

PREVENTION OF NONCARIOUS LESIONS IN CHILDREN

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Summary

Probably due to the fluoridation and improved oral hygiene habits, there has been a significant caries decline in children in developed countries. At the same time, epidemiological studies show significant increase of hard dental tissue loss by noncarious processes.

Noncarious wear could be the result of three processes: abrasion, attrition and erosion. Nowadays, the most important of them, and the most frequent is dental erosion, an irreversible dissolution of hard tissue caused by acids, without bacterial involvement that affects both primary and permanent dentition by the same pathophysiological process.

The first step in dental erosion prevention is identifying children in risk early enough by evaluating different etiological factors. Based on this analysis, an individually tailored preventive program should be suggested to the children and presented to their parents. That program should comprise: dietary advice in order to improve their dietary habits, fluoridation, improvement of salivary flow rate by using buffering products and advice on the proper dental hygiene.

Not only patients, but also many dental and medical professionals are not sufficiently educated about the epidemiology, etiology and the ways of prevention of this irreversible loss of hard dental tissue. The knowledge on all these aspects of dental erosion should represent an important part of a contemporary paediatric and preventive (dental) medicine.

Key words: prevention; noncarious lesions; dental erosion; children.

INTRODUCTION

Noncarious wear is a result of three processes: abrasion, attrition and erosion. Abrasion is the noncarious wear produced by interaction between teeth and other materials. Attrition is the noncarious wear caused by direct tooth to tooth contact. Nowadays, the most important and the most frequent noncarious process is dental erosion, irreversible dissolution of hard tissue by acidic substances, without bacterial involvement that affects both dentitions [1].

Some studies on primary teeth in preschool children have indicated dental erosion in 6-50% of all children surveyed [2-5]. Cukovic-Bagic [6] showed that even 78% of Croatian preschool children (aged 4-5) had some evidence of dental erosion. The questionnaire data indicated an association between dental erosion and consumption of sweet drinks, fruit, snacks and biscuits. Results showed no association with oral hygiene habits, but with the higher educational level of the parents, the prevalence of dental erosion was lower. Wiegand [7] showed that 32% of German kindergarten children had erosion on at least one tooth. The prevalence of dental erosion among Australian school children was 68% [8]. Jaeggi and Lussi [9] found, among children aged 5-9 years, that 14% of them had erosive lesions in permanent teeth. El Aidi [10] showed in their longitudinal study (18-months follow-up) on dental erosion in children (10 to 12) that the prevalence of dental erosion increased from 32.2% to 42.8%. The evidence of dental erosion among 12-year-olds from The Hague was 25% [11]. Many studies which have investigated children aged 9 to 17 years indicated that the prevalence of dental erosion was between 11 and 100% in all children surveyed [10,12-19].

These facts on the high prevalence of dental erosion among children confirmed the need of identifying children at risk and introducing the adequate preventive measures. These could be done, at the first place, through identifying the **etiological factors**: patient-related factors and nutritional factors (modified by some other general factors). Furthermore, **preventive measures** should comprise: dietary advice based on patient's dietary habits, fluoride regimens, stimulation of salivary flow rate, use of buffering products and advice on the proper dental hygiene.

ETIOLOGICAL FACTORS

The etiology of dental erosion in children is similar to that in adults. Generally, the main etiological factor is considered to be an increase in extrinsic or/and intrinsic acid exposure.

Dental erosion has multifactorial etiology and the etiological factors could be divided in two groups: patient-related factors and nutritional factors. There are, as well, other general factors like education, health, knowledge, employment, habits and behavior which could also influence and modify the erosive process [1].

Patient-related factors are: eating/drinking habits, reflux/vomiting, saliva and pellicle, medication and tooth cleaning.

Nutritional factors are: acid type, pH value, buffering capacity, calcium, phosphate, and fluoride concentration.

Patient-related factors

Dietary (eating/drinking) habits have been the most extensively studied etiological factor and they represent main patient-related factor for dental erosion. The excessive consumption of erosive beverages and foods, as well as the way of beverages consumption (bottle feeding, drinking with/without straw, sipping or sucking) is considered to be the most important extrinsic factor for dental erosion in children. According to the data, there is a constant increase in consumption of carbonated drinks and juices, as well as other non-alcoholic beverages [20]. Excessive sport activity among children with the consumption of sports drinks can be a co-factor in the development of dental erosion. Also, dental erosion is possible among children who are training pool water sports where the water pH value is very low [21].

The most relevant intrinsic factors in children and adolescents are gastroesophageal reflux and vomiting [22,23].

Gastroesophageal reflux disease is one of the most frequently diagnosed gastroenterological problem, with equal prevalence in adults and children [24,25]. Osatakul [26] showed that even 8% of Thai infants had reflux. Except dental erosion, possible symptoms of gastroesophageal reflux could be: acid regurgitation, epigastric pain, and heartburn, acidic or bitter taste after waking up, odynophagia, dysphagia, nausea, vomiting, coughing, asthma and dyspnea. Clinical picture of gastroesophageal reflux with regurgitation during sleeping could be asymmetrically distributed erosive lesions (depends on the side preferred while sleeping) [1].

