

Tooth wear in children: An investigation of etiological factors in children with cerebral palsy and gastroesophageal reflux

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It has been suggested that tooth wear is becoming more common in both adults and children, but there are no definitive, longitudinal studies to confirm the subjective clinical impressions.^{1,2}

The etiological triad of attrition, abrasion, and erosion in relation to tooth wear is well documented, but the individual importance of each of these factors varies considerably from one patient to another. Anecdotal evidence indicates that the importance of erosion, particularly in children, may well be increasing. Published scientific evidence is, however, scarce.

It has also been suggested that children with cerebral palsy have an increased prevalence of tooth wear related to attrition. This has been stated to be due to parafunctional activity associated with abnormal muscular behavior. A common problem in neurologically impaired children is vomiting and a consequent failure to thrive. This is seen in children with cerebral palsy, and it is now known that gastroesophageal reflux occurs frequently in these children.³ Recently published studies have described an association between gastroesophageal reflux and palatal erosion.^{4,5} It is possible

that the tooth wear seen in children with cerebral palsy may be more related, therefore, to erosive factors than to the physical influences of attrition.

The aim of this investigation was to establish the prevalence and distribution of tooth wear in different groups of children attending a children's hospital and to assess the possible influence of gastroesophageal reflux, dietary factors, and parafunctional activity.

METHODS

Fifty-one children attending the dental outpatients department at Birmingham Children's Hospital were included in the study. They were examined clinically and all surfaces of all teeth were scored according to the criteria shown in Table 1. This is based on the Tooth Wear Index of Smith and Knight.⁶ All the children were examined by the same person (L.S.) under standard illumination from a Kavo dental operating light. The data were recorded by a trained assistant. In cases of doubt the lower score was assigned.

In an attempt to differentiate between the physical influences of attrition and abrasion and the chemical influence of erosion, a further grouping was undertaken. The data relating to the wear of the incisal edges, which is largely due to attrition, were excluded. Although occlusal surfaces of posterior teeth are also

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Table 1 □ Diagnostic criteria for Tooth Wear Index.

Score	Criteria	Surfaces
0	No loss of enamel surface characteristics	B, L, O, I
1	Loss of enamel surface characteristics	B, L, O, I
2	Loss of enamel, visible dentin on less than a third of the surface area	B, L, O
3	Loss of enamel with visible dentin Loss of enamel, visible dentin on more than a third of the surface area	I
4	Loss of enamel and substantial loss of dentin but not exposing pulp or secondary dentin Complete loss of enamel, pulp exposure or exposure of secondary dentin Pulp exposure or exposure of secondary dentin	B, L, O I

B = buccal or labial; L = lingual or palatal; O = Occlusal; I = incisal.

subject to attrition, erosion can be diagnosed on these surfaces, particularly in primary molars, and is seen as "ditching" or "cupping" of the surface, which is not coincident with occlusal contacts. The children were classified in one of three groups:

- No, or mild erosion: No score higher than 1
- Moderate erosion: At least one tooth in the dentition scored 2
- Severe erosion: At least one tooth in the dentition scored 3 or 4.

Training and calibration exercises were conducted and have been reported previously.^{7,8} Following the clinical examination a structured interview was undertaken by a different examiner (S.W.) and an extensive questionnaire was completed. This elicited information on medical history, medication, gastroesophageal reflux, feeding and drinking habits, parafunctional activity, and toothbrushing procedures.

In addition, children with cerebral palsy had twenty-four-hour ambulatory esophageal pH monitoring. This was undertaken after initial sedation with oral chloral hydrate. The esophageal manometry was performed using a triple lumen catheter passed intranasally. During the twenty-four hours of continuous monitoring, the patients were allowed to have their normal diets and to continue with daily activities.³

Statistical evaluation was done using analysis of variance and loglinear analysis. A *p* value of ≤ 0.05 was accepted as significant.

RESULTS

Of the fifty-one children examined, twenty-one had cerebral palsy. The other thirty children had medical problems of a wide range, many with congenital cardiac conditions, renal and liver transplants, or who were in remission from leukemia. Eight children of the thirty had a documented history of gastroesophageal reflux and these children were, placed, therefore, in a

Table 2 □ Mean age, range and number of participants in each group.

