Dental Erosion

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The media are finally beginning to inform the general public that they are at risk for dental erosion as a result of the foods and the beverages they consume. Dental erosion or erosive tooth wear not only can be caused by extrinsic (dietary) acids but also intrinsic acids. Historically, anorexic and bulimic patients have been the population dentists have had to be aware of, but with the increasing prevalence of gastroesophageal reflux disease (GERD) in the general population, another population must be monitored. Tooth wear is usually multifactorial, and it is often difficult to assign a specific etiology; abrasion, attrition, and erosion must all be considered as potential etiologies. This critical appraisal reviews four articles looking at dental erosion and its relationship with GERD.

A Difference in Perspective—The North American and European Interpretations of Tooth Wear

D. BARTLETT, K. PHILLIPS, B. SMITH

International Journal of Prosthodontics 1999 (12:401–8)

ABSTRACT

Objective: The purpose of this paper was to consider possible explanations for the difference in the volume of dental literature regarding tooth wear and dental erosion observed in Europe as compared to North America.

Materials and Methods: A review of North American and European literature regarding the etiology, prevalence, and appearance of erosion, attrition, and abrasion. No inclusion and exclusion criteria for the literature either considered or reviewed was defined.

Results: The review of the literature was divided by possible etiologies of tooth wear. Erosion was subdivided into sources of acid—dietary, gastric juice, and industrial. Dietary acids show a statistical correlation to enamel erosion but have little evidence correlating to dentin erosion. Gastric juice as a possible source of acid either from patients with eating disorders or GERD is plausible but more difficult to investigate as an etiology. Industrial sources as an etiology of dental erosion have decreased as occupational safety regulations have increased.

Attrition is tooth-to-tooth wear and can be due to normal or parafunction. Bruxism may be caused by stress or occlusal interferences, but evidence is inconclusive.

Abrasion, tooth wear from other materials, has been associated with toothbrushing, toothpaste, and certain

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DOI 10.1111/jerd.12038

foods. Abrasion lesions may also be associated with abfraction.

Site specificity for source can help to define the etiology, but is not definitive. Gastric acid, for example, primarily impacts palatal surfaces of maxillary incisors.

Conclusions: In North America, the primary cause of advanced tooth wear is viewed as attrition. European literature considers that erosion is the primary etiology of tooth wear. More studies have been conducted in Europe on the etiology and prevalence of tooth wear than in North America.

COMMENTARY

The primary deficiency of this article is the failure of the authors to disclose how they chose the papers they used to determine the differences between the North American literature and European literature related to advanced tooth wear. It is neither a systematic review nor a comprehensive literature review on the subject. Despite this deficiency, a number of important points can be gleaned from the article. First, there is a considerable difference in how North American dentists and European dentists view advanced tooth wear. The Europeans see the primary etiology as chemical erosion, and in both, their descriptive and investigative literature describe it as "erosion." The North American literature generally describes wear as "attrition" because of tooth-to-tooth contact.

The most important point of the article is that advanced tooth wear is rarely unicausal and the etiology is usually multifactorial, so it is incorrect and imprecise to describe it as either "erosion" or "attrition." The authors suggest using the simple term "wear." Perhaps the contemporary term "erosive tooth wear" would be even better as it provides the very clear connotation that the etiology of advanced tooth wear is multifactorial.

Systematic Review: Gastroesophageal Reflux Disease and Dental Lesions

F. PACE, S. PALLOTTA, M. TONINI, *et al.*

Alimentary Pharmacology and Therapeutics 2008 (27:1179–86)

ABSTRACT

Objective: This paper reviewed the existing literature to assess the relationship between dental erosion and gastroesophageal reflux disease (GERD).

Materials and Methods: A search of Medline and Cochrane Controlled Trials Register (from January 1996 to September 2007) was conducted for the terms dental erosion and gastroesophageal reflux or esophagitis in human studies and published in English.

The information considered was inclusion criteria of patients, patient setting, diagnosis of GERD, study design, sample size, number of dropouts, main outcome measures, and study conclusion.

