

## Excessive tooth wear on human dental enamel: a case report

Desgaste excessivo em esmalte dentário humano: relato de caso

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### Abstract

**Introduction:** although reports on dental erosion have appeared in literature for a long time, there is currently a growing interest among researchers and clinicians about this matter. Potential risk factors for loss of dental hard tissue are changed lifestyle and eating patterns, with increased consumption of acid foods and beverages. **Case report:** an atypical tooth wear on the buccal surfaces of the mandibular teeth in a 45-year-old woman referred for orthodontic treatment, associated with the frequent consumption of whiskey and lemon, is reported. A comprehensive approach, such as the recognition of dental erosion joined with a careful investigation about eating habits was performed. Ultrastructural examination of replicas of the teeth showed practically structureless enamel and dentin surfaces. **Conclusion:** the screening for dental erosion in patients seeking orthodontic treatment is advisable to be a usual procedure. Recommendations for treatment and prophylactic measures are made emphasizing the need of multiprofessional attention.

**Keywords:** Dental abrasion. Acidity. Alcoholic beverages. Diagnosis. Dental erosion.

### Resumo

**Introdução:** embora relatos sobre erosão dentária já apareçam há bastante tempo na literatura, existe atualmente interesse crescente entre pesquisadores e clínicos sobre esse assunto. Fatores que representam riscos potenciais para a perda de tecido duro do dente são as mudanças no estilo de vida e no padrão de alimentação, com o aumento no consumo de alimentos e bebidas ácidas. **Relato de caso:** lesões atípicas de desgaste dentário na superfície vestibular das unidades inferiores, em uma mulher com 45 de idade, encaminhada para tratamento ortodôntico, associadas ao consumo frequente de uísque e limão, foram relatadas. Uma abordagem abrangente, como o reconhecimento da erosão dentária, em conjunção com a investigação cuidadosa dos hábitos alimentares, foi realizada. O exame por meio da microscopia eletrônica de varredura, realizada em réplicas dos dentes, revelou superfícies de esmalte e dentina praticamente desprovidos de elementos estruturais. **Conclusão:** sugere-se que uma avaliação direcionada à busca por erosão dentária em pacientes que procuram por tratamento ortodôntico seja um procedimento rotineiro. A atenção multiprofissional, envolvendo o tratamento e o uso de medidas preventivas, é essencial para a adequada atuação junto ao paciente.

**Palavras-chave:** Abrasão dentária. Acidez. Bebidas alcoólicas. Diagnóstico. Erosão dentária.

### INTRODUCTION

Loss of dental material is a well-known phenomenon. The etiology of this loss is generally related to mechanical processes, such as attrition, abrasion, and abfraction, and also to a chemical process, which is erosion<sup>1</sup>. The rate of tooth wear in man is normally related to a variety of diets in combination with oral hygiene habits<sup>2</sup>. It is usually limited to a subclinical level and should be more deeply investigated when the loss of substance reaches a clinically visible level. Dental enamel in the oral cavity is exposed to acid from many sources. In an environment in which it overwhelms the buffering capability of saliva, the acid will erode the enamel<sup>3</sup>. Chemical disintegration of enamel, defined as erosion, occurs by continuous layer-by-layer dis-

solution of the enamel crystals and, besides to cause local loss of dental hard tissue, leads a softened layer at the surface of the remaining tissue susceptible to abrasion<sup>1</sup>.

Dental erosion may be caused by intrinsic or extrinsic factors<sup>4,5</sup>. Eating disorders, like anorexia nervosa, bulimia nervosa, and gastrointestinal disturbances not otherwise specified with frequent regurgitations, erosion being caused by propulsion of gastric content into the mouth, are intrinsic factors<sup>6-8</sup>. Low salivary flow rates with insufficient buffering capability are believed to be additional factors<sup>9</sup>. Disorders of the upper alimentary tract, specific metabolic and endocrine problems, cases of medication side-effects and drug abuse, and certain psychosomatic disorders can also be cited<sup>7,9</sup>.

