

# Non-carious tooth surface loss

A look at the causes, diagnosis and prevention of wear

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*“Diagnosis involves a need to identify the factor(s) contributing to tooth wear. This is to preserve the remaining dentition and to improve the long-term prognosis of any restorative treatment completed...”*

**N**on-carious tooth surface loss is a normal physiological process occurring throughout life, but it can often become a problem affecting function, aesthetics or cause pain. This loss of tooth structure or wear is often commonly termed abrasion, attrition, erosion and abfraction. Often, this wear is a complex combination of these and there is difficulty identifying a single aetiological factor. Diagnosis, prevention and treatment should be based on these multifactorial causes.

## Causes

Knowledge of the aetiology is important for preventing further lesions and halting the progression of lesions already present. In addition, treatment will be ineffective in the long term unless the aetiological factors are eliminated.

Here is a discussion of the common causes:

- 1. Congenital abnormalities:** Amelogenesis and dentinogenesis imperfecta (Figure 1) may cause regressive changes in teeth and extensive tooth wear can result from normal function.
- 2. Attrition:** is the loss of tooth structure or restoration caused by mastication or contact between occluding or interproximal surfaces. It primarily affects occlusal or incisal surfaces, but slight loss can occur at the contact points. This type of tooth wear can be significant in patients with “primitive diets” e.g. the aboriginal population - high quantity of dietary abrasives (Molnar et al, 1983). However the most common cause of attrition is probably parafunctional activity such as bruxism (Figure 2) (Smith BGN, 1989 and Dahl et al, 1975).
- 3. Abrasion:** is the loss by wear of tooth substance or restorations caused by factors other than tooth contact. Rubbing of pipes, hairclips, musical instrument mouthpieces, excessive tooth picking, etc, could cause this. The most common cause is incorrect or over-vigorous tooth brushing (Figure 3).



Figure 1. Dentinogenesis Imperfecta.



Figure 2. Severe tooth attrition.



Figure 3. Toothbrush abrasion.

- 4. Erosion:** is the progressive loss of dental tissue by chemical means not involving bacterial action. Acid is the most common cause of erosion demineralising the inorganic matrix of teeth.



Figure 4: Palatal acid erosion in bulimic patient.



Figure 5: Abfraction lesion.

**5. Dietary erosion:** may occur from food and beverages like fruit juices and soft drinks, which are highly acidic. The potential for erosive damage by these beverages may not be well understood by the public. Another source of dietary acids are orally administered drugs like chewable vitamin C tablets, aspirin, iron tonics and replacement HCl used by patients with gastric achlorhydria (Levith et al, 1994). Winetasters also often present with significant.

**6. Regurgitation erosion (Voluntary and involuntary):** is the return of gastric contents to the mouth. This is highly acidic (pH 2) and erosive. Repeated episodes may be more problematic.

**a. Involuntary regurgitation:** or gastroesophageal reflux can occur due to hiatus hernia or as a consequence of pregnancy or chronic alcoholism.

**b. Voluntary regurgitation:** is usually associated with an underlying psychological problem. Eating disorders commonly associated are anorexia nervosa and bulimia nervosa. The effect of acid regurgitation in bulimic patients often exhibits perimolysis - erosive lesions localized to the palatal aspect of maxillary teeth (Figure 4). Often the pattern of tooth wear in these patients is additionally affected by other factors like consumption of diet beverages and erosive foods (as patients strive to control their weight), xerostomia, caused by vomit-induced dehydration or drugs such as diuretics, appetite suppressants and antidepressants (Hellstrom 1977).

**7. Environmental erosion:** patients that are exposed to acids in the workplace, e.g. battery factory workers have shown a higher prevalence of erosion in Germany and Finland (Tuominen M 1989). Exposure to high levels of hydrochloric acid can also occur in improperly maintained swimming pools.

**8. Abfraction:** are cervical abrasive lesions thought to be caused by occlusal stresses. The tooth can flex causing tensile and compressive forces at the necks of teeth resulting in cracks in the enamel (Figure 5).

**9. Restorative materials:** the use of porcelain can accelerate tooth wear, especially if this porcelain is unglazed and rough/unpolished (Mahalick JA et al, 1971). Newer materials have been developed like the low-fusing porcelains, which have a finer particle size and exhibit similar wear as natural tooth structure. Metal occlusal surfaces are also recommended for those patients with severe wear or bruxism.

**10. Saliva and dry mouth:** Xerostomia may follow radiotherapy, medications, etc, and may produce both rapid caries and dental erosion. Because the acids are not well-buffered and not diluted by saliva, patients may suffer from erosion. In those patients who displayed accelerated tooth wear, there is strong evidence for a critical role of saliva, particularly of resting salivary pH. There are several reasons for a link between salivary dysfunction and tooth wear:

- Reduced clearance of dietary acids;
- Reduced pH of saliva;
- Reduced buffer capacity, preventing both dietary and also endogenous acids from being neutralized;
- Reduced remineralisation of surfaces; and
- Softening of tooth structure leading to accelerated wear from normal wear and tear under occlusal and incisive forces, and labial wear from tooth brushing.

**11. Body image:** Attempts to control body weight may influence patients to consume acidic foods, such as fruit and diet drinks. This struggle to achieve the ideal body weight may also increase the prevalence of eating disorders.

**12. Loss of posterior support:** It has been suggested that there is an increase in force per unit area in the remaining dentition, thereby causing an increase in tooth wear. A review of the literature does not support this assumption (Kayser and Witter, 1985).