Results: Seventeen eligible studies, including five child populations and one special needs adult population were included. The authors concluded that the variation of outcome measures was too large for a meta-analysis, so a qualitative analysis was performed.

Adult Studies: The prevalence of dental erosion ranged between 5–47.5% with a median value 32.5%. The greatest prevalence of erosion was found when GERD patients were defined by symptoms. Two studies provided no data on the prevalence of dental erosion but suggested greater loss of tooth structure was seen in GERD patients than in controls.

Child Studies: The prevalence of dental erosion was found to range from 13–87% with one study not reporting prevalence.

 DOI 10.1111/jerd.12038

Adult Special Needs Study: Dental erosion not only attributed to GERD but also to vomiting, rumination and regurgitation was noted in these subjects. In this study, 46% of the subjects had dental erosions and 65% of those had GERD.

The included studies used heterogeneous definitions of GERD but confirm the prevalence of dental erosion in adult GERD patients that is higher than the general populations. The prevalence of GERD in patients with dental erosion ranges from 21–83%.

Conclusions: Dental erosion is the predominant oral manifestation of GERD and is highly prevalent in the general population.

COMMENTARY

This review points out the weaknesses of current erosion studies. As the authors noted, they were unable to compare the studies via meta-analysis for many reasons. First, subject selection occurred two different ways either from a population of dental erosion subjects who were being examined for GERD or from a population diagnosed with GERD being examined for dental erosion. Second, a variety of definitions and diagnostic methods exist for GERD. Third, the outcome variables are not constant across the studies.

The authors argue that dental erosion is a predominant oral manifestation of GERD and is highly prevalent in the general population. However, the highly variable numbers and range of prevalence they present from the reviewed studies make it difficult to give much strength to their conclusions. Although they mention that they are unable to accurately compare populations and definitions and indexes, they do not consider this a reason to weaken the correlation between GERD and dental erosion.

Gastroesophageal Reflux and Dental Erosion

A. MILOSEVIC

Evidence-Based Dentistry 2008 (9:54)

ABSTRACT

Objective: This paper was a critical review of Pace's systematic review.

Results: In adults with GERD, erosion prevalence was found to be between 5% and 40% in six studies. In erosion patients, prevalence of GERD ranged between 21–83% in four studies. In pediatric studies an even wider prevalence of erosion was found, 13–87%.

Several weaknesses of the systematic review were noted:

- The outcome measures mainly utilized epidemiological indexes used to measure wear (tooth surface loss) not specifically erosion.
- The authors did not perform any meta-analysis because of "marked variation in outcome measures."
- A small number of studies met the selection criteria, resulting in only 11 adult studies being included in the systematic review.
- There are two main study designs from which the data was complied, prevalence of erosion in GERD cases or prevalence of GERD in subjects with dental erosion.
- Due to the variety of indexes used and variation in study design the reliability and comparability of the data from the reviewed studies is significantly compromised.
- The systematic review's authors conclude there is a strong association between GERD and dental erosion, but the correlation coefficients actually appear to be weak to moderate.
- There are a number of confounding factors that were not addressed during the discussion of the systematic review, including the fact that there was no critique

 DOI 10.1111/jerd.12038

of the confidence of the results in the included studies.

Conclusions: The systematic review should have been more critical of studies included. A more accurate conclusion to be drawn from the review is that an association between GERD and dental erosion is plausible but the strength of the association remains unclear.

COMMENTARY

Milosevic downgrades the strength of the Pace's systematic review. The difficulties mentioned by Pace comparing studies are expounded upon by Milosevic and given as the reason for lowering the association between GERD and dental erosion to plausible rather than conclusive. Comparing the various wear indices used in the study did not allow for meta-analysis and measure wear, not solely tooth loss from dental erosion. The small number of studies with small sample sizes limits the generalizability of the data presented in the systematic review.

The clearest point from this critique is that although there is an association between GERD and dental erosion, the prevalence of GERD in a dental erosion population and the prevalence of dental erosion in a GERD population are currently unknown.

