Bruxism in children with brain damage

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Ninety-one children with brain damage were examined with regard to the degree of dental wear in relation to the degree and symptom of brain damage. Abnormal wear was found in a statistically established greater frequency in the group of children most severely mentally retarded, while it was not found in children of normal intelligence. Of the children with most severe mental retardation, 8 were at a 6-month level of development and all of these had abnormal wear. The others had reached the one-year-old stage, at which it is likely that normal protective reflexes or the ability to sense pain in the parodontium begin to develop. Of 7 children with severe cerebral palsy, 4 showed abnormal wear and also belonged to the most severely mentally retarded group. The investigation shows that abnormal dental wear is more closely related to a low level of mental development than to the degree of severity of cerebral palsy. The absence of proprioception in the parodontium is discussed as a possible cause of bruxism.

Key-words: Bruxism; child; brain damage

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Children with brain damage sometimes show very severe dental wear; in control groups of normal children, no cases of such severe wear have been recorded. The severe wear indicates that these children have more pronounced bruxism than normal children (*Siegel*, 1960; *Magnusson & de Val*, 1963; *Swallow*, 1972). *Magnusson & de Val* (1963), *Rosenbaum, McDonald & Levitt* (1966) and *Fishman, Young & Haley* (1967) reported that bruxism was more common in children with cerebral palsy than in control groups. In studies of bruxism in mentally retarded children that have so far been published, the term 'abnormal abrasion' has varying implications; the authors have been unable to find any uniform definition.

Children with different types of cerebral palsy have been compared for the presence of abnormal wear, most often without taking into account their level of maturity. Children with other types of brain damage have generally also been relegated to one single group, when compared according to the presence of bruxism, even if their I.Q.'s have varied between 20 and 80 (*Gullikson*, 1969) or 24 and 100 (*Tannenbaum & Miller*, 1960). Several authors express the opinion that bruxism in persons with cerebral palsy occurs primarily in the athetosis group (*Album*, 1954; *Koster*, 1956; *Rosenbaum et al.*, 1966; *Isshiki*, 1968). However, *Siegel* (1960) found that if the symptom of cerebral palsy was sufficiently pronounced, abnormal wear was present just as frequently

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in children with spasticity as those with athetosis.

The aim of the present investigation was to find out whether high degree of dental wear is linked to any special type of mental retardation, and whether the degree of brain damage has any bearing on the degree of dental wear. The degree of dental wear in a group of children with different types of mental disorder, with or without cerebral palsy, and at varying levels of development, was therefore compared with the degree of dental wear in normal children.

MATERIAL AND METHODS

Ninety-one children with various types of brain damage took part in the investigation. They were divided partly according to the type of symptom of brain damage, partly according to their level of development. This level was assessed according to the school achievement the child was capable of. The children were divided according to school-type into four groups numbered 1—4 (Table I). Type 1 means ordinary basic school with children of normal intelligence. In type 2, special school; children can learn to read and write at a slower rate than usual — to about the level of a normal fourth class (I.Q. 60—75). Special schools may be found integrated in ordinary schools; the children often live at home and can, after training, manage to make their own way to school. They receive vocational training and when adult they can cope with simple outside employment or work in a sheltered workshop. In school-type 3 the children attend training classes in a special school (I.Q. 45—60), and must be supervised. They receive social and vocational training. The best pupils can, when adult. work in sheltered workshops, while those still requiring supervision engage in occupational therapy. Finally, in school-type 4 there are children with more severe mental disorders (I.Q. < 45) and several handicaps. Many of them are completely disabled and their teaching consists mainly of social training.

