

Dental Erosion: A Case Study of a Marathon Runner

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Abstract: This paper presents a case study of a recreational runner who unwittingly has caused severe damage to her dentition through her lifestyle and dietary habits. It should serve as a reminder to all dental practitioners that dental problems occur even in patients who seem to be following a healthy lifestyle.

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Clinical Relevance: Dental erosion affects many child and adult patients and can be difficult for the dentist to manage and costly for the patient. Prevention of these problems, by giving advice in the form of patient education, is preferable to having to repair such damage.

Non-carious tooth surface loss (erosion) is not a new phenomenon;¹ it has been described and reported in many papers. Several different aetiological agents have been implicated in erosion but the consumption of acidic drinks is recognized as one of the major contributory factors.

There is considerable encouragement, in the form of advertising campaigns on television, adverts in specialized sports magazines and commercial sponsorship of sporting events, for professional and amateur athletes to use sport supplement drinks. These drinks are used by athletes before competing in long-distance events to boost energy levels, and during the race to prevent dehydration. Although the professional athlete will receive dietary advice from a trainer or dietician, the amateur athlete might not have access to this

specific advice and therefore be more influenced by commercial pressures to use sport supplement drinks.

An investigation into the use of sports supplement drinks and dental health in young swimmers and cyclists showed no relationship between erosive toothwear, dental caries and consumption of these drinks;² however, the mean age of the swimmers was only 17 years and of the cyclists 20 years.

The fact that sports drinks have the potential to damage the teeth has been recognized,³ but the manufacturers of these drinks are apparently unconcerned by this.⁴ In addition, the trend to adopt a healthier lifestyle (with increased strenuous exercise and the potential to ingest acidic sports drinks) has been linked with dental erosion.⁵

CASE REPORT

A 56-year-old woman was referred by her general dental practitioner to the Department of Restorative Dentistry at University Dental Hospital and School, Manchester because she was concerned that her front teeth appeared to be 'wearing away.' She had no complaint

regarding function or sensitivity.⁶ It was not known if the patient was a regular attender or had only sought advice in respect of the wear of her teeth.

Clinical Examination

Clinical examination recorded teeth present as:

7	5	3	1		1	2	3	7
7	4	3	2		1	2	3	7

with caries evident at $\underline{5}$ $\underline{3}$ and $\overline{7}$ $\overline{7}$ and abrasions buccally at $\overline{3}$ and $\overline{3}$. The caries in $\underline{5}$, $\overline{7}$ and $\overline{7}$ was extensive. There was generalized gingivitis, most noticeable at $\underline{1}$.

Extensive tooth tissue loss was apparent on the palatal aspects of $\underline{3}$ $\underline{1}$ $\underline{1}$ $\underline{2}$ $\underline{3}$, showing a characteristic exposure of dentine bordered by a rim of enamel.⁷ Significant, but less severe, hard-tissue loss was apparent on the labial/incisal surfaces of the above teeth and incisally at $\overline{3}$ $\overline{2}$ $\overline{1}$ $\overline{2}$ $\overline{3}$ (see Figures 1-3).

Radiographic Findings

Radiographic examination highlighted



Figure 1. Palatal view of the upper anterior teeth, showing loss of enamel and dentine. Caries is also visible on the distal surface of $\underline{3}$.

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Figure 2. Anterior view, showing incisal edge erosion/attrition and loss of definition of the labial surface. There is a large cavity on the buccal aspect of 7̄.



Figure 3. Occlusal view of the lower arch showing loss of incisal tooth surfaces.

the loss of tooth substance at the upper anterior teeth and showed periapical changes on 5̄ and 7̄ (Figures 4 and 5). The appearance of 7̄ suggested a periendo lesion but this was not found clinically.

Other Examination

No relevant medical or dental history that would account for the extensive erosion type pattern of tooth surface damage was ascertained. Indeed, the patient considered herself fit and healthy. There was nothing in the patient's medical history to suggest psychological problems. When specifically asked about eating disorders, she denied ever causing self-induced vomiting and was unaware of any gastro-oesophageal reflux (this, however, does not rule it out entirely as the phenomenon of silent reflux has been identified). She appeared physically to be of a normal height to weight ratio.