Another intrinsic source of acids is chronic vomiting, which could be the first sign of anorexia nervosa and bulimia nervosa, diseases which usually start in the adolescent period of life. Dentists are often the first medical professionals who could recognize the typical erosive lesions in the occlusal and oral tooth surfaces in the, particularly, maxillary incisors [27,28]. Except dental erosion, other symptoms of frequent vomiting could be: enlargement of the parotid gland, redness of oral mucosa, rhagades on lips and skin and nail changes [29].

The next very important patient-related factor is saliva and pellicle. Saliva protects the teeth from acid attack through thinning, neutralization, reduction of enamel dissolution by calcium and phosphate ions, and pellicle formation [30-34]. This is the reason why teeth with thicker pellicle show less erosion than teeth with thinner pellicle. In children under the radiotherapy of the head and neck area, saliva production could be reduced. Also, the prolonged contact of teeth with drugs of low pH value can cause dental erosive lesions.

For the tooth cleaning, soft toothbrushes and low abrasive dentifrices are advisable to protect the loss of hard dental tissues as well as the manual toothbrushes rather than the electric ones [35].

Nutritional factors

The erosive potential of dietary products is not only determined by the frequency of consumption and the pH value. It is also determined by its buffering capacity; with the higher buffering capacities, the elevation of the pH will be prolonged. The chelator properties are also the influencing factor through the interaction with saliva. Other factors such as calcium, phosphate and fluoride concentration are also important determinants and they have a protective effect [36-38]. Very recent study from 2011 by Lussi [39] analyzed 60 medications and dietary substances showing the variables with significant impact on dental erosion, such as pH value, the fluoride and calcium concentrations and the buffer capacity. Some other studies showed a reduction of the erosive potential of isotonic drinks by adding calcium or phosphopeptide-stabilized amorphous calcium phosphate (CPP-ACP) [40-42].

PREVENTIVE MEASURES

Every successful prevention should be based on the adequate risk assessment. The first factor for dental erosion risk assessment is taking a good patient's history which should comprise dental, medical, dietary and behavioral aspect. The period of recording dietary intake should be over the 4 days including weekend. Increased risk of dental erosion could be considered if more than four acidic ingestions per day plus at least one additional risk factor is present. It should be mentioned that the behavioral factors have a decisive influence on the appearance and progression of erosive lesions [43].

The second factor for the risk assessment is the clinical evaluation of dental erosive lesions. There are many well known indices for recording tooth wear, but the most appropriate clinical index is the Basic Erosive Wear Examination (BEWE) index [44]. The clinician should pay attention also to two other non-carious lesions, abrasion and attrition, which are very frequently present in primary and mixed dentition mostly on the primary teeth. The BEWE index is designed to provide a simple scoring system that can be used with the diagnostic criteria aiming to transfer the results of all six sextants into one, score sum. According to it, treatment plan could be presented, as well as the frequency of follow up. Not only clinical evaluation by BEWE index, but also, the photographs, the study models and the bitewing radiographs could be useful for following the progression of dental erosion [1,13].

The third factor which has to be evaluated for the risk assessment of dental erosion is saliva analysis. It comprises measurement of salivary flow (resting saliva and stimulated saliva) and the buffering capacity of saliva. These two measurements are easy to perform with many available commercial tests, under few conditions:

the child should not eat and drink, should not chew the gum and had none of the prophylactic measures for at least one hour before the measurement [1].

The presence of dental erosion in primary dentition significantly increases the risk of suffering from erosion in permanent dentition [12,13]. The risk of permanent dentition being affected by loss of substance, which increases with age, should be prevented by early prophylactic measures.

Preventive measures could be implemented through the main three aspects: control of the extrinsic acids, control of the intrinsic acids and dental hygiene management.

Minimally invasive treatment, as a potential fourth aspect could be not only preventive, but an interceptive. This could happen if patients (mostly adolescents) are not regular in their dental check-ups and come when their subjective symptoms of tooth hypersensitivity are clearly obvious. In these cases application of adhesive systems as a prophylactic measure and renewing it every six to nine months, as well as use of pastes containing potassium or arginine could be of a significant help [1,33,34].

Control of extrinsic acids

In order to identify patients at risk, the children should be asked to record their dietary intake over the course of at least four consecutive days including a weekend days, so the clinician could evaluate the erosive potential of the diet.

Recommended preventive measures for managing acid intake could be reducing consumption of acidic foods and beverages to as few meals as possible.

