

# RISK ASSESSMENT FOR TOOTH WEAR

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## ABSTRACT

Tooth wear has an increasing prevalence in the UK population. The aetiology is commonly multifactorial, and the aetiopathology is through a combination of erosion, attrition, abrasion and abfraction.

Erosion is associated with intrinsic or extrinsic acids, and therefore subjects with reflux disease and eating disorders are at increased risk. Fruit juice, fruits and carbonated drink consumption, frequency of consumption and specific habits are also risk factors.

Attrition is more prevalent in bruxists. Other habits need to be considered when defining the risk of tooth wear. Abrasion is usually associated with toothbrushing and toothpastes, especially in an already acidic environment.

Patients with extensive lesions that affect dentin may be at higher risk, as well as those presenting with unstained lesions. Monitoring of the progress of tooth wear is recommended to identify those with active tooth wear. Indices for tooth wear are a helpful aid.

## Definition

Tooth wear is defined as the loss of tooth tissue by means other than bacteria.<sup>1</sup> It can be further classified into the following categories: erosion, attrition, abrasion and abfraction. Tooth wear is usually a physiological aging process that has been affecting mankind for centuries. Evidence of this can be found in excavated human skulls where the dentition has remained fully or partially intact.

## Prevalence

The 2009 Adult Dental Health Survey showed that the prevalence of anterior tooth wear in the UK dentate population had increased from 66% in 1998 to 77% in 2009. While the incidence of severe tooth wear remains low, there seems to be an increasing number of younger individuals (aged 16-34 years) with moderate tooth wear which indicates an alarmingly rapid rate of disease progression.

## Aetiology

As well as being physiological, the progression of tooth wear can be modified by various internal and external circumstances. These can include the type of food and drink ingested, the quality of tooth structure, habit patterns and medical conditions. It is important to highlight that the tooth wear process is multifactorial. Rarely are worn teeth the result of a single pathological factor, and clinicians need to consider that a variety of aetiological factors are likely to be involved in most cases.

## Erosion

Dental erosion can be defined as the loss of hard tooth structure by chemical means, notably acids.<sup>2</sup> The acids involved in the erosive process are of non-carious origin and may be intrinsic or extrinsic.

## KEY WORDS

Tooth Wear, Erosion, Abrasion, Attrition, Risk Assessment

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Figure 1: Tooth wear associated with intrinsic erosion

incisors, as seen in Figure 1. In addition, the occlusal surfaces of molars<sup>4,5</sup> can be affected due to the way in which acids may be emitted from the gastro-intestinal tract. This can lead to ‘cupping out’ of the surfaces as seen in Figure 2.

However, ingested acids (such as fruit juices or sports drinks) in contact with the dentition may damage the entire dentition, or simply the anterior teeth.<sup>3,6</sup> This usually occurs along the labial and incisal aspects of the affected teeth and can also present with a smooth enamel surface, with loss of perikymata and surface texture.<sup>5</sup>

The presence of staining on tooth surfaces may be suggestive of historic erosive potential, as the implication would be that there had been sufficient time for dietary chromogens to adhere to the tooth surface without being worn off.

### Intrinsic acids

Gastro-oesophageal reflux disease (GORD) and dental erosion have been

### Presentation

Early diagnosis of dental erosion can be challenging to diagnose because early changes in the enamel surface can be visually difficult to detect and patients are usually asymptomatic. Although sensitivity is not common, when present, discomfort may occur from the application of thermal, mechanical or chemical stimuli. Careful history-taking, clinical examination and the appropriation of a reasonable recall

period is essential to ensure that suspected erosion is monitored and managed well.

The location of erosive lesions may help to identify the aetiology.<sup>3</sup> This is due to the origin of acid exposed to the teeth (extrinsic or intrinsic) and also because of the mode of exposure. For example, patients presenting with intrinsic acid-related tooth erosion will often be affected along the palatal aspects of



Figure 2: Cupped out erosion lesions occlusally and abrasion lesions buccally

linked to each other in numerous reports.<sup>7,9</sup> Some individuals may suffer with reflux without any GORD-related symptoms (silent refluxers) so identifying this group of individuals may prove a difficult task.<sup>10</sup>

Historic or current treatment with proton-pump inhibitors, such as omeprazole, may suggest a patient with increased risk of dental erosion.