**13. Drug use:** can be another cause of bruxism and has an effect on attrition and dehydration leading to possible erosive conditions.

### Diagnosis

Diagnosis involves a need to identify the factor(s) contributing to tooth wear. This is to preserve the remaining dentition and to improve the long-term prognosis of any restorative treatment completed.

An initial comprehensive examination is performed, including a thorough medical and dental history and an orofacial and dental clinical exam. Radiographs and other special tests may then be carried out. Such tests may include saliva tests, fracture finder, pulpal sensibility testing, etc.

Questions regarding diet, lifestyle, medications, stress, brushing habits, consumption of sports drinks, etc, can help in aiding diagnosis. Saliva testing may be appropriate; a food diary may also be required. A classification of wear can be made from clinically observed features and habits and careful collation of all this information is required to determine the risk factors and educate patients to help minimize long term damage by tooth wear.

Diagnosis needs to also be made as to whether the wear is physiological or pathologic? If wear has produced an unsatisfactory appearance, sensitivity, reduction in facial height and vertical dimension of occlusion then tooth wear is considered pathologic and this may constitute the need for treatment. A period of monitoring may be required to decide on appropriate management.

This monitoring may be carried out by:

- Photographic records;
- Measurements of teeth;
- Study model comparison;
- Tooth wear index;
- Impression of splint and comparison of changes over 3 months;
- Indices: Erosive tooth wear from a clinical view is a surface phenomenon, occurring on areas accessible to visual diagnosis. Diagnosis is therefore a visual rather than instrumental approach and can be compared with different Tooth Wear Indices - Indices by Eccles (1979) and Smith and Knight (1984) (Table 1).

### Prevention

Causes of tooth surface loss must be understood to adopt appropriate preventive measures.

Abrasive effects of aggressive tooth brushing can be reduced with education, but can be difficult to change especially with in-built memory. Patients must be informed of correct technique and to use a soft brush. Preference for abrasive dentifrice may need to be changed to a low abrasive one. Other abrasive habits can

**Table 1.**

Indices suggested by *Smith and Knight* referring to tooth wear in general; and *Eccles* including diagnostic criteria for erosive tooth wear.

<i>Tooth wear index according to Smith and Knight</i>		
Score	Surface	Criteria
0	B/L/O/I C	No loss of enamel surface characteristics No loss of contour
1	B/L/O/I C	Loss of enamel surface characteristics Minimal loss of contour
2	B/L/O I C	Loss of enamel exposing dentine for less than one-third of the surface Loss of enamel just exposing dentine Defect less than 1mm deep
3	B/L/O I C	Loss of enamel exposing dentine for more than one-third of the surface Loss of enamel and substantial loss of dentine Defect less than 1-2mm deep
4	B/L/O I C	Complete loss of enamel, or pulp exposure, or exposure of secondary dentine Pulp exposure or exposure of secondary dentine Defect more than 2mm deep, or pulp exposure, or exposure of secondary dentine
<i>Index according to Eccles</i>		
Class	Surface	Criteria
Class I		Early stages of erosion, absence of developmental ridges, smooth, glazed surface occurring mainly on labial surfaces of maxillary incisors and canines.
Class II	Facial	Dentine is involved for less than one-third of the surface. Type 1: ovoid or crescentic, concave lesion at the cervical region of the surface which should be differentiated from wedge-shaped lesions. Type 2: irregular lesion entirely in the crown which has a punched-out appearance where the enamel is absent from the floor.
Class IIIa	Facial	More extensive destruction of dentine particularly of the anterior teeth, most of the lesions affecting a large part of the surface, but some are localised and hollowed-out.
Class IIIb	Lingual or palatal	Lesions of the surface for more than one third of their area, incisal edges become translucent due to loss of dentine, the dentine appears smooth, and in some cases is flat or hollowed-out, gingival and proximal margins have a white, etched appearance.
Class IIIc	Incisal or occlusal	Incisal edges or occlusal surfaces are involved into dentine, flattening or cupping, restorations are seen raised above the surrounding tooth surface, incisal edges appear translucent due to undermined enamel.
Class IIId	All	Severely affected teeth, where both labial and lingual surfaces are extensively involved.
B = Buccal or lingual; C = cervical; I = incisal; L = lingual or palatal; O = occlusal.		

also be changed like pipe smoking, aggressive use of interdental sticks, etc.

Erosive effects may require change in dietary intake to minimize acidic drinks/foods. Regurgitation erosion is difficult to prevent and some chronic cases require referral. Milder cases are normally controlled with self-medication and dietary control. Counseling may be offered for those concerned with body image or suffering from eating disorders.

Patients must be advised to not brush immediately following acid intake or regurgitation but to rinse their mouth carefully. These patients may also benefit from a fluoride mouth rinse and/or higher fluoride concentration toothpaste. There has also been reports that the use of Tooth Mousse (GC) helps neutralize acid challenges from acidogenic bacteria in plaque and other internal and external acid sources. The CPP-ACP molecule binds to biofilms, plaque, bacteria, hydroxyapatite and surrounding soft tissue, localizing bio-available calcium and phosphate.

Erosion can often be exacerbated by a reduction in salivary flow and investiga-

tions like saliva testing may provide information to prevent dehydration and help stimulate salivary flow. Chewing sugar free gum may help in boosting saliva flow.

Bruxism and attrition may be prevented with the use of occlusal splints and stress management. Occlusal adjustment and addition with restorations may also be required.

Monitoring of all preventive measures needs to be performed even if no restorative treatment is performed as to the effectiveness of the program to ensure long-term success and maintenance for patients suffering from tooth surface loss.

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