Group	Mean age in years	Age range in years	Number
A. Cerebral palsy with reflux	14.4	6.7 to 20.7	12
B. Cerebral palsy No reflux	10.0	3.9 to 12.9	9
C. Medical condition with reflux	8.5	5.2 to 13.5	8
D. Medical condition No reflux	7.9	3.5 to 13.4	22

separate subgroup. The remaining twenty-two had no history of reflux nor any medical problems known to be associated with it.

Of the twenty-one children with cerebral palsy, nine were found not to have any significant gastroesophageal reflux, but the other twelve had abnormal activity with a median reflux index of 11.4 percent and a range from 5.4 to 59 percent. The presence of reflux was unrelated to chronological or developmental age.³

The children were placed, therefore, in the following groups (Table 2):

- A. Cerebral palsy, with reflux
- B. Cerebral palsy, no reflux
- C. Other medical history, with reflux
- D. Other medical history, no known reflux.

There were differences in mean age between the groups, but there was also a wide age-range. When the erosion scores were assessed and the children were placed in the low, moderate, and severe erosion groups, it was found that nine of the twelve children (75 percent) with cerebral palsy and significant reflux had moderate or severe erosion. All the children in group C, with a different medical condition and significant reflux had moderate or severe erosion. The majority of the children with cerebral palsy or other medical problems and no reflux had, however, very low levels of erosion.

When the questionnaires were analyzed, there were found to be no statistically significant differences between any of the acidic-drink or food intakes.

Fewer than half of all the children in all groups had more than three intakes daily of soft drinks. There were also no significant differences in toothbrushing habits or the times at which toothbrushing was undertaken.

Seven of the twelve children with cerebral palsy and reflux had a history of parafunctional activity compared with two of the nine with cerebral palsy and no reflux. Four of the twenty-two children with a medical problem also had some parafunctional activity. These differences were not statistically significant.

Table 3 □ Levels of erosion, acidic beverage consumption and parafunctional activity.

Percentage of subjects showing each parameter with numbers in parentheses.

Group	Low	Erosion % (Number) Moderate	Severe	Acidic drinks > 3 × daily	Parafunctional activity	Bed-time acidic drink
A. Cerebral palsy with reflux	25(3)	25(3)	50(6)	17(2)	57(7)	—
B. Cerebral palsy No reflux	67(6)	33(3)	—	45(4)	22(2)	45(4)
C. Medical condition with reflux	—	75(6)	25(2)	25(2)	13(1)	25(2)
D. Medical condition No reflux	77(7)	17(4)	5(1)	45(10)	17(4)	23(5)

DISCUSSION

Of the total fifty-one children who were investigated in-depth in this study, twenty-five had moderate or severe levels of dental erosion. When compared to the UK Child Dental Health Survey of 1993, this is a high-level of erosion, although direct comparison is not possible due to the differences in the diagnostic indices and the age-ranges in the two studies.⁹

The children in groups A and C had significantly higher erosion levels than the other two groups. From this study it would appear that the tooth wear was related to whether the children had gastroesophageal reflux, not to whether they had cerebral palsy. This appeared to be much more important than parafunctional activity or any of the dietary influences. Differences have been found in "normal" children in the intake of soft drinks related to levels of erosion, particularly for carbonated drinks.^{7,10} There may be a relationship between the consumption of acidic foods and drinks and regurgitation associated with gastroesophageal reflux. Certainly acidic fruit juices have been shown to provoke reflux, and they may have, therefore, extrinsic and intrinsic effects. Nevertheless, much gastroesophageal reflux occurs due to the incompetence of the gastroesophageal sphincter, which may occur as a primary disorder or a secondary neuromuscular problem, such as occurs in cerebral palsy.

The results from the current investigation concur with those from the study by Bartlett *et al* that sug-

gested gastroesophageal reflux contributes to tooth wear. This may be much more important in the etiology of the tooth surface loss in children with cerebral palsy than the parafunctional activity, which has been classically regarded as the cause.

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