Other causes include vomiting, which may be linked to stress, pregnancy, migraines, etc. Vomiting may also be self-induced, in the form of bulimia nervosa.<sup>11</sup>

Rumination is a phenomenon where the lower oesophageal sphincter is relaxed, allowing recently swallowed foodstuffs to re-enter the oral cavity, be re-chewed and swallowed once again.<sup>12</sup> Although rare in Western societies, rumination is a commonly occurring part of mealtimes in some cultures. Within Western cultures, the habit is more frequently noted among professionals and individuals with learning disabilities and has also been linked with psychological illnesses including depression.<sup>13</sup>

Chronic alcoholism is a condition that has also been linked as a cause of dental erosion<sup>3,4,14</sup> both intrinsically and extrinsically. Many alcoholic beverages such as red wine are acidic in nature<sup>3</sup> and have a direct erosive potential. Excessive consumption of these beverages may lead to vomiting, which also exposes the oral cavity to highly acidic gastric juices.

Another side effect of long-term alcoholism may be a reduction in the buffering capacity of saliva, which is thought to protect against further hard tissue loss.<sup>5</sup>

### Extrinsic acids

Extrinsic acids contact enamel and dentine most commonly in the form of food and drinks.<sup>12</sup> Citrus and sour items often contain vast amounts of acid in the form of citric acid. In contrast, most soft carbonated drinks contain phosphoric acid. Both acids can lead to tooth erosion and with acidic beverages becoming a major component of modern diets, a higher prevalence of tooth wear in the younger population is not wholly surprising. The importance of these acids comes in the mode of consumption and frequency of intake, with a higher frequency of exposure (e.g. repeatedly sipping fruit juice) and direct contact with dental hard tissues causing increased tooth wear (not drinking through a straw).

Peculiarly, adopting a healthy lifestyle has the potential to present one with dental erosion. Healthy diets, which are considered to include more fruits and vegetables, may lead to higher dental erosion in some individuals. Sports or energy drink consumers may also find their teeth at a higher risk of developing erosive lesions and if consumed when one is already dehydrated and with a reduced salivary flow, the effects may be even more significant.<sup>5</sup>

Regular swimmers may be at a higher risk of developing dental erosion if they exercise in pools with a low pH. Disinfection of swimming pools is performed using chlorinated gas and sodium hypochlorite. It has been found that dental erosion occurs in just under

40% of competitive swimmers training in a pool with a pH of 2.7.<sup>15</sup> However, current UK guidelines states the recommended pH of a swimming pool lies between 7.2 and 8.0.

Environmental acid exposure from industries where individuals were subjected to gaseous acids, such as those emitted from battery acids and gas-works, historically gave rise to tooth wear as an occupational hazard. However, tooth wear caused by these forms of acids is becoming increasingly rare due to more stringent regulations on these industries.<sup>16</sup>

### Other predisposing factors

Erosive lesions can be modified by several factors, of which salivary flow is a key factor.<sup>5</sup>

The oral soft tissue musculature is also thought to play a role in protecting some dental hard tissues from acid exposure while others that are unprotected are affected.

### Attrition

This is the wear of teeth following contact with opposing teeth.<sup>17</sup> This is a normal physiological action when teeth are grinding food together during mastication, but in patients with a parafunctional habit such as bruxism, attrition-related tooth wear can be very significant. Individuals with a Class II/2 incisal relationship can also be at greater risk of experiencing anterior tooth wear.



*Figure 3: Tooth wear with elements of erosion and attrition*

Bruxism is a habit developed often as a coping mechanism for stress and as a result may go through periods of activity and quiescence. However, the initial trigger for this could be due to changes in the occlusal surfaces of oral hard tissues, such as following the placement of a new restoration or the loss of a tooth, which also could also alter the position of remaining teeth.<sup>18</sup> Another possible cause has been highlighted as being psychosocial, such as one's stress adaptive capacity. Pathophysiological causes for bruxism, which are largely associated with sleep disorders, may play an important role too.<sup>19</sup>

Attrition may lead to loss of occlusal vertical dimension.<sup>20</sup> Patients presenting with tooth wear as a result of attrition often have flat incisal and occlusal surfaces with a loss of surface texture and morphology on the affected surfaces, as seen in Figure 3. There may be chips or fractures along these surfaces, giving an indication towards the cause of tooth wear. Attrition may present in a localised or generalised fashion affecting some or all of the occlusal and incisal surfaces of the teeth. It can be apparent as wear caused by occlusal ceramic restorations and as such, it is observed in the areas that

function opposing these restorations. An occlusal examination is a useful diagnostic aid and it can highlight attrition that manifests as matching wear facets.

