

# Erosion

## Detecting and managing dental erosion

### Dental erosion - the emerging dental problem?

Scientific interest in dental erosion has considerably increased in recent years. Additionally, a growing interest in dental erosion among dental practitioners gives the impression that the prevalence of erosive dental defects is increasing. Is this really the case or are we just becoming more aware of the problem? What is causing this increase, if it really exists, and what can we do about it?

This practice information sheet looks at the prevalence and aetiology of dental erosion, and contains some practical suggestions for management.

### Dental erosion – prevalence

Epidemiological studies have shown that the prevalence of dental erosion in children varies widely between 2 and 57% (Linnett and Seow, 2001). Such a variation is not surprising as different surveys use different indices and study different levels of severity of defects. Where there are combinations of attrition and erosion the age of an individual is also important as a lesion classified as physiological wear for an older person may be considered a pathological lesion for a younger person. The trend over time in prevalence of dental erosion is even more difficult to evaluate due to some methodological differences between studies and because most of the studies have been published in the relatively short period since the early 1990s.

### Causes of dental erosion

The aetiology of dental erosion is different to dental caries and depends on the presence of strong acids other than those coming from fermentation of carbohydrates by plaque microorganisms. There are two types of acids in the oral environment - extrinsic and intrinsic. **The extrinsic sources of acids** can be dietary, industrial or pharmacological and frequently involve the consumption of



Exogenous erosion in two wine assessors.

RHS - combined with attrition and abrasion (courtesy GJ Mount).



Erosion from bulimia



Endogenous erosion  
- 21 year old

acidic foods and drinks or acidic medications. These acids include phosphoric, citric, acetic, ascorbic, tartaric and malic acid.

Regurgitation of gastric contents into the mouth, as occurs in gastroesophageal reflux, is the most common source of **intrinsic acid** – mainly HCl. A list of the more common erosive agents is given in Table 1.

### pH is not a direct indicator of erosive potential

The pH of gastric acid is around 1.2, and the pH of exogenous acids vary between 2.5 - 4.0. However pH itself does not directly translate into erosive potential, as other chemicals accompanying the strong acid in a particular exogenous product may modify the erosive potential. Yoghurt is one of the products with pH around 4.0 but no evidence of causing erosion for most people. This is likely to be because of the high concentration of calcium and phosphate ions present, inhibiting the erosive demineralisation of apatite through the 'common ion effect'. Another example is mature red wine, which is much less erosive than young red or white wines, again it is presumed because of the many other chemicals present that inhibit demineralisation.

A multitude of factors may modify the erosion process, such as saliva, oral hygiene practices, and presence or absence of fluoride. Also, the salivary pellicle does protect the teeth from erosion. The thickness of acquired salivary pellicle varies within the dental arches, which may also be responsible for the site-specificity of dental erosion (Amaechi et al, 1999).

### Physical protection of teeth

This may involve coating of vulnerable surfaces with unfilled resin or GIC, or placement of protective adhesive restorations or crowns where severe loss of tooth structure has been experienced. Full coverage crowns are not a total solution to severe erosion, as the erosive acids will continue to attack the tooth structures apical to the crowns. If a patient has active erosion complex restorative work should be avoided. Some patients may wear a night guard for bruxing in which case a lining of neutral fluoride gel will be particularly useful when nocturnal gastric reflux is a problem.

### Continuing monitoring for erosive damage

This is essential for some time after control has been achieved or restorations placed as endogenous erosion in particular has a habit of re-occurring.

The monitoring part of management:

- the patient will be able to advise the practitioner of recurrence of endogenous erosion episodes, and effectiveness of control methods;
- recurrent dentinal sensitivity is a frequent useful indicator of continuing demineralisation, particularly where exposed roots are involved;
- the practitioner is able to assess whether tissue is still being lost. Methods which have been recommended for monitoring short term continuing loss of enamel structure (ie. over six weeks to three months) are: (a) place a small circle of unfilled resin on the lingual surface of vulnerable teeth. A 'lip' of lost enamel may be discernible by dental loupes around the area protected by the resin. (b) It may be feasible for some dentists to place a scratch line across vulnerable enamel using a No. 12 scalpel blade or similar. If the scratch diminishes or disappears over a one month period, active erosion is present.

Long term monitoring of continuing enamel loss is best achieved with repetitive impressions of vulnerable teeth, from which dies are formed. Assessment of loss of dimension with calipers will indicate that the erosion is still active.

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For exogenous erosion, the following useful alternatives should be suggested to the patient:

- drinking more water, particularly between meals;
- limiting the frequency of acidic foods and drinks by restricting to main meals; finish with a small piece of cheese or a drink of milk;
- consuming fruit juices, soft drinks and sports drinks through a straw;
- rinsing the mouth with water after any acidic challenge to teeth;
- substituting non acidic alternatives instead of acidic drinks eg. flavoured milk instead of all soft drinks and cordial;
- swallowing Vitamin C tablets or solutions rather than chewing.