Recommended preventive measures for reduction of acid exposure could be avoiding baby bottle feeding, avoiding sipping and drinking beverages swiftly without sucking between the teeth [45]. Furthermore, it has to be suggested to increase the remineralizing effect by choosing calcium-enriched drinks and foods and to finish meals with cheese. Also, it is useful to rinse mouth with water, milk or (stannous) fluoride oral rinse after acid consumption, as well as to stimulate the saliva production by chewing tooth-friendly gum. The saliva stimulated by the use of sugar-free chewing gum could promote the remineralizing action in the erosion and abrasion cases [46].

Control of intrinsic acids

The best method currently used by gastroenterologist in treating reflux is to prescribe proton pump inhibitors in order to raise the pH value in the esophagus, such as esomeprazole, lansoprazole, omeprazole, pantoprazole or rabeprazole [47-49]. Gastroesophageal reflux is an unstable condition, particularly in children, and this is

why the pH monitoring is suggested after one year [25]. In case of adolescent patients suffering from anorexia or bulimia nervosa, gastroenterological, psychological and/or psychiatric treatment is mandatory [29].

Further simple preventive measures to reduce intrinsic acid production could be avoiding reflux-inducing foods and beverages, such as citric acid, vinegar, fatty foods, tomatoes, chocolate, carbonated drinks etc. Patients should be advised to eat several small meals during the day instead of large meals, with avoiding the meal just before sleeping. Also, it is advisable to chew the gum after meals to reduce postprandial reflux and not to toothbrush immediately after vomiting.

Dental hygiene management

As a part of preventive measure against dental erosion, the children should be instructed in adequate oral hygiene procedures. The moment of toothbrushing after an erosive attack, as well as the kind of toothbrush and toothpaste used might influence the appearance and the progression of dental erosion [50,51]. First of all, children should be advised not to brush teeth immediately after acid exposure but with a delay of 30 min to 1 hour. This is of course the exception, and the rule (for the children who are not in the risk of dental erosion) is that teeth should be brushed immediately after eating. Patients should use gentle toothbrushing technique, soft toothbrushes with as many as possible bristles and low abrasive dentifrices containing fluoride. The abrasivity of the toothpaste is determined by the size and amount of abrasives, buffering capacity, fluoride content and pH value [52,53]. Regular application of (stannous) fluoride oral rinse and/or highly concentrated fluoride gels should be mandatory in case of high risk of erosion. In her study, Ganss [54] showed that regular fluoridation decreased the progression of erosion *in vitro*. Lussi [55] also confirmed that oral hygiene products containing fluoride and in spite of their acidity had no erosive potential. Titanium fluoride and stannous-containing substances also have protective properties against erosion [56,57].

CONCLUSION

There is an increasing number of children with dental erosive lesions of both primary and permanent teeth. From the available studies *in vitro* and *in vivo*, it could be suggested to professionals to make an individually tailored preventive program for every patient. It should include dietary advice, fluoride intake, intake of buffering medicaments and stimulation of salivary flow rate, advice on gentle brushing and adequate oral hygiene measures, as well as treating dentin hypersensitivity if it exists. Early detection of children under a risk for dental erosion is the main

task of every responsible dental practitioner in order to implement the preventive measures on time.

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Sažetak

Prevenција nekarijesnih lezija u djece

U razvijenim zemljama postoji značajan pad karijesa vjerojatno radi fluoridacije i poboljšanih oralno higijenskih navika. U isto vrijeme, epidemiološka istraživanja pokazuju značajan porast gubitka tvrdih zubnih tkiva nekarijesnim procesom.

Nekarijesno trošenje moglo bi biti rezultat tri procesa: abrazije, atricije i erozije. U sadašnje vrijeme, najvažnija i najčešća među njima je dentalna erozija. Dentalna erozija predstavlja nepovratni gubitak tvrdog zubnog tkiva uslijed kiselina, bez prisustva bakterija, i zahvaća obje denticije, mliječnu i trajnu, istim patofiziološkim procesom.

Prvi korak u prevenciji dentalne erozije jest, evaluirajući različite etiološke faktore, dovoljno rano identificiranje djece koja su pod rizikom. Temeljem te analize, trebalo bi predložiti djeci i predstaviti njihovim roditeljima individualno osmišljen preventivni program. Taj program bi trebao sadržavati: prehrambeno savjetovanje kako bi se poboljšale prehrambene navike, fluoridaciju, povećanje količine sline, primjenu puferirajućih proizvoda i savjetovanje o odgovarajućoj dentalnoj higijeni.

Ne samo pacijenti, nego i mnogi stomatološki i medicinski stručnjaci nisu dovoljno educirani o epidemiologiji, etiologiji i načinima prevencije ovog nepovratnog gubljenja tvrdih zubnih tkiva. Znanje o svim aspektima dentalne erozije trebalo bi biti bitan dio suvremene dječje i preventivne (dentalne) medicine.

Ključne riječi: prevencija; nekarijesne lezije; dentalna erozija; djeca.

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