Tooth wear — dental erosion†

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This article aims to address the issues arising out of the increasing concern by general dental practitioners of erosion-related tooth wear. The prevalence, common presentation, differential diagnosis, likely aetiology, prevention and management of suspected cases of this form of tooth wear are considered.

The last decade has seen a resurgence in interest in toothwear, specifically erosion. The topic has been highlighted by the increasing prevalence of tooth erosion in young people. The national child dental health survey in 1993[1] and the 1992–3 *National diet and nutrition survey: children aged 1½ to 4½ years,*[2] measured for the first time the prevalence of dental erosion on a national scale. This article attempts to answer some of the questions that are commonly asked, following the publication of the results of these two national surveys.

What is tooth wear? Is it just part of the normal ageing process?

Tooth wear is usually a combination of attrition, abrasion and erosion and some small loss of tooth substance can be regarded as normal. Indeed, a tooth wear index[3] has been described which measures wear from all sources and gives a set of maximum acceptable tooth wear scores. It serves as an indicator of likely wear for each decade of life from 25 years of age.

Attrition is wear from tooth-to-tooth contact, whereas abrasion is caused by an object-to-tooth contact such as toothbrushes; erosion is the irreversible loss of dental hard tissue due to a chemical process and not directly associated with mechanical or traumatic factors or with dental caries.

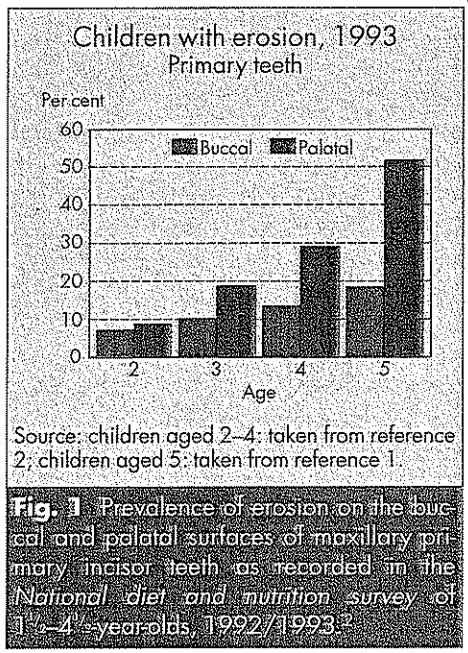
Although tooth wear has usually been divided into attrition, abrasion and erosion, in reality it is a combination of these but often with differing proportional effects.

If erosion and caries both involve chemical loss of tooth substance, how do they differ?

Caries results from the acids produced by the metabolism of dietary sugars and thus by definition occurs on plaque covered sites. As such, it generally presents in a more localised manner than erosion, with the latter occurring in plaque-free areas. Furthermore, the kinetics of the two processes tend to be rather different in that caries tends to be slower with a dynamic equilibrium between phases of de- and re-mineralisation.

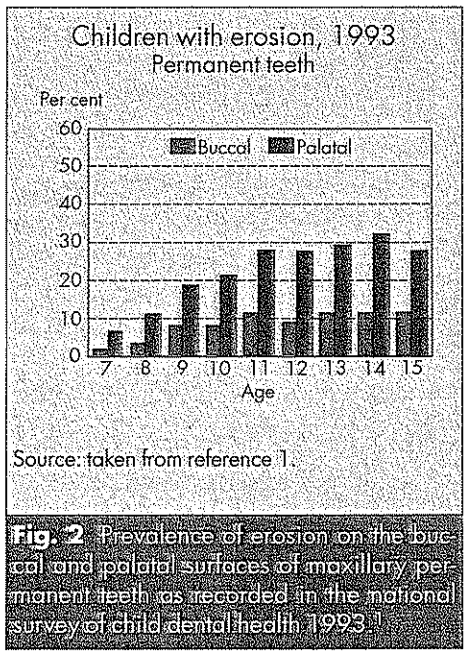
In contrast, erosion involves more rapid demineralisation[4] and remineralisation will probably only be seen during prolonged periods between intake of dietary acid. The presence of sugar in the diet is not pertinent to erosion, although sugar consumption should not be ignored since carious lesions can be superimposed on erosive lesions.

How can I be sure that what I am seeing is erosion and not something



Source: children aged 2–4: taken from reference 2; children aged 5: taken from reference 1.

Fig. 1 Prevalence of erosion on the buccal and palatal surfaces of maxillary primary incisor teeth as recorded in the *National diet and nutrition survey* of 1½–4½-year-olds, 1992/1993.[2]



Source: taken from reference 1.

Fig. 2 Prevalence of erosion on the buccal and palatal surfaces of maxillary permanent teeth as recorded in the national survey of child dental health 1993.[1]

If the cause of the tooth wear is predominantly erosive, the effects will be seen as concave loss of tooth surface with smooth, shiny margins, unlike the roughened areas normally associated with decalcifying surfaces[5,6] (see figs 3–8).

