

## Prevalence of tooth wear

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### Introduction

We often hear that tooth wear and erosion are becoming more prevalent -but what exactly does it mean? Firstly, there are some issues around definitions and how different countries interpret them (Fig. 1, 2 and 3).




Fig. 1: Shows a case where the primary cause was erosion caused by an eating disorder. The repeated exposure of gastric acid to the teeth caused the loss of tissue.  Zoom



Fig 2: Shows the outcome of attrition or bruxism. In this very severe case the continual clenching or grinding of the teeth has caused the loss of the incisal edges of the teeth. [Zoom](#)



Fig 3: Shows the affect of abrasion on the cervical surfaces of upper teeth. Traditionally toothbrushing has been considered to be the cause acid erosion is probably important. [Zoom](#)

It is clear that acid erosion is a consequence of non bacterial dissolution of enamel and dentine attrition is tooth to tooth wear and abrasion is tooth against another surface (Smith et al.1984a). What is not so clear is how you assess a particular tooth and then classify the type of tooth wear from the appearance of the lesion. This has important consequences particularly when trying to compare the prevalence data from different countries.

In North America the role of erosion in tooth wear is not as well understood or appreciated as it is in Europe (Bartlett et al. 1999). Even within Europe the interpretation of erosive tooth wear differs. Some countries will include the cervical wear lesions as fundamentally erosive whereas others might consider abrasion more important. This in itself is not a problem

provided that any measure used to evaluate tooth wear does not discriminate between the aetiology. However, there are a number of indices measuring specific tooth sites or surfaces, for example palatal surfaces of upper incisors and occlusal surfaces of lower molars, and using them to give data on prevalence.

The only reliable way to measure changes to teeth in large populations are tooth wear indices. Most indices use changes to the anatomical appearance of teeth to record the amount of wear. Some indices measure tooth wear on every surface of every tooth (Smith et al. 1984b), some use selected sites (O'Brien 1993) and others use specific surfaces (Dahl et al. 1989). Other studies have reported the prevalence of erosion rather than tooth wear (Johansson et al. 1993). The difficulty lies in making a diagnosis of the aetiology and then using an index which does not record other causes of tooth wear. Most importantly, it is clinically very challenging to diagnose the aetiology from the appearance of a lesion without a comprehensive dietary and dental history (Kidd et al. 1993, Bartlett et al. 2000]. In most cases changes to the anatomy of teeth from tooth wear is a combination of erosion, abrasion and attrition and it is difficult to assess which component is most important. It is generally safer not to be specific and use an index to record change and then use the results to allow analysis of risk factors to identify the cause.

Another important question is what is exactly meant by prevalence. The oxford dictionary definition is "widespread; of wide extent or occurrence; in general use or acceptance" but in terms of tooth wear what does this actually mean? The prevalence of dental caries is usually measured using the parameters "decayed, missing, filled teeth" (DMFT). The prevalence of the disease can then be compared between different countries and geographical regions provided the same assessment of caries is used by all. Although the prevalence of filled teeth may suggest an outcome of decay there are other reasons why teeth are restored, for instance, worn teeth. Despite the complexities with the DMFT the same universal agreement does not exist for tooth wear and erosion.

What is the important assessment which measures prevalence of tooth wear and erosion? Is it the percentage of exposed dentine surfaces or the most commonly worn tooth or tooth site? An obvious possibility might be the percentage of exposed dentine in a population. Provided researchers use similar or comparable indices there is a possibility that the prevalences can be compared. The Smith and Knight tooth wear index (TWI) has been used extensively by different researchers around the world and is perhaps the most widely used index. The index is a way of recording changes to the anatomical structure of teeth and is evaluated on each tooth and is independent of the aetiology. Teeth are divided into four sites: cervical, buccal, occlusal/incisal and lingual/palatal. Other indices also record the degree and severity of dentine exposure so it should be possible to break down the more complex indices to simpler ones so that comparisons can be made. A new index has recently been developed which is simple and possible to use for re-analysis of tooth wear scores. The basic erosion wear index (BEWE) has the potential for widespread up take by different researchers.

Knowing the percentage of dentine exposure in a given population may be useful but it also ignores the impact of tooth wear on enamel. For dentine to become exposed the enamel overlying it must also have been lost. Many indices focus the outcome of the recording on the degree of involvement of dentine and often ignore the effect on enamel. From a preventative concept the aim must be to prevent wear of enamel and therefore some recognition of the damage to enamel should be considered. However, changes to the enamel surface from tooth wear or erosion can be more difficult to distinguish from a normal appearance.

Over the past 20 years there have been a number of studies evaluating the prevalence of tooth wear in different populations. By far the majority of prevalence studies have been reported on children and adolescents as these groups are easier to investigate and recruit. Studies on adults on the other hand tend to be less common because of the difficulty of recruitment. One convenient adult study population are military personnel and there have been a number of studies investigating this particular group (Johansson et al. 1996, Johansson et al. 1996). One of the first studies conducted on adults recruited subjects from general dental practice but used a ratio to record the severity of wear and unfortunately most subsequent studies have not used the same technique.

### **Prevalence of tooth wear and erosion in the deciduous dentition**

Most of the studies on tooth wear in children have been reported from Europe (Jones et al. 1995, Al-Malik et al. 2002, Wiegand et al. 2006). Millward et al. (1994) investigated 178 4-year old children from Birmingham, UK and reported that as high as 17% showed involvement of dentine exposure. The results from this study are amongst the highest levels reported by any geographical region. The authors reported that almost half the subjects showed some sign of tooth wear and the most commonly affected tooth surface was the palatal/lingual of the maxillary incisors. When such high levels of wear are observed the outcome could almost be considered normal. Another study on 987 pre-school children conducted in Saudi Arabia reported 31% showed some evidence of tooth wear with 13% having dentine exposure. However, in this study the measurements were restricted to the primary maxillary incisors. A larger study in China on 1,949 children aged 3-5 years old reported that only 5.7% showed signs of wear (Luo et al. 2005). It is difficult to understand why the geographical areas showed such a difference but it may reflect socio-economic state of the nations.

