

*The greater availability of fruit-based drinks and carbonated beverages in shops, and particularly now in vending machines in schools, is raising serious dental problems.*

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# 'Soft' drinks are hard on children's teeth

**T**ooth wear is something we normally associate with ageing. We expect a certain degree of wearing away of tooth enamel and even the underlying dentine as a person gets older. The process of wearing away of the hard dental tissues occurs in three principal ways: *attrition*, due to tooth grinding; *abrasion*, due to the action of abrasive materials; and *erosion*, where the tooth tissue is dissolved by acids.

All three types of tooth wear can occur in children, but by far the most important in young people is the loss of tooth tissue resulting from dental erosion.

## Tooth attrition

Nowadays much of the food we eat is heavily refined, but some elements of foodstuffs contribute to tooth wear by virtue of their abrasiveness, so that chewing grinds away part of the occlusal or chewing surface of the teeth. This process is known as attrition.

As well as abrasive foodstuffs, habits like grinding our teeth, which are much more common than is generally realised, and often performed unconsciously, also produce this pattern

of wear. Figure 1 shows tooth wear from attrition in a 15-year-old who habitually ground his teeth at night. The teeth of prehistoric man characteristically show marked attrition. Their diet was so abrasive that their teeth were soon worn flat.

## Tooth abrasion

Another way in which teeth become worn is through vigorous toothbrushing, characteristically a forceful horizontal scrubbing action, which abrades the side surfaces of the teeth. Toothbrushing in combination with the more abrasive toothpastes can produce wedge-shaped notching at the necks of the teeth. Figure 2 shows this characteristic notching in an extracted upper canine, where the individual has cut more than halfway into the tooth.

'Toothbrush abrasion', as it is known, is seen more particularly in the older person, and is more prevalent in people with good oral hygiene than in those who take less trouble cleaning their teeth. The gums recede, exposing the more easily worn cementum, a thin layer of hard tissue covering the root surface in this region of the

Fig 1. Tooth wear from attrition in a 15-year-old who habitually ground his teeth at night. Note that the teeth are considerably shortened.

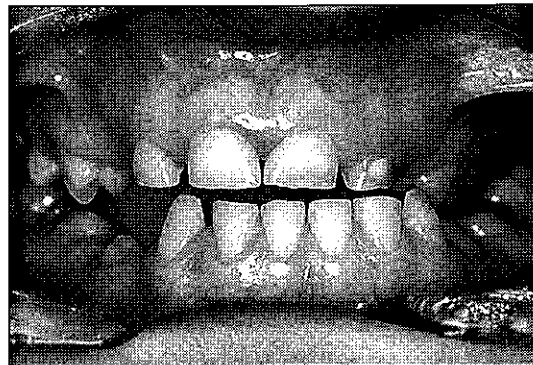


Fig 2. Toothbrush abrasion in an extracted upper canine, showing characteristic notching at the neck of the tooth where the individual has cut more than halfway through the root.



Fig 3. Acid erosion of the two upper central incisors in a child resulting from the consumption of fizzy drinks.



tooth. The cementum is abraded away, exposing the root dentine, which is supplied by nerve fibres. As a result the dentine can become hypersensitive. Pain, sometimes intense, can occur on minor stimulation from hot, cold, or sweet substances, or merely by touching the sensitive spot.

This is a common dental problem, and a number of toothpaste manufacturers market 'desensitising toothpastes' to give relief. Habits such as nail biting, pipe smoking and the opening of hair grips with the teeth are the sort of activities which, if carried out repeatedly, can produce characteristic wear patterns.

### Tooth erosion

This third type of tooth wear is the most important in children, and is therefore the principal subject of this article. Tooth erosion occurs

as a result of direct action by acid in the mouth, in which the tooth substance is simply dissolved. The bacteria that accumulate around the neck of the teeth do produce minute quantities of acid by breaking down carbohydrates, but this action results in dental decay (caries) rather than tooth erosion. Bacteria are not responsible for erosion. Rather, erosion is caused by relatively large quantities of acid at high concentrations.