The site of the wear can also be diagnostic with more pronounced wear on lingual or palatal surfaces, whereas attrition occurs more on incisal or occlusal surfaces as a result of tooth-to-tooth contact. Abrasion is more likely to manifest on buccal or

†*This paper has been based on a BDA Erosion Fact File produced by the authors for the BDA in January 1995.*

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cervical surfaces of teeth and be worse on one side of the mouth than the other because of toothbrushing habits. However, the site of the erosion may be more closely determined by the nature of the causative factor.[7]

How common is dental erosion?

As has already been said, a certain amount of tooth wear is natural physiological wear and has to be seen as part of normal ageing of dental tissues. Recent articles, however, have provided useful information on the prevalence of dental erosion in children.[8,9]

The dental survey of children between the ages of 1½ and 4½ associated with the *National diet and nutrition survey*[2] and the national child dental health survey of 1993,[1] show that the prevalence of any erosion on the palatal surfaces of the primary teeth rises from 8% in 2-year-olds to 50% in 5-year-olds (fig. 1).

In the permanent dentition the prevalence of any erosion on the palatal surfaces is 8% in 7-year-olds, rising to 31% in 14-year-old children (fig. 2). The proportion of children exhibiting erosion extending into the dentine was 24% in the 5-year-olds and 2% in the 15-year-old children.

What is thought to be the cause for loss of tooth tissue by erosion?

There are a number of causes for erosion of tooth tissue but bear in mind that this process may be going on alongside abrasion and/or attrition and it is often practically difficult to separate the effects as well as the causative factors.

The most frequently cited reason for erosion nowadays in children is acidic drinks, either as pure fruit juices or as carbonated beverages.[5,10,11] This association, however, is not new in this country.[12] Rather we have become more aware of the phenomenon with the wider availability and usage of soft drinks. Consumption of soft drinks has increased dramatically since the 1950s by over 700 per cent. This trend shows no indication of levelling off and the UK figures are still a long way behind the figures in the USA.

Average consumption per head of the population can also hide important facts, as we know that soft drink intake is much higher in younger age groups. Forty-two per cent of fruit drinks are consumed by children aged between 2 and 9 years.[13] There is also huge individual variation.

Frozen fruit juices (ice lollies, juice on a stick, etc) may present an even greater risk because of the acid buffering capacity of such confectionery.[14] There are also other acidic dietary factors in children, as well as regurgitation, which may be contributory factors to erosion.

Presumably adults are less at risk?

That really depends on their usage of acidic beverages, as well as a host of other agents known to produce erosion. For example, pickled foods and vinegar applied directly to foodstuffs, can potentially be harmful if taken in excess. Similarly vitamin preparations, acid replacement therapies and a variety of medicines can produce similar effects.[6]

Overt regurgitation of acidic gastric contents has a fairly characteristic pattern of wear. It affects not only palatal surfaces of upper teeth but the occlusal and sometimes buccal surfaces of molar teeth.

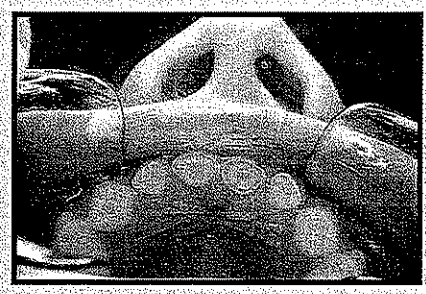

Fig. 3 Erosion of the palatal surfaces of maxillary primary incisor teeth in a 4-year-old child drinking carbonated beverages frequently.

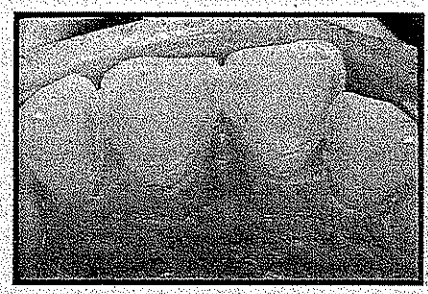

Fig. 6 Palatal views of the teeth of a teenager with a history of regurgitation.

Fig. 4 Erosion of primary canine and molar teeth in a 10-year-old child of dietary origin.

Fig. 7 Palatal views of the teeth of a teenager with a history of regurgitation.

Fig. 5 Erosion of the labial surfaces of the maxillary incisor teeth in a 10-year-old girl drinking carbonated beverages.

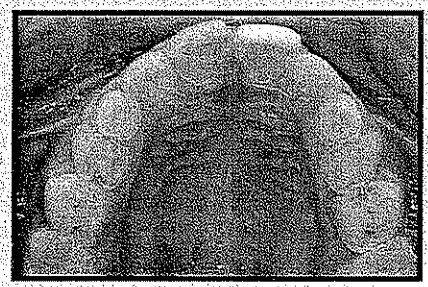

Fig. 8 Erosion, of dietary cause, involving the palatal surfaces of primary and permanent teeth in an 8-year-old girl.

