscle tenderness in 12-year-olds. *Geering-Gaerny & Rakosi* (1971) found that 40.9 % of 238 children aged 8—14 had initial symptoms of dysfunction in the masticatory system. Increased pressure tenderness in musculus pterygoideus lateralis was diagnosed in almost all of those with these symptoms. The frequencies of muscle tenderness showed no sex difference. *Helkimo et al.* (1972) found the same distribution between men and women in a study of the masticatory system in Lapps. The number of cases with unilateral symptoms in this material was significantly greater than the number with bilateral symptoms. The same finding has been reported in clinical studies of patients with functional disorders of the masticatory system (*Kruse*, 1965; *Greene et al.*, 1969; *Agerberg et al.*, 1970).

It was especially interesting to analyse the group with muscle tenderness who did not have recorded bruxo facets on the incisor and canine teeth. The statistically established difference between the facet and non-facet groups in regard to diagnosed palpation tenderness in musculus masseter on one side and m. pterygoideus lateralis on the other may depend on lateral movement to extreme positions being more frequent in the facet group (Table V). Another reason for bruxo facets not always being diagnosed in these cases may conceivably be that the child has adapted himself to the intercuspal position and finds it without sliding via primary contacts, a movement pattern which may be fatiguing for the muscles. Palpation of musculus pterygoideus lateralis can sometimes be mistakenly experienced as painful. Bruxism might also be a recent phenomenon, which has not yet worn the teeth. Clenching might also occur in or near the intercuspal position not giving bruxo facets according to the definition used.

Monozygotic and dizygotic groups

The results agree with those of *Bawkin* (1973) who also found no significant intra-pair mean weight difference between 12-year old monozygotic and dizygotic twins. *Lundström* (1948) obtained results which indicated that the size of overjet and overbite was genetically influenced. The degree of influence was greater for the overjet than the overbite which is also the case in the results presented here.

Of the dizygotic twins, those from sparsely populated areas had an almost statistically significant higher frequency of recorded bruxo facets than those from more densely populated areas. This result might be interpreted as indicating that it is more bruxism-provoking to live in the country-side than in the city. Children in such areas often have to travel a long way to school in the main district, which means they have long working days. Moreover Västerbotten towns are not of the big city type and the environment probably does not put as much strain on children as the big city environment.

The results show that the monozygotic twins have a significantly higher frequency of the same intra-pair facet pattern than the dizygotics (Table IX). This indicates that heredity strongly influences the individual pattern of masticatory movement, and appears thus to be of importance in determining the presence or absence of bruxo facets. In the groups of twins in which one or both twins had bruxo facets, there was only one pair of twins in the monozygotic group in which only one of the twins had some form of bruxo facets (Table IX). *Olkinuora* (1972) expressed the view that only so-called genuine bruxism is influenced by genetic factors, and not bruxism caused by stress. This study probably includes both the above mentioned types of bruxists. In a study on the occurrence of stress in a normal school class material of 12-year-olds, 72 % of the children with bruxo facets showed symptoms of stress (*Lindqvist*, 1972).

In regard to the occurrence of occlusal interferences or muscle tenderness, genetic factors proved to be of no importance. The present study indicates that hereditary factors may influence central triggering of bruxism and, via morphology, the pattern of bruxism, but do not significantly influence the occurrence of such local triggering factors as occlusal interferences. Twin studies provide no information on the genetic mechanisms involved, but only tell us that genetic factors are of significance in the formation of, in this case, bruxo facets.

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