Extrinsic factors include demineralizing acidic food, beverages, snacks, or exposure to acidic contaminants in the work or leisure environment<sup>9,10</sup>. Because of the widespread use of energy and sport drinks and the fact they are consumed continuously during sport activities, there is a concern about their erosive potential too<sup>11</sup>. In modern

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societies the factor dietary is becoming more important as, in order to avoid gaining weight, some people eat a lot of fruits, salads, or vegetables<sup>10</sup>, generally with great erosive potential. Vitamin C (ascorbic acid) has also achieved food fad status and has a low pH, strong enough to contribute to dissolve the enamel<sup>12</sup>. In the literature, it is frequently reported that alcoholic beverages and drinks containing citric acid have shown to be more erosive than those that contain phosphoric acid<sup>13-15</sup> or malic acid<sup>16</sup>.

In this article, we aimed to report a case of dental erosion caused by extensive consumption of whiskey and lemon in natura for a long period of time. The extent of the damage we observed on enamel and dentine of this patient is impressive. A review of the literature on the etiology and the related factors was also presented.

### CASE PRESENTATION

After obtaining the term of free and informed consent, duly signed, this article was analyzed and approved by the Research Ethics Committee of the School of Dentistry of Federal University of Bahia. A 45-year-old woman presented to the orthodontic clinic of the University in order to have her orthodontic treatment performed. Anamnesis revealed an unremarkable medical history and a dental history punctuated by several clinical interventions. She denied symptoms of gastroesophageal reflux, xerostomia, or bruxism. Intraoral examination revealed extensive eroded areas on the buccal surfaces of mandibular canines, premolars, and molars. No lesions were found at the maxillary arch or at the lingual surfaces of the mandibular teeth. The patient did not report pain or sensitivity associated with any of the affected teeth. The oral mucosa was moist, pink, and with a small lesion adjacent to left mandibular central incisor, created when she brushed this region. She reported to toothbrush twice or three times daily. There was no salivary gland enlargement bilaterally. The saliva was clear and flowed freely from salivary ducts bilaterally. Normal pooling of saliva was noted on the floor of the mouth.

As the explanation for this phenomenon could not be found in the teeth themselves in terms of developmental disturbances, patient was asked about her dietary habits. Patient denied anything unusual on her diet, denied to have a great consumption of soft drinks, but reported a history of drinking whiskey frequently and Tahiti lemon in natura daily for more than 10 years. She also reported she was used to hold both drinks in the mouth for several seconds and tasting before swallowing. These two substances were evaluated in a pH meter machine (Corning 340, Corning Incorporated, New York, NY, USA) in order to determine their pH values.

This history and symptoms confirmed the diagnosis of dental erosion. The lesions on the dental surfaces were registered by clinical photographs and scanning electron microscopy (SEM) of models of the buccal surfaces of the affected teeth. Impressions were made in a silicone

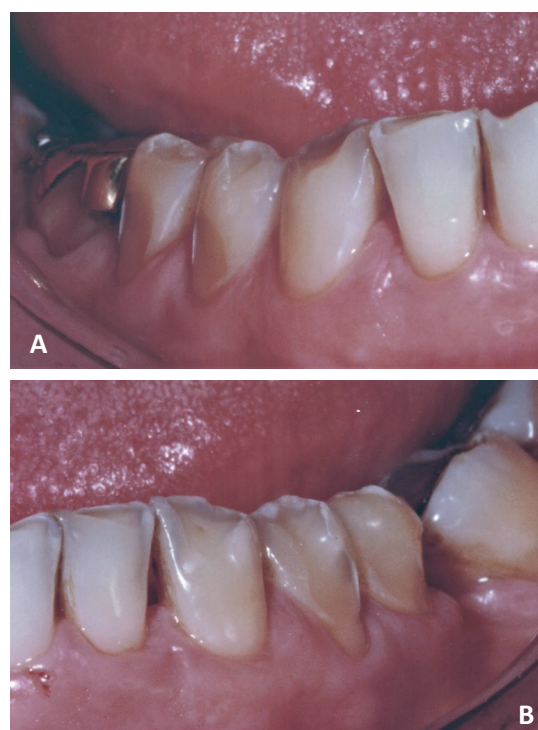
material (Optosil® Comfort Putty with Activator, Kulzer, Hanau, Germany) to obtain gross impressions which after adequate relieve were used to get the final accurate models (Xantopren® VL Plus with Activator, Kulzer, Hanau, Germany). Positive replicas were cast in epoxy resin (Araltec, Ciba Geigy, Basel, Switzerland) mixed carefully in a rubber bowl with a smooth brush to avoid air bubble formation. The models were sputtered with gold-palladium for examination in the SEM (JSM-840A, Jeol, Tokyo, Japan) operated at 25 kV.