This is seen in patients with anorexia and bulimia[15] or more subliminal reflux, which is often asymptomatic.[16]

Other common conditions that cause reflux in adults are sickness in pregnancy, chronic indigestion and heartburn, and hiatus hernia. Chronic alcoholism can also lead to erosion of tooth tissue.

Environmental causes for such tooth loss are industrial and frequent swimming in heavily chlorinated water.

Is this something we need to be concerned about — surely it is not a major problem?

As yet, this is not a major public health problem but the dangers, particularly in the young, of frequent consumption of carbonated beverages (even diet versions) or large volumes of fresh fruit juices do need to be highlighted. This is increasingly a problem these days when people are concerned with eating healthily, and fresh fruit juices are seen as part of this. However, it is the excessive consumption of these acidic foods and drinks that tends to be the problem.

Identifying the aetiological factors

- a careful history, with a thorough medical history is important
- this should be followed up by a three day diet history to elicit possible causative factors. Remember that, rather like dietary review for dental caries, we are often comparing two different time scales, with the causative factor operational some time ago and not evident in a current diet enquiry
- an occupational history is obviously important for adults
- monitoring wear is vitally important, so study models with a silicone rubber index are an important record
- standardised photographs can be helpful
- salivary tests for flow rate and buffering capacity
- if there is something obvious as a causative factor in the diet history, then the patient (or parent) can be counselled appropriately. This usually centres around reducing the frequency of intake of the erosive food or drink and certainly avoiding these as snacks or just before bedtime
- where the habit cannot be eliminated then confining its use to meal times will be helpful
- drinking acidic beverages through a straw will reduce the erosive potential on the, usually, more severely affected anterior teeth but molars can be as vulnerable
- finishing a meal with something neutral or alkaline may be beneficial, for example a small piece of cheese which, although acidic, will stimulate salivary flow and thus create an alkaline environment.

  Patients should also be instructed to avoid toothbrushing immediately after consuming something acidic as this is likely to accelerate abrasion[17]
- in the patient where gastric regurgitation, of whatever form, is a problem then fabrication of an occlusal splint to be inserted at high risk times can reduce the insult to the teeth. Additionally, if the splint is loaded with an alkali like magnesium hydroxide or sodium bicarbonate, both of which are readily available in supermarkets, this may further neutralise the effects of gastric acid. Non-acidulated fluoride gels may also be useful within a splint[18]
- as with patients taking sweetened medicines, early contact with the patients physician may result in a safer, non-erosive drug being substituted as well as general help in the most effective management of such patients. Physicians are often unaware that the dental problem is compounded by the prescription of sweetened antacids, which by the very nature of the way they are used may produce rampant decay. It is worth noting that one such preparation, Gaviscon is now available in a sugar-free preparation.[16]

Fig. 9 If your suspicions are aroused that tooth erosion is present then you need to identify the aetiological factor(s)

As with caries, frequency of consumption is a critical factor in determining the extent of the erosive process. There may be protective factors in the saliva and research is underway on this aspect now in the UK.

As far as tooth erosion being a cause for concern, we have to look at the implications of such findings. Excessive fruit juice consumption in the young is hazardous, especially in the primary dentition. The reduced amount of tooth tissue means that sensitivity or even frank pulp exposure, supervenes early on.

In the permanent dentition replacement of lost tooth tissue is expensive and while a search for a causative factor is being made prior to restoration, increased tooth sensitivity as well as poor aesthetics can be a problem.

What can be done to prevent this happening?

We need to be more vigilant, especially in the light of the results not only from the national child dental health survey, but also those from more local studies. Early, subtle changes in enamel need to be detected so that appropriate intervention is made. This relies on dentists being aware of the potential for erosion to occur, even in pre-school children. Once your suspicions are aroused then you need to identify the aetiological factor(s) (see fig. 9).

If I have a patient with such a problem, whose teeth are sensitive or very worn, what can I offer them?

The important point for patients like this is that you do not normally attempt to restore the eroded surfaces until you are absolutely sure the problem has stopped. This is why regular monitoring with study models is important. Otherwise you leave islands of restorations surrounded by surfaces that are continuing to erode. Worse still, caries may be initiated underneath the restoration, unbeknown to you.

Sensitivity is helped by using fluoride mouthrinses, application of fluoride varnishes and by the use of desensitising toothpastes. Once you have established that the causative factor has been removed then the affected surfaces can be restored. This is usually done with veneers or if the labial/buccal and palatal/lingual surfaces are both badly affected, then full coverage crowns may be indicated. Prior to restoring the sur-

palatal/lingual veneers. This necessitates the patient wearing a bite raising appliance in order to reduce the overbite.[19,20]

Conclusion

The heightened awareness of dental erosion means that we should all be more aware of the potential for this to occur in our patients. Early intervention with dietary advice, monitoring and treatment where appropriate, may help to reduce the financial burden which severe erosion often entails.

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