Quantitative Analysis of Tooth Surface Loss Associated with Gastroesophageal Reflux Disease: A Longitudinal Clinical Study

D. TANTBIROJN, M.R. PINTADO, A. VERSLUIS, *et al.*

Journal of the American Dental Association 2012 (143:278–85)

ABSTRACT

Objective: The purpose of this study was to examine the pattern and progress of erosive tooth wear of individuals with GERD.

Materials and Methods: Fourteen subjects with GERD and six control subjects were enrolled in the study. The inclusion criteria for GERD participants were: diagnosis of GERD by a physician, receiving medical treatment or taking over-the-counter medicine for acid reflux, or experiencing heartburn or sour or bitter taste in the mouth at least twice per week. Exclusion criteria were: excessive occlusal wear or cervical tooth surface loss, bruxism, or extreme erosive activity such as excessive consumption of acidic food and drinks.

Polyvinylsiloxane impressions were made at baseline and six months. The impressions were poured in dental stone and scanned with an optical scanner (Lava Scan ST, 3M ESPE, St. Paul, MN, USA). Cumulus software (Regents of the University of Minnesota, Minneapolis, MN, USA) was used to align the models. Alignment was performed in three dimensions for each tooth by selecting areas where no wear was noted. Surface loss greater than 0.02 mm was then reported as volume loss (in cubic millimeters). All tooth wear, abrasion, attrition, and erosion was measured. Teeth were identified with non-contact erosion and those with erosion/attrition.

Results: Mean volume loss per participant and the mean volume loss per tooth with measurable surface loss were significantly greater in the GERD group than the controls. Nine of the 12 participants with GERD had surface loss from erosion. Of 38 teeth with erosion, 16 were non-contact surfaces (no opposing tooth wear).

Not all participants with GERD had extensive tooth surface loss. The mean (± SD) volume of loss was significantly different but highly variable, 1.78 (±1.49) mm^3.

Conclusions: Loss of tooth structure in subjects with GERD was significantly greater than that in control

 DOI 10.1111/jerd.12038

subjects. Erosive wear on occlusal surfaces was twice as high due to the combination with attrition.

COMMENTARY

This study is a good start at attempting to quantitatively assess erosive wear. Despite the short time period (6 months) covered, measurable wear was observed. This may suggest that dentists should be quicker at making the diagnosis of erosion to prevent damaging tooth wear. Also, physicians must inform GERD patients about how quickly erosive tooth damage can occur. It will be interesting to follow these patients over a longer period of time and see if the erosive process can be slowed or halted.

Calibration and correlation of the models was explained, but it seems that selecting areas that have no wear over extended periods of time would be difficult. However, the authors were confident that they were able to accurately align the models.

The study involved a small sample size, and while a large number of teeth were analyzed, wear can be very limited. Additionally, as the authors mentioned, patients with GERD and dental issues were more likely to be recruited because the recruitment materials highlighted the symptoms of tooth erosion. Thus, a biased population may have been examined.

The data support the observation that dental erosion is highly variable. Not all GERD patients had extensive tooth loss, so an increased sample size would help to limit the variability. There also appears to be the need to study what factors contribute to a GERD patient having aggressive or no dental erosion.

SUGGESTED READING

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THE BOTTOM LINE

- Tooth wear is multifactorial, and it is rarely possible to identify a single etiology in a specific patient. North America has been slower in understanding the erosive component of tooth wear because of the focus on attrition as the primary etiology.
- Dental erosion and GERD are associated; however, the strength and prevalence of this association is highly variable. Dentists should closely monitor GERD patients and be proactive at treating them for dental erosion. Patients who have erosion on palatal and lingual surfaces should be questioned for a history of heartburn and GERD. If they are not being seen by a physician regarding these symptoms, they should be referred to their primary care physician.
- The presence of erosion and attrition appears to be a particularly harmful combination and demands active intervention.
- Factors that determine whether an individual with GERD will or will not develop dental erosion have not been clearly identified. More research is needed to identify specific risk factors for erosion.

This paper was written by LCDR Kristi Erickson, DC, USN while a graduate student at The University of North Carolina, Chapel Hill training in Operative Dentistry. The views expressed in this article are those of the author and do not reflect the official policy or position of the Department of the Navy, Department of Defense or the U.S. Government.

 DOI 10.1111/jerd.12038