

DENTAL EROSION: RISK ASSESSMENT, EPIDEMIOLOGY AND PREVENTIVE MEASURES

PhD Thesis abstract

Scientific advisor: PhD. Prof. Székely Melinda

PhD student: Andreea Borș

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Introduction

Dental erosion is the result of a pathologic, chronic, localized, painless loss of dental hard tissue chemically etched from the tooth surface by exogenous or endogenous acids without the involvement of microorganisms. This multi-factorial condition includes different chemical, biological, and behavioural factors contributing to its development. The most important extrinsic sources are dietary acids. Progressive erosive loss may lead to functional and aesthetic limitations, as well as hypersensitivity and extensive restorative treatment. Prevalence data show that erosive tooth wear is a common condition increasing steadily, in all age groups, especially in younger ones. Hence, research in the field of dental erosion has expanded over the last few years. Though, systematic, cross-sectional prevalence data and incidence studies are scarce. Therefore, a conclusion about the occurrence, progression and distribution of erosive lesions cannot be made easily. Studies revealed that is more difficult to displace a soft drink film by saliva than it is to displace a salivary film by a soft drink. Further research is asked to quantify the impact of all these factors in more detail, using reproducible and standardized methods. A prerequisite for preventive measures is to evaluate the different etiological factors in order to identify persons at risk and to suggest tailored preventive measures to the patients. In this thesis, we aimed to collect data on dental erosion to contribute with a review as well as an original research in the comprehensive knowledge of the different risk and protective factors of erosive lesions.

The thesis consists of two parts. The first part **current knowledge stage**, mainly theoretical, consists of four chapters. **First chapter** is an overview with emphasis on chemical and histopathological aspects on dental erosion. The **second chapter** on diagnosis of erosion is followed by the **third chapter** on risk factors, heading extrinsic causes of erosion. **Fourth chapter** is devoted to analyze epidemiological studies on prevalence, incidence and distribution of the condition. In this chapter a detailed investigation on a broad spectrum of views on dental erosion are presented and critically evaluated, over three subsections describing the main trials conducted among children and adolescents, young adults and adults. The second part **personal contributions** describes the three clinical and two exploratory studies that we performed during our research on dental erosion.

1. Working hypothesis and objectives. We purposed to investigate the association of dental erosion, diet and dietary habits, to record prevalence and incidence data and to develop protective strategies against the erosive insult.

2. General Methodology. A number of five studies, comprised both qualitative and quantitative measurements. Statistical analyses were conducted with GraphPadInStat and GraphPadPrism statistical programs. Chi-square test, Fisher's exact test, one-way ANOVA test were used to check differences between groups. Student's t test compared the average between two groups. Any *p* values less than 0.05 were considered statistically significant.

3. The prevalence of dental erosion in young adults in Târgu-Mureș.

Aims: To assess the consumption of acidic beverages and the prevalence of dental erosion in young adults living in Târgu-Mureș, Romania. **Material and methods:** The cross-sectional study involved a representative sample of subjects aged 18 to 30-years. Dietary information was gathered by a multiple-choice questionnaire. The tooth erosion index proposed by Lussi was used for erosion recording. **Results:** Enamel loss was the most prevalent type of erosive tooth wear (grade 1). The prevalence of dental erosion in screened subjects was significantly higher in individuals exposed to frequent intake of acidic soft drinks. **Conclusions:** The findings suggested a high consumption of soft drinks and an increased prevalence of dental erosion in young adults.

4. The progression and incidence of tooth erosion in a cohort of young adults - a longitudinal study.

Aims: (1) to assess the incidence of tooth erosion in young adults living in Targu-Mures, Romania and (2) to evaluate relationship between acidic dietary habits and erosive lesions occurrence. **Material and methods:**

In 2009 a longitudinal study on dental erosion was started including randomly selected dental students. Subjects completed a multiple-choice questionnaire on dietary habits and attended the clinical examination. For the assessment of erosive tooth wear the Lussi index and BEWE score was used. The procedures were repeated also after two years. **Results:** Subjects with regular exposure to acidic beverages were more likely to develop erosive lesions than subjects with occasional or no consumption. **Conclusions:** In investigated young adults the level of increasing prevalence and the incidence value represent concern.