## Abrasion

Abrasion is the loss of tooth surface material caused by friction against the tooth with an extrinsic agent, e.g. toothbrush bristles, dentifrices, foodstuffs, dental floss.<sup>17</sup> The characteristic appearance of abrasion-induced cavities is their location along the cervical margins of the teeth along the labial, buccal and interdental regions. The lesions are often associated with the type of brush bristle, amount of force used, frequency of brushing and abrasiveness of toothpaste.

However, a synopsis of clinical *in situ* and *in vivo* studies<sup>21</sup> concluded that tooth wear associated with toothbrushing only reaches pathological levels in cases of abuse or when acid erosion is also present.

## Abfraction

Abfraction is also often cited as a form of tooth wear but is a largely defunct term in the UK. It is a phenomenon thought to be induced from occlusal stresses.<sup>22</sup> Microstructural fractures are

noted in the areas of stress concentration which, similar to abrasion, tend to collect along the cervical margins.<sup>17</sup>

## Quality of tooth tissues

The inherent quality and nature of the dental hard tissues will also determine the extent to which tooth wear occurs.<sup>5</sup> For instance, those suffering hereditary dysplasias such as amelogenesis imperfecta, which affects the enamel and the extent of calcification, can be more susceptible to dental erosion.<sup>23</sup>

## Clinical diagnosis of tooth wear

When faced with the clinical scenario of a patient suffering with tooth wear, making a diagnosis is often challenging as the process is usually multifactorial.<sup>24</sup> For instance, erosion may result in the 'softening' of dentine and enamel, which may then undergo abrasion and attrition.<sup>2</sup>

A diagnosis can only be as definitive as the history and examination obtained from a patient.<sup>25</sup> The location, extent and severity of tooth wear can help to identify the primary cause whilst the surface characteristics of the enamel and dentine also play a part in identifying the severity. Equally, the presence or

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**TABLE 1**  
**TABLE OF RISK PARAMETERS**

Medical history	Reflux, Gastro-oesophageal reflux disease (GORD), Ruminantion, Eating disorders, Alcoholism, Healthy diets
Diet	Fruit, Fruit juices, Carbonated drinks, Frequency of consumption, Manner of consumption
Other acids	Occupational, Swimming
Habits	Bruxism, Toothbrushing, Other objects
Exam	Extent of lesions, Presentation, Dentin hypersensitivity
Index	Basic Erosive Wear Examination (BEWE)

absence of patient symptoms such as dentine hypersensitivity or tenderness of the facial musculature may help the identification of the cause.

The use of clinical photographs to act as a baseline to compare future tooth wear and the use study models have been advocated too but both offer a retrospective approach on the monitoring of tooth wear. Matrices constructed of putty can be of similar use.

### Tooth wear indices

Various indices have been proposed to record tooth wear. Although only applicable for tooth wear where erosion is the primary causative agent, the Basic Erosive Wear Examination (BEWE)<sup>26</sup> offers an efficient and simple tool with

strong similarities to the commonly used Basic Periodontal Exam (BPE). Sextants are scored the worst of possible scores. The scores are all added together to provide a management solution based on a clearly defined protocol.

### Management of the risk factors

The first and the most important step in the management of the risk factors is the accurate diagnosis of the cause of tooth wear.<sup>12</sup> The aetiopathologic elements of the tooth wear need would need to be managed. Intrinsic erosive tooth wear may need to be managed with habit modification and appropriate referrals could be considered. Extrinsic erosive tooth wear would require diet advice

and habit modification. Attrition may progress at a slower rate with the use of an occlusal splint.<sup>27</sup> The management of abrasion would take into consideration the adaptation of oral hygiene habits and the elimination of acidic challenges. The role of fluoride in the prevention of tooth wear has been explored, and could be beneficial, but the number of studies is still limited.<sup>28</sup>

In the clinical scenarios where restorative management of the worn dentition is appropriate, various clinical modalities can be considered. These can be in either a conformative occlusal approach or in a Dahl concept with raising the occlusal vertical dimension. Depending on the clinical presentation, composite build ups, metal backings, onlays or crowns can be prescribed.<sup>29</sup>

A suitable aid memoire to assessing the risk parameters for tooth wear can be found in Table 1.

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