It is sometimes possible to detect whether the offending acid is from an extrinsic source, for example from foods and drinks, or is intrinsic, that is, acid regurgitated from the stomach. The pattern of wear and the particular surfaces that are affected help determine the origin of the acid. Figure 3 shows the effects of acid erosion on the two upper central incisors in a child. In many cases there may be a combination of types of tooth wear, for example, erosion exacerbated by abrasion.

### A UK 'erosion survey'

Because of concern from many dental teaching centres in the United Kingdom and elsewhere that the prevalence of tooth surface loss and specifically dental erosion was quite severe in some young people, tooth wear was assessed in the most recent survey of the dental health of school children undertaken in the United Kingdom (O'Brien, 1994). Additionally, tooth wear was examined in the National Diet and Nutrition Survey conducted in pre-school children in 1992/1993, the results of which were published recently (Hinds & Gregory, 1995).

In the former study, assessment of dental erosion was made on two surfaces, the front (labial) and back (palatal) of upper incisor teeth, in both the primary (first) and permanent (second) dentitions. These are the first teeth to erupt. They are most likely to show evidence of wear if causative factors are present because they have been the longest in the mouth. The examining dentists were asked to score the surface according to the severity of wear (that is, whether enamel, dentine or the dental pulp at the centre of the tooth were involved), as well the extent of tooth surface affected. In the latter study, wear was assessed on primary incisor teeth.

### Toddlers and fizzy drinks

The results from the pre-school ('toddlers') sample of 1,390 1.5-4.5-year-olds, indicated

that 29% of the 3.5-4.5-year-olds had some erosion and that 10% had severe erosion involving the pulp (Hinds & Gregory). Accompanying the dental survey was an extensive enquiry into the child's diet together with anthropometric measurements. From these data the child's nutritional status was determined.

Despite a number of pertinent questions in the dietary questionnaire about factors thought to be related to dental erosion, such as the type of drinks consumed and their pattern of consumption, no significant relationship could be demonstrated between these variables and the presence of dental erosion. A weak trend emerged of a positive association between the consumption of carbonated beverages and erosion, especially of palatal surfaces (43% of children consuming such drinks daily had evidence of erosion compared with 28% in children who consumed these drinks less frequently).

### Erosion in 50% of 5-year-olds

In older children, results from the 1993 national survey of children's dental health, which examined over 17,000 5-15-year-olds, indicated that in the older children too, tooth wear was a significant finding (O'Brien, 1994). For example, 52% of 5-year-olds had evidence of loss of tooth tissue from palatal surfaces of teeth, with 24% reported to have more extensive loss involving the pulp. In 15-year-olds there was evidence of some erosion of the incisor teeth in 27% of children, and for 2% the loss of tooth tissue was severe, affecting at least dentine but in some cases pulp tissue as well.

No attempt was made during the questionnaire part of this survey to look into children's dietary habits, so that no conclusions can be drawn about the likely causes of the erosion recorded.

A further survey of the dental and nutritional status of schoolchildren is being planned jointly by the Ministry of Agriculture, Fisheries & Food and the Department of Health; this time in 1500 5-18 year olds. In this next enquiry, to be conducted during 1996 and 1997 (a one-year period to include seasonal variation in diets), questions will be asked specifically to determine the causative factors associated with dental erosion.

### Where does the acid come from?

Broadly, there are two sources of the acids responsible for erosion of tooth tissue, intrinsic and extrinsic.

### Intrinsic

The intrinsic source is acid from the stomach which is regurgitated either voluntarily or, more usually, involuntarily. This type of reflux can occur asymptotically, so that the individual is unaware that it is happening.

In these circumstances, dental erosion may be the first indicator of disease elsewhere in the body. Asymptomatic reflux of gastric juices may not only impact against the teeth but some may be aspirated into the lungs. There is good evidence from the literature that children suffering from asthma and chest infections may do so as a result of aspiration of refluxed gastric contents. Persistent reflux can also lead to scarring and stricture of the oesophagus. This form of tooth surface loss is evident too in young people suffering from anorexia or bulimia.