5. *In vitro* assessment of erosive potential on dental enamel of different beverages marketed in Târgu-Mureş

Aims: To analyze the erosive potential of three popular beverages marketed in Târgu-Mureş, Romania, using surfometry. **Material and methods:** Enamel blocks of permanent human teeth were incubated at 37°C in individual receptacles. In order to maintain reference surfaces for lesion depth determination, varnish was applied on half of the fragments surfaces. The specimens were subjected to erosion by immersion in orange juice, carbonated cola and energy drink. The pH of tested drinks was measured. **Results:** Carbonated cola caused the highest significant increase in surface roughness, followed by energy drink. Orange juice caused significantly less wear. Carbonated cola had the lowest pH and orange juice the highest value. ANOVA test revealed an association between pH of beverages and lesion depths. **Conclusions:** The study showed a significant association between exposure to acidic drinks and irreversible loss of dental hard tissues.

6. Quantifying Human Enamel Erosion Caused By Freshly Squeezed Juices

Aims: To investigate *in vitro* minimal erosive effects of freshly squeezed fruit juices on human enamel during short time incubation by determination of calcium and phosphate dissolution. **Material and methods:** Human enamel blocks were divided randomly and assigned for immersion at 37°C in 5 ml juice, for different spot times 3, 6, 9 and 12 minutes, respectively. The juices analyzed were orange juice (OJ), apple juice (AJ), orange mixed with carrot juice (1:1, O+C) and apple mixed with carrot juice (1:1, A+C). Amount of titratable acid and pH was measured for the tested solutions. Calcium and phosphate release were determined using spectrophotometry. **Results:** AJ showing the lowest pH and a high value for buffering capacity had the most pronounced erosive effect. O+C was less erosive. The enamel demineralization increased when prolonging the immersion time. **Conclusions:** Erosive capacity is mainly determined by pH and to a lesser extent by the buffering capacity.

7. Three Years Longitudinal Study Assessing Preventive Strategies for Dental Erosion

Aims: To test a possible affordable measure to prevent erosive lesions occurrence. **Material and methods:** The sample subjects received dental clinical examination and dietary history was recorded. Daily acidic beverages consumption was considered a risk factor for dental erosion. Patients received dietary counselling including information on tooth erosion. They were advised to rinse the mouth with still water after every acid attack to increase the salivary pH and to allow the saliva to re-harden tooth surfaces. After three years the procedures were repeated. **Results:** Subjects not rinsing with water after acidic beverages attack were more likely to develop erosive lesions than those following these measures. **Conclusions:** Our results seem to indicate the beneficial effects of mouth rinsing with still water on the incidence of dental erosion.

8. General conclusions:

- The clinical and experimental results of the research of this thesis reveal significant relationships between acidic drinks and dental erosion;
- The results indicate that dietary habits and consumption of carbonated soft drinks and acidic fruit juices represent aetiological factors of the high prevalence and incidence of dental erosion in young adults;
- Soft drinks and even healthy freshly squeezed fruit juices are acidic beverages, their erosive capacity is mainly determined by pH and to a lesser extent by the buffering capacity;
- The findings suggests that epidemiological data on prevalence and incidence of dental erosion would be of interest when future treatment needs in the population are to be planned in Targu-Mures, Romania;
- As it is difficult to control possible aetiological factors, such as the intake of all acidic beverages or special drinking habits, it is necessary that “after acid attack” strategies to be developed for the prevention of dental erosion;
- Monitoring of patients with signs of tooth erosion and raised awareness of dental professionals might be recommended.