When the patient realized where the line of questioning was leading, she volunteered the information that she had been a long-distance runner for more

than 20 years, competing in half and full marathon events and training regularly to reach race fitness. In an average year she usually ran in five half marathons and three full-distance races. During a race she would consume up to 13 litres of a well-known sports drink (Isostar, produced by Novartis Nutrition SA) – about 500 ml per mile. During training runs she routinely drank 500 ml every two miles and took supplements of 'PowerGel' (a high-energy viscous gel, manufactured by PowerBar Inc., Berkeley, CA). The composition of these supplements is shown in Table 1. Her training regime consisted on average of two medium-distance runs per week, with intake of high-energy supplements as detailed above. During intense periods of training she had a tendency to overlook her fluid balance, so heading towards a state of mild dehydration and burdening the already compromised oral environment with a lack of protective saliva.

A further compounding factor in this individual was that, as well as pursuing an active fitness regime, she ate a healthy diet. She was aware of the detrimental effect of sugar on the dentition and avoided sugar in the form of sweets, etc. She ate one grapefruit for breakfast every morning and resisted drinking the more common beverages of tea and coffee (again perceived as unhealthy) for the more 'healthy' alternatives – fruit juices, fruit teas and carbonated water.

Treatment

The patient was advised on her intake of these high-energy sports drinks and other erosive drinks. She was informed of the effects the low pH of these beverages have on the dental hard tissues. It was also pointed out that the high sugar content of the energy drinks and gels was a factor in her caries and that she should make every effort to reduce both the amount and frequency of their consumption, particularly the gels which are very viscous and stay in close contact with the teeth for a considerable period (the patient knew of some contemporaries who held this gel

in the buccal pouch whilst running).

The importance of good plaque control was emphasized; she was given advice on regular and effective toothbrushing and interdental cleaning and on the daily use of a fluoride mouthwash to protect against continuing deterioration. It was also stressed that she should not carry out any oral hygiene measures immediately after consuming any cariogenic or erosive drinks or after strenuous exercise but should allow adequate time – at least 30 minutes – for the pH of the oral environment to return to normal. Alternatively she could rinse with plain water to lower the cariogenic/erosive effect.

On completion of treatment planning the patient returned for treatment with her general dental practitioner.



Figure 4. Periapical radiographs to show the relative radiolucency of the coronal aspects of the teeth surrounded by a more radio-opaque enamel rim. This is a common appearance with palatal hard tissue loss.

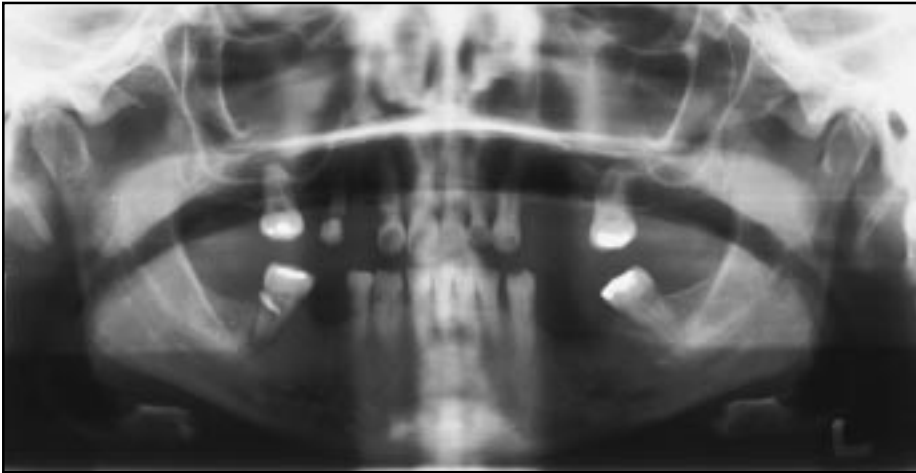


Figure 5. Orthopantomograph highlighting the periapical lesions in 5] and 7].

DISCUSSION

The effects of a large and frequent intake of fluids with low pH and high titratable acid value have been investigated and, whilst it cannot be categorically stated that they alone cause such tooth destruction they are viewed with a high degree of suspicion.^{2-4,8-10} The work by Milosevic^{2,8} is suggestive but not conclusive, as individual dietary and lifestyle factors cannot be accounted for and it is therefore impossible to blame any individual source in this situation. In addition, Lussi and colleagues¹⁰ show that results for the sports drink in question compare favourably with other citrus and soft drinks in terms of baseline pH and amount of buffer required to bring to neutrality. It has also been demonstrated that fluoride ion content (whether inherent or added) can reduce erosive potential. Other workers have also suggested that high intake of acidic beverages, combined with the dehydrating effects of strenuous exercise, reduces salivary flow and buffering capacity, thereby decreasing the protective effect offered by a normally moist oral environment.^{5,11} In some individuals vigorous exercise increases gastro-oesophageal reflux, again prolonging the time for which the teeth are exposed to a low pH.¹²