Since exposed dentin is more vulnerable to mechanical damage and chemical disintegration, it was considered to be necessary to cover the lesions. A treatment plan was prepared, including multidisciplinary action, and involved the establishment of preventive measures to control the risk of future dental wear, including the application and prescription of topical fluoride, and guidance with regard to diet, controlling the ingestion of acid substances, and oral hygiene. Restorative treatment with resin composite was planned to be conservative, without cavity preparation, bonded to the affected surfaces by means of the adhesive system, thereby restoring shape, function and esthetics to the teeth.

### RESULTS

Clinical photographs registered a great amount of dental structure loss on buccal surface of canines, premolars, and molars as can be observed in Figure 1.

**Figure 1** – Intraoral view of enamel and dentin erosion on buccal surface of mandibular teeth. A, right side; B, left side; C, occlusal aspect of left side.

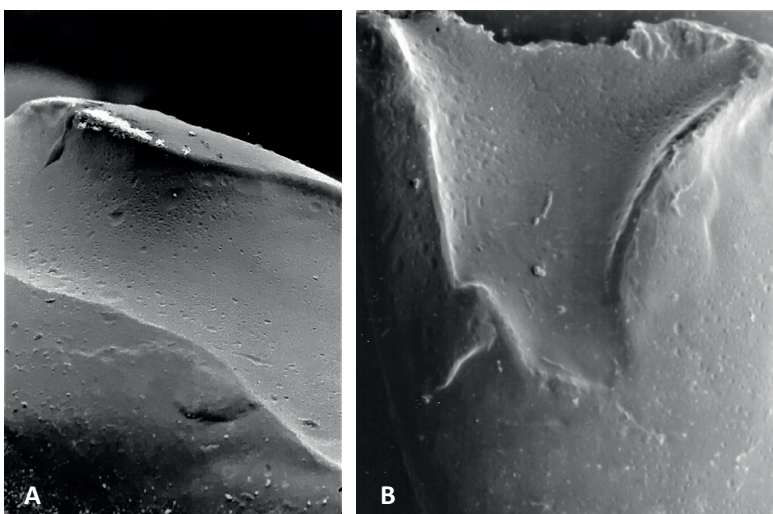




Source: The authors.

SEM examinations of the replicas showed a general smoothing out of developmental irregularities, leaving the impression of a practically structureless surface with only a few wear striations present. There was evidence that those areas where enamel prisms attained the surface reacted differently as compared to aprismatic surfaces where no prism structures were seen (Figure 2).

**Figure 2** – Scanning electron micrographs of epoxy resin casts of buccal surface of left mandibular teeth. A, canine; B, first premolar.



Source: The authors.

The pH measurement revealed a very low pH for Tahiti lemon *in natura* around 1.92 while the brand of whiskey she was used to drinking also had a low rate around 2.84. In this case the cause of the damage was defined and then it was possible to control the destruction and restore the function and aesthetic appearance of the teeth.

## DISCUSSION

Dental erosion has been defined as the physical result of acid without bacterial involvement. Early stage of dental erosion includes a smooth surface. Advanced stages include developing enamel concavities, lesions

with longer depth than width, and undulating borders. In severe cases of dental erosion, the dental morphology almost disappears<sup>1,10</sup>. The pattern of erosion is related to the frequency the dental tissue is exposed to acidic fluid<sup>17</sup>. In this report, the patient were used to hold the acid drinks, especially the whiskey, in around the vestibular groove, which greatly facilitated demineralization on the buccal surface of the mandibular teeth.