### Extrinsic

The extrinsic source is from acids consumed as food, drink, or medicines, and includes acid from industrial sources. The latter is seen particularly in adults working in an acidic environment without adequate protection, for example battery workers exposed to sulphuric acid fumes, and welders. Occasionally there have been case reports in the literature of people suffering dental erosion as a consequence of frequent swimming in gas-chlorinated pools with poorly controlled pH levels. pH is a measurement of acidic/alkaline activity: the lower the value below 7 (neutral), the higher the acidic potential.

### Not enough H<sub>2</sub>O, too much CO<sub>2</sub>?

The most significant source of acid challenge to the teeth in children and adolescents is probably from bad dietary practice. In pre-school children, frequent consumption of insufficiently diluted fruit-based squash drinks and carbonated beverages, including 'diet' versions, is the prime cause of dental erosion. The dissolution of carbon dioxide in carbonated drinks results in a lowering of the pH and an increase in many instances of titratable acidity. Evidence from dietary studies conducted on children indicate that a significant number of infants under one year of age consume bottled cola-type drinks. Unfortunately, we have no data yet to be able to set a threshold of acid challenge to the teeth, below which we can say erosion definitely does not occur.

## Beware extra Vitamin C!

The evidence from studies in older children suggests that frequent consumption of soft drinks is the main culprit, especially carbonated beverages, many of which contain 'acidity regulators' to maintain their acidity and therefore their taste. 'Sports' drinks, heavily marketed towards those wishing to maintain an image of a healthy lifestyle, are just as damaging. This damage may be increased where drinks contain 'extra vitamin C', as this provides another source of acid, ascorbic acid. These drinks are commonly consumed after intensive exercise when the mouth is dry and thus devoid of the protective action of saliva, which helps to neutralise acids in the mouth. The greater availability of fruit-based drinks and carbonated beverages in shops, and particularly now in vending machines in schools, is likely to exacerbate this problem.

## Is erosion on the increase?

We do not know whether the prevalence of dental erosion is increasing in the UK or indeed in other countries, because as yet there are no data. We must await the results of the forthcoming National Diet and Nutrition Survey of 5-18-year-old children, which will indicate whether the prevalence has increased in this country by comparison with the 1993 Child Dental Health Survey.

What we do know is that patients who experience dental hypersensitivity require treatment, which is often unpredictable. Coating the exposed dentine surfaces with varnishes or desensitising agents is often ineffective, and if there is some improvement it is frequently short-term. More elaborate conservative treatment may be required, such as fillings or even root treatment. The options can be expensive and commit the patient to a lifetime of costly maintenance and care.

## Messages for teachers and parents

From a nutritional standpoint, it has recently been observed that children can consume so much in the way of fruit-based squashes, sugar-free or otherwise, that they lose much of their appetite and become malnourished as a result. This condition has been given the name 'squash syndrome'. Another consequence of squash syndrome is likely to be an increase in dental caries.

However, with respect to young people and tooth tissue loss we need to redouble our efforts

in the field of health promotion to ensure that the public is properly informed of the dental hazards of acidic intake, and that potential risk factors are minimised. This means . . .

- **Reducing the availability of damaging drinks to children, who may be less discerning than adults as well as feeling pressurised by peer groups to conform.**
  - **Providing ready access to safe alternatives such as water, milk, or well-diluted sugar-free squashes; and, for older children, having unsweetened beverages such as tea and coffee available.**
- And also, more specifically, making young people aware of the dangers of . . .
- **Frequent consumption of acidic foodstuffs, and in particular fizzy and fruit-based drinks.**
  - **Using, or misusing, their teeth as 'tools'!**
  - **Grinding their teeth away.**
  - **Brushing their teeth away.**

## References

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# Version 18

The 'pick and mix' Health  
Related Behaviour  
Questionnaire