### Chemical control and protection

A number of methods to provide chemical control of erosion have been proposed.

- Use of ant-acid preparations to neutralise acids, especially from gastric reflux: Meurman and others (1988) studied 'High Wear Risk Clinic' patients experiencing endogenous erosion and found ant-acid preparations not very practical or effective when compared with rinsing with water.
- Addition of calcium, magnesium, phosphates or fluoride ions to beverages to reduce their erosive potential: most experiments (Sorvari et al, 1988) have demonstrated that the amounts of these ions needed to inhibit the erosive effects of acidic beverages were so high that it would be impractical to do it and concentrations would often be unsafe for children.
- Application of concentrated topical fluorides to teeth prior to an erosive challenge: the application of concentrated topical fluoride gels and varnishes before the erosive challenge is likely to take place was found experimentally to provide some inhibition of demineralisation of both roots and crowns (Mok et al, 2001). This was found to be useful clinically where chronic endogenous erosion or wine assessor's erosion were experienced. Acidulated fluoride gels were found to be almost twice as protective as neutral fluoride gels. The timing of their use is critical. Gastric reflux is often spasmodic and unpredictable therefore self application of fluoride gels in the evenings for nocturnal reflux, or evenings and early mornings for morning reflux was found to be most useful. For wine tasters about to commence an intensive period of tasting, either self application of fluoride gels or professional application of fluoride varnishes the day before the judging sessions was found useful and did not affect taste discrimination.

### Further information

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When dental erosion is diagnosed, it is important to investigate and identify the acid source, and to determine if the process is ongoing. The aim of treatment is to eliminate the cause of acid exposure, and to minimize the effects of acid exposure where it is not possible to remove the acid source. For active erosion prevention is most important but where that is not possible composite resins should be used to protect the enamel. When erosion is not active, restorative treatment may need to be considered, eg. crowns to restore lost vertical dimension, and composite resin for aesthetics.

### Other factors affecting erosion

1. The period of time erosive acids remain in contact with the teeth, and frequency of contact have some effect on erosion severity and rate of progression.
2. Illegal or prescription drug use and severe dehydration following extreme exercise or to achieve weight loss (eg. rowers, jockeys, boxers), are risk factors that affect teeth only while the condition or its effect lasts. However some other risk factors may be long lasting, eg., from radiation damage to salivary glands or from Sjogrens' Syndrome or on-going medication for some incurable conditions.
3. Maturity of enamel with its increased resistance to acidic dissolution has been shown to reduce susceptibility to caries. However, there is no evidence that it will protect against erosive acids. The reasons are that erosive acids have the ability to dissolve even fluorapatites and fluoride enriched apatites which inhibit dissolution by the weaker caries causing acids.

Another aspect of tooth surface susceptibility relates to locations where the surfaces are most effectively protected by thick pellicle and plaque. For example, interproximal surfaces rarely become eroded, whereas those surfaces most exposed to natural and physical cleaning are most susceptible.

### High risk groups for erosion

Advanced erosion usually affects the elderly. Reduced saliva production, in some, can contribute to severe forms of erosion. The most common causes of dry mouth in older people are the ageing process and possibly poly-pharmacy.

**Advanced cases of erosion have recently been described in young people, including young children.**

These are usually associated with chronic gastric reflux, though many cases of early childhood caries are considered to be more erosion than caries. The latter cases result from prolonged contact of sweet, acidic drinks (eg. fruit juices, syrups, soft drinks) with deciduous teeth. It is not an uncommon practice that such drinks are put in a bottle for the child to suck whilst going to sleep. With teenagers and young adults, excessive consumption of soft drinks, including diet soft drinks, is a common cause of erosion.

Other categories of people at high risk of erosion are those that exercise extensively, distance swimmers using swimming pools, wine assessors, and citrus orchardists. There have been a number of reports of vegetarians with advanced erosion, resulting from excessive consumption of berries and fruits. Chronic asthma sufferers can experience advanced erosion caused by frequent use of certain asthma medication eg. puffers.

**Table 1. Causes of exogenous and endogenous erosion**

**The more common causes of exogenous erosion;**

**Dietary** citrus fruits, fruit juices, carbonated beverages, vinegar and pickles

**Medicines** ascorbic acid, HCl replacement therapy, frequent acetylsalicylic acid use, some iron tonics, some cough suppressant syrups, some antiseptic mouthrinses.