Table I. *Distribution according to type of brain-damage symptom and school-group, 91 children*

School-group	1	2	3	4	Total
Cerebral palsy					
Spastic	9	3	2	3	17
Non-spastic	3	2	0	5	10
Mongolism	—	1	14	2	17
Mental retardation					
Acquired	—	2	2	1	5
Origin unknown	—	23	14	5	42
	12	31	32	16	91

Included in the investigation are children with Down's syndrome, cerebral palsy and/or mental retardation. The mental retardation was partly of unknown genesis or inherited, partly (as in the children with cerebral palsy) caused by organic cerebral damage such as perinatal asphyxia or intracranial haemorrhage, and partly caused by postnatal trauma such as encephalitis. The children with cerebral palsy were divided into one spastic and one non-spastic group according to *d'Avignon, Bille & Hagberg* (1960). The non-spastic group included children with hypotonic diplegia, ataxia and dyskinesia. The average age of the children was 11.9 years (range 10.1—14.3).

The children with cerebral palsy were divided into three groups according to degree of severity: mild, moderate and severe. Children with the mild form were slightly disabled but could move freely and required no means of assistance. The

moderate form meant more severe disablement, and personal help with such procedures as dressing, as well as transportation help. Children with the severe form were completely disabled and required custody.

Bruxism was diagnosed by recording the degree of dental wear. Because of the poor participation of the patients, facets could seldom be matched against each other, and the size of extreme movements could not therefore be measured. The clinical assessment was supplemented with recording on plaster models in 84 cases; the other 7 did not co-operate when the impressions were made.

The degree of dental wear was determined by recording enamel and dentine facets on the permanent teeth. At times the enamel had been worn away on large areas of masticatory surface on the first molars (Fig. 1). The cusps that have to carry the heaviest pressure — the lingual in the upper jaw, the facial in the lower jaw — were sometimes so abraded that the occlusal surfaces sloped in a downward-facial direction (Fig. 2) (*Krogh-Poulsen*, 1973). Such wear was defined as abnormal.

An evaluation was made of the general level of development of the children in school-group 4. This level was estimated according to the children's ability to speak, to make contact, and to eat. They were divided into three groups for verbal ability: those without speech, those who used occasional words, and those who used 2—3-word sentences. Children without speech were estimated to be at a 6-month level of development, while using occasional spoken words and understanding them came at the one-year-old stage (*Annell*, 1965). The ability to make visual contact constituted the lowest degree of contact, while the next step was the recognition of people and objects. A child with these functions had reached a 6-month level of development. At a higher level of contact ability came phonetic contact with particular meaning, or some form of sign language. These recordings were made for all the children in school-group 4, except for one child since he had moved out of the county.

Eating ability was estimated according to the type of food: ordinary, puréed or liquid via tube.

RESULTS

For the whole material the frequency of abnormal dental wear was 17 % — divided according to school-groups 1, 2, 3 and 4: 0 %, 13 %, 9 % and 50 % respectively. Of 16 children in group 4, eight had abnormal dental wear. Distribution according to school-type and the degree of dental wear can be seen in Table II. The number of children in group 4 with abnormal dental wear was significantly higher than for the other school-types (Table II). They showed a degree of dental wear according to examples B and C in Fig. 1. Of the 7 children in groups 2 and 3 who had abnormal dental wear, 6 showed dental wear according to example A (Figs. 1 and 2).

The distribution of degree of dental wear according to symptoms of brain damage

Table II. *Distribution according to degree of dental wear and school-group, 91 children*

School-group	Abnormal dental wear	Normal dental wear	Total
1	0	12	12
2 and 3	7	56	63
4	8	8	16
	15	76	91