### **Prevalence of tooth wear and erosion in adolescents**

There have been considerably more studies undertaken in the mixed dentition of children at school. Like that observed in the deciduous dentition the larger studies often focus grading wear on selected teeth or sites to create an estimation of the condition. One group of researchers measured erosive wear on study models/casts of 1000 11-year olds and reported up to 70% of tooth surfaces and 26.4% with advanced lesions high incidence of

erosive wear (Ganss et al. 2001). A smaller sample reported the results from 210 11-14 year olds and observed less destruction with less than 2% with dentine exposure (Bartlett et al. 1998). The difference between the studies was that dentine involvement was used by the latter as a measure of advancement whereas the shape and depth of the lesion was used by the former. Another significant difference between the studies was that the most commonly worn surface in the study reported by Bartlett et al. was the palatal surfaces whilst Ganss et al. reported the occlusal and incisal surfaces. The reason for this difference again is not clear. There may be geographical differences between populations but within Europe that may be difficult to understand. Another possibility is that researchers are using differently focused indices. If one group is recording erosion they may not be recording the effects of abrasion or attrition. To fully appreciate the effect of tooth wear in a given population the impact of changes to the tooth surface as a result of non cariogenic causes needs to be recorded. Once done the aetiology may be considered.

The larger studies mostly report the impact of tooth wear on specific sites. Truin et al. (2005) reported the prevalence of erosion in a group of 12 year old children in the Hague, the Netherlands. Their examination was limited to the palatal surfaces of the incisors and canines and the occlusal surfaces of first molars. Wear was observed on 59.7% of the subjects with 2.7% having dentine involvement. Milosevic et al. (1994) reported 30% exposed of dentine in 1035 14-year olds in Liverpool, England. Their study included all tooth surfaces and observed the most commonly affected surface was the incisal edges of upper and lower incisors. A study by the same group using multi focus selection recruitment showed even a higher prevalence of dentine exposure approaching 50% (Bardsley et al. 2004). These results have been supported by other studies in England. Al Draigian et al. (2001) reported 51% of subjects with dentine exposure but only 2% with severe levels. Dugmore et al. (2004) reported much lower levels of dentine involvement with only 2% from 1,753 12-year olds. It is difficult to understand why such wide variation in dentine exposure is observed in so many different studies. Many subsequent studies have excluded the incisal surfaces from any comparative analysis. Perhaps the most important figure to remember is that severe dentine exposure remains around 2% in most studies.

The difference between gender has been reported in a number of studies. Most studies have reported the incidence to be more common in males (van Rijkom et al. 2002). A recent review concluded there was an increasing trend towards increasing wear with age (Jaeggi et al. 2006). In addition, dietary habits, presence of gastrooesophageal reflux and socio-economic status all affected the prevalence of erosive tooth wear.

### **Prevalence of tooth wear and erosion in adults**

Comparatively few adult studies have been reported as this probably reflects the difficulty in recruitment and selection of subjects. Children and adolescents attend school and consideration can be made for socio-economic status by using specific selection criteria. However, adults over the age of 18-years are more difficult to investigate. Institutionalised

adults such as military personnel provide some opportunity but the group are a convenient sample.

Johansson et al. reported the occlusal and incisal wear amongst Swedish military personnel and reported that 28% had erosion of the maxillary teeth. Lussi et al. (1991) reported around 10% of 391 subjects had exposed dentine. Unlike many other studies this group reported buccal/facial dentine exposure to be more frequent than palatal/lingual surfaces.

The largest study to date was on 10,827 extracted teeth and reported between 1321% of teeth but the study lacks a relevance to the oral environment (Sognaes et al. 1972). Xhonga and Valdmanis (1986) examined 527 subjects selected randomly and aged between 14 and 88 years (or: and aged from 14 to 88 years). The authors suggested that the prevalence in the USA was around 25% but dentine involvement was comparatively rare at 4%. The largest clinical study in general dental practice on 1007 adults aged 18-88 reported pathological levels of wear approaching 5%. Unlike all other studies this particular group of researchers grouped ages together and subjectively estimated the expected wear rates based on the 1007. Those subjects with higher levels of tooth wear were assessed as having pathological levels. However, the overall figure of around 5% with higher than normal levels of tooth wear seems to compare well with other studies.

The concept of pathological levels of tooth wear has recently been discussed. Whilst it is a convenient and emotive principle the meaning is more difficult to define.

Different researchers, government officials and patients will interpret the data differently depending upon their subjective view of the impact of tooth wear. Patients will consider low levels of exposed dentine pathological because of the impact on appearance of teeth. Whereas, government officials may have consider higher levels because of the financial implications of treating a condition that can affect up to 50% of a population. As a result the term pathological tooth wear is not particularly helpful as it usually relates to an individual's subjective interpretation. Perhaps a better estimate for the impact of tooth wear and erosion in the community is the 'percentage of dentine exposure'.

## **Conclusion**

Tooth wear and erosion are modern day problems for dentistry. Patients are increasingly concerned about their appearance and generally wish to delay the aging process and this includes the impact upon teeth. There is reasonably strong evidence to suggest that tooth wear is an age related phenomenon and it is common. The implication for dentists is that early diagnosis and prevention are vital to the well being of their patients. Overwhelmingly the evidence indicates that tooth wear and erosion affect most people but fortunately only a relatively small proportion develops severe levels.

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