**Occupational** wine assessment, acid vapours (battery workshops)

**Recreational** improperly chlorinated large swimming pools, heated spas (Zero DT, 1996).

**The more common causes of endogenous erosion are vomiting, regurgitation or reflux due to;**

**Anatomical defects** eg. hiatus hernia, deficient gastro-aesophageal spinctre, aesophageal diverticulosis

**Psychological problems** eg. anorexia nervosa/ bulimia, severe alcoholism, severe stress

**Medication** for some severe health problems chemotherapy, severe asthma, or other drugs severely irritating the gastric mucosa

**Side effect of some cytostatic drugs**

**Associated with peptic ulcer or uremia**

**Prolonged nausea during pregnancy**

### Signs and symptoms of dental erosion

Changes seen in dental erosion range from slight loss of tooth surface characteristics to extensive loss of tissue with pulp exposure and abscess formation. Symptoms of dental erosion range from no symptoms through sensitivity to severe pain associated with pulp exposure.

In enamel, early signs of erosion include:

- rounding of sharp angles
- dentine cupping or scooping
- thinning of enamel
- any restorations present may appear to be above the tooth surface.

If the erosion continues, signs become more exaggerated leading to eventual total loss of enamel.

On exposed root surfaces, early erosion presents itself as a detectable softening of the surface and is indistinguishable from root caries. Erosive demineralisation of the root cementum and dentine appears to progress more rapidly than during caries process. With time, following repeated erosive episodes, the cementum/dentine becomes very soft, is easily damaged by brushing, coarse foods or dental scaling and polishing and becomes very sensitive. **However, the demineralised collagen, if it remains well hydrated by saliva and is not physically damaged, can be readily remineralised with fluoride and can regain almost its original profile and hardness.**

Table 2 summarises location of dental erosion lesions associated with different causes.

**Table 2. Characteristics of dental erosion associated with different causative factors**

Form of erosion	Affected areas
All	Affected tooth surface is smooth and appears crazed.
Dietary	Depends on cause.
Medication	Occlusal surfaces of the molars and palatal surfaces of the upper molars.
Gastric reflux or vomiting	Occlusal surfaces of the molars and palatal surfaces of the upper anteriors and premolars.
Occupational	Usually buccal surfaces of the upper and lower anterior teeth.

*Based on "The prevention of dental disease" Edited by JJ Murray 1989.*

### Differential diagnosis of dental erosion

It is important to distinguish dental erosion from dental caries (Table 3). Although the end result is often similar, these two pathologies rarely (but may) occur simultaneously at the same site. In cases of true erosion, the tooth enamel is demineralised by direct contact with acids, while caries is a disease that occurs by the action of acids produced by plaque biofilm micro-organisms (Moss SJ, 1998).

**Table 3. Erosion and dental decay - differential diagnosis**

Characteristics	Erosion	Early Caries
Tooth surface affected	Predominantly smooth surfaces, rare on approximal surfaces.	Anywhere, but less frequent on self-cleaning surfaces eg. occlusal 2/3 of labial or palatal surfaces.
Location in the mouth	Anterior or posterior teeth, often bilateral, in areas with low plaque levels	Posterior or anterior teeth, not bilateral, associated with areas of plaque retention.
Appearance	Surface smooth and appears glazed, if oral hygiene very good the affected area may be yellowish (dentine showing through) and well polished.	Surface smooth (noncavitated lesions), later may become cavitated.
Colour	Similar to tooth colour, may become yellowish as enamel becomes thinner, if dentine exposed becomes yellow and never stains.	Varies from white through yellow to dark depending on stage of lesion development and staining.

### Management of dental erosion

Accurate diagnosis of the condition and its causes along with patient's awareness is the first aspect in establishing the management program. The next task is to help the patient firstly control the causes where possible, and then if necessary protect the teeth against further damage. Endogenous erosion is the most difficult to control and protect the teeth against. Cases of Anorexia Nervosa or Bulimia can be extremely difficult to manage, as the patient is usually unwilling to acknowledge that an eating disorder exists. Direct suggestion of the condition will usually result in the patient being unwilling to return for further treatment. Because of these issues, the prime task is to protect the teeth against erosive demineralisation.

**Seeking medical help should always be recommended in any case of endogenous erosion.**

When exogenous sources of acid are causing erosion, patients are usually very willing and able to control the causes. The exception is wine assessors, whose livelihood requires them to be frequently tasting hundreds of wines. These will be considered as a special case later, as the numbers of people becoming involved in this industry in Australia is increasing rapidly.

There are four steps that are necessary in the management of erosion cases.

- Behavioural aspects of control
- Chemical control and protection
- Physical protection of the teeth
- Maintenance

### Behavioural aspects

The dental professional can recommend a number of simple behavioural control measures that can be very effective in reducing erosive damage, particularly from endogenous erosion.

These involve:

- rinsing the mouth immediately after the acidic attack, with water, milk or if possible 0.2% NaF mouthrinse (ie., containing 900-1000 ppm F ion)
- not brushing for at least 30 minutes after an attack, to permit some salivary stabilisation of the tooth mineral structure.