$\chi^2_{(2)} = 16.75$ $p < 0.001$

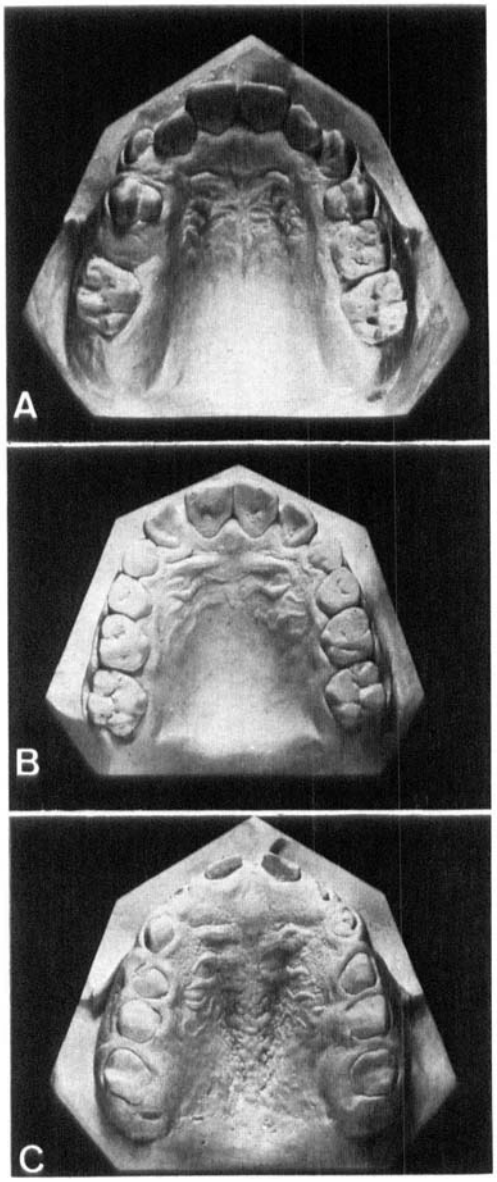

Fig. 1. Examples of different molar facets.

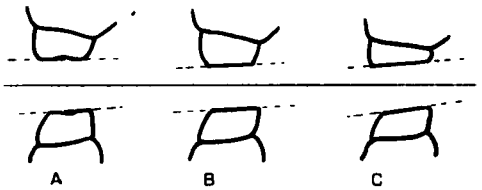

Fig. 2. Examples of different molar facets.

Table III. *Distribution according to degree of dental wear and type of brain-damage symptom, 91 children*

	Abnormal dental wear	Normal dental wear	Total
Cerebral palsy			
Spastic	1	16	17
Non-spastic	4	6	10
Mongolism	3	14	17
Mental retardation			
Acquired	1	4	5
Origin unknown	6	36	42
	15	76	91

Table IV. *Type of brain-damage symptom and presence/absence of abnormal dental wear, 91 children*

	Abnormal dental wear				Normal dental wear				Total
School-group	1	2	3	4	1	2	3	4	
Cerebral palsy									
Spastic	0	—	—	1	9	3	2	2	17
Non-spastic	0	—	—	4	3	2	—	1	10
Mongolism	—	—	1	2	—	1	13	—	17
Mental retardation									
Acquired	—	—	—	1	—	2	2	—	5
Origin unknown	—	4	2	—	—	19	12	5	42
	0	4	3	8	12	27	29	8	91

Table V. *Distribution of degree of cerebral palsy and school-group, 27 children*

School-group	Mild form	Moderately severe form	Severe form	Total
1	10	2	0	12
2	4	1	0	5
3	0	1	1	2
4	0	2	6	8
	14	6	7	27

Table VI. *Degree of cerebral palsy and presence/absence of abnormal dental wear, 27 children*

	Abnormal dental wear	Normal dental wear	Total
Mild form	0	14	14
Moderately severe and severe form	5	8	13
	5	22	27

$\chi^2 = 6.6 \quad p < 0.05$

Table VII. *Distribution according to degree of dental wear and speech and contact ability respectively. School-group 4, 15 children*

	Speech	Occasional words	No speech	Total
Abnormal dental wear	—	—	8	8
Normal dental wear	2	4	1	7
	2	4	9	15

	Visual contact	Recognition	Phonetic contact	Sign contact
Abnormal dental wear	8	8	—	—
Normal dental wear	7	7	6	5
	15	15	6	5

can be seen in Table III. Of 27 children with diagnosed cerebral palsy, 5 had abnormal dental wear. Among the 19 children with diagnosed cerebral palsy in groups 1, 2 and 3 there were none with abnormal dental wear (Table IV).