Epidemiological data on the incidence of erosion together with clinical observations suggest that dental erosion is fairly common and has had an increased prevalence between different age cohorts of young people over time<sup>18</sup>. In some specific groups such as vegetarians even higher percentages have been found<sup>19</sup>, dietary factors being considered the most common etiologic factor implicated in the development of dental erosion<sup>9</sup>. It seems that the erosive capability of different drinks, juices and foodstuffs is significantly associated with their titratable acidity, their pH values, their phosphate and fluoride contents<sup>1</sup>. A not too old study<sup>6</sup> referred to the critical pH of dental enamel as 5.5, as though this were a fixed value. In fact, the critical pH varies over a wide range, its value depending on the concentrations of calcium and phosphate in the solution<sup>3</sup>. In addition, although the solubility of some minerals, such as sodium chloride, is virtually independent of pH,

the solubility of hydroxyapatite increases about ten-fold for each unit decrease in pH<sup>16</sup>. The patient of this report presented a frequent consumption of whiskey and a daily consumption of Tahiti lemon. The pH values of her preferable whiskey around 2.8 and of Tahiti lemon around 1.9 suggest a high correlation of both drinks with the damage on the enamel.

Another factor which seems to minimize the erosion magnitude is the normal salivary flow and function<sup>9</sup>. A previous study<sup>20</sup> showed that specimens stored in artificial saliva had a significantly lower mineral loss and this suggests a possible protective or remineralizing effect. In this report, as the patient did not present problems with salivary flow, treatment of enamel with topical fluoride should provide an additional protection. Besides, the erosive effects of acid from extrinsic sources can be potentiated or lessened by other factors, including the method of consumption, frequency of ingestion, kind of acid and amount of time that the acid is in contact with enamel<sup>10,13,15</sup>. Patient reported to hold both drinks, especially whiskey, in the mouth for several seconds and tasting before swallowing. This habit probably has a close relation with the extent of lesions.

When the demineralized tissue is brushed, accelerated abrasion occurs until the affected layers are removed<sup>8</sup>. It is difficult to isolate the effect of the erosive and abrasive components in lesions, but where a substantial loss of enamel thickness has occurred, the pathogenesis

probably involves erosion<sup>2</sup>. This was shown, in particular, to be the case in lesions as they were observed in this report. Due to the very acidic nature of the erosive agents and the immediate clearance of the dissolved minerals, enamel was lost layer by layer from the surface. In that process, the holes and the sharp edges on them acted as stress concentrations and determined the shape of deterioration. This mechanism differs fundamentally from that of a subsurface demineralization occurring underneath a microbial plaque and leading to dental caries<sup>17</sup>. The scanning electron micrographs showed how the variability of surface enamel modifies the erosive process. The occurrence of prismatic versus aprismatic enamel, particularly in premolars, is of key importance in the progression of erosion. Aprismatic surface enamel presents an irregular type of dissolution while prismatic one shows a characteristic dissolution where initial erosion affects specifically the prism sheath areas and then the enamel prism cores followed by interprismatic areas<sup>1,8</sup>. In dentin, the first area to be affected is the peritubular dentin. With progressing lesions, the dentinal tubules become enlarged but finally disruption is seen also in the intertubular areas<sup>8</sup>.

Since the exposed dentin is more vulnerable to mechanical damage and chemical disintegration than enamel, covering the buccal surfaces of the affected teeth is considered to be necessary. In this case, once the cause of the damage was identified, we recommended the patient to try to reduce whiskey and lemon intake and contact time, avoiding keeping drinks in the mouth. In addition, she was instructed to avoid brushing her teeth immediately after consuming acidic drinks. Thus, it was possible to minimize the destruction and refer the patient to restore the function and aesthetic appearance of the teeth.

## CONCLUSION

The screening for dental erosion in patients seeking orthodontic treatment is advisable to be a usual procedure. The patient in our case report presented with generalized dental lesions and with a history of excess whiskey and lemon consumption. The chemical challenge of the enamel surfaces, particularly in combination with mechanical wear, could be an explanation for those lesions. Strategies to prevent erosion include identification of any causative medical conditions, decreasing consumption of acidic foods and beverages or removing their erosive potential, and protecting teeth from erosive substances. These facts show the great complexity of treatment of erosion lesions and the need of a multiprofessional teamwork, emphasizing the importance of an early diagnosis.

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