Grouping the children with cerebral palsy according to school-type showed that the mild forms of cerebral palsy were found in groups 1 and 2. The moderately severe forms were found mainly in groups 3 and 4, while the severe form appeared to some extent in group 3 and mainly in group 4 (Table V). Abnormal wear was found only in the moderate and severe forms of cerebral palsy (Table VI).

An analysis of the 8 children in group 4 who had abnormal dental wear showed that 1) there was one case of spastic cerebral palsy, four of non-spastic cerebral palsy, two of mongolism and one of acquired mental retardation; 2) all of them were without speech, in contrast to the other group with normal dental wear, of whom all the children but one could speak (Table VII); 3) all had visual contact and recognised people and objects, but were without the other forms of contact — phonetic contact and sign language (Table VII). All children in the group with normal dental wear ate ordinary food, while in the other group one was tube-fed and two were given puréed food.

DISCUSSION

The degree of dental wear defined as abnormal was not found in any child in normal classes studied previously (*Lindqvist*, 1971, 1973).

The results show that in the pathomechanism of abnormal dental wear the degree of mental retardation is of greater importance than other symptoms of brain damage (Tables IV and III). No child in school-group 1 had abnormal dental wear. In groups 2 and 3 seven children had abnormal dental wear but it was less pronounced than that shown by the children in group 4. The group at the lowest level of development, school-group 4, contained a statistically established greater number of children with abnormal dental wear than the other groups (Table II). *Brown* (1970) has

reported one case of abnormal dental wear in a severely retarded boy.

A more detailed gradation of the level of development of the children in school-group 4 was made by assessing their ability to make contact. The ability to speak occasional words and to link them with definite concepts usually comes at about the one-year-old stage (*Annell*, 1965). None of the children with abnormal dental wear who were in school-group 4 had reached this level of development — in contrast with the children showing normal dental wear. The phonetic and sign contact shown by the latter group indicated the beginning of a conceptual activity that usually starts after the age of one (*Beard*, 1970). This activity was absent in the children with abnormal dental wear. The level of development for this group is presumably nearer the 6-month-old stage, while the group with normal dental wear is at the one-year-old level regarding speech and contact ability. Another sign of immaturity in the group with abnormal dental wear was that one child had to be tube-fed and two ate only puréed food.

Normal protective reflexes for teeth and surrounding tissues have presumably not had time to develop at the age of 6 months. Since there was no destruction of the teeth in the group at the one-year-old level, one may assume that proprioception in the parodontium develops at the same time as the higher functions already mentioned. The abnormal dental wear found in children of school-group 2 and 3, though less pronounced than in those of group 4, is probably due to a diminished sense of pain or defective ability to interpret information concerning pain. This can affect the proprioception so that the normal protective reflexes against destruction of the teeth no longer function. Proprioception in the parodontium can thus be of significance in the generation of bruxism.

Siegel (1960) observed that abnormal dental wear was present in children with the severest forms of cerebral palsy, irrespective of whether there was spasticity or not. In the present study the children were roughly divided according to the degree of severity of their cerebral palsy. Of 27 children, seven had so severe a form of cerebral palsy that they were completely disabled; four of these showed abnormal dental wear. The material is small but the result might indicate a connection between abnormal wear and the degree of severity of cerebral palsy.

It was conceivable that the abnormal wear was the result of prolonged intense dental contact caused by spasticity in the masticatory muscles (*Siegel*, 1960). An examination of these children's masticatory muscles was therefore made, but no definite evidence supporting this hypothesis could be found. On the other hand, two of the children were observed to clench their teeth with great force during the examination — a reaction often found in mentally retarded people.

Children with a high degree of brain damage often show various types of stereotypy, especially when they lack any other occupation. Two of the children occupied themselves a large part of the day by grinding their teeth, which could be seen as a form of stereotypy. Their teeth were abnormally abraded since proprioception presumably was reduced.

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