This case highlights the need for taking great care to include details of the patient's lifestyle when recording the dental history. Sometimes patients who

seem to have a very healthy lifestyle need very specific oral health advice. The interesting factor in this case was the length of time the patient had been participating in long-distance running. Many people would consider that this was not the sporting regime of an amateur or recreational jogger and, although the patient did not consider this amount of exercise excessive, her dedication may be regarded as something of an obsession. An investigation into the possible relationship between the psychological and physiological traits of the habitual runner and the obsession with body image shown by anorexic patients¹³ states that there is little evidence to suggest that the committed runner shares any characteristics with anorexics. However, a recent review article disputes this point, highlighting that athletes who compete in sports where body image or weight is important to performance have an increased tendency to eating disorder.¹⁴ Evidence is given that eating disorders are higher in female athletes than non-athletes and a specific name has been given to a sub-clinical disorder – *anorexia athletica* – which is not as pronounced as anorexia nervosa or bulimia.¹⁴ Although the patient in this report showed no sign of an eating disorder it is worth bearing in mind – particularly if a patient is a young woman who has a passion for her chosen sport – that excessive commitment to training may be a mask

to control body weight.

Although previous studies have not shown any direct link between dental erosion and consumption of sports drink, the age of the sportsmen and women studied was quite low, and the period of exposure to the erosive substance consequently shorter than in the patient reported here.

It was also interesting to note that the patient was aware of the effects of sugar on teeth and avoided sugary confectionery. Although she clearly understood the sugar–dental caries connection in respect of food, she did not associate her energy drinks, which are heavily loaded with sugar, as being causative in her dental caries – nor did she appreciate the possible effects of a ‘high-energy paste’ that is designed to stay in the mouth for slow release of sugars. An interesting anomaly is that athletes may not think that a product manufactured and promoted for people participating in what might be considered healthy sports has any possibly unhealthy effects.

Dental erosion may affect only a small section of the population, and indeed only a small number of athletes in those sports where the time span for competition at an amateur level is wide. It is important to advise young athletes and older athletes alike of the potential long-term dental risks of exposure to erosive sugary drinks and the possible benefits of taking supplements such as fluorides. There is also a case for making dietary advice available to all

Isostar (Novartis Nutrition SA):

- Composition – high-energy drink.
- At 10% concentration – pH 2.38, titratable acidity 8.50 with 0.1 M NaOH to neutrality.
- Contents – sugar (72 g per 100 g), maltodextrin, acidity regulator, citric acid, various minerals and vitamins.
- Consumption advice – take small sips regularly before, during and after exercise.

PowerGel (PowerBar Inc., Berkley, Ca):

- Composition – high-energy viscous gel
- Contents – maltodextrin, fructose, citric acid, minerals and vitamins. 28 g carbohydrate per 41 g (5 g sugar).

Table 1. Composition of the high-energy supplements taken by many athletes.

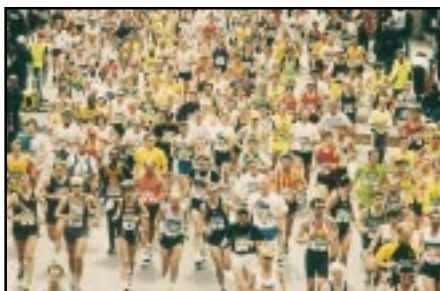


Figure 6. A not inconsiderable number of athletes, of all ages, may be at risk of dental erosion. The patient discussed here is in this photograph.

athletes and for collaborative research between dieticians, sports performers and dentists to prevent long-term damage to the dentition (Figure 6).

Further thought may be necessary in the female athlete who shows signs of erosion at a young age. The question may arise as to whether the erosion is due to the effects of the diet alone or whether there may be an underlying

eating disorder and/or excessive training regime. If there is, the athlete should be warned of the possibility of developing the 'female athlete triad', which has long-term consequences – fluctuating hormone levels and osteoporosis.¹⁵

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ABSTRACTS

EASIER ENDODONTICS!

An Evaluation of the Effectiveness of Two Canal Lubricants in Removing Smear

A. Tam and D.C. Yu. *Compendium of Continuing Education in Dentistry* 2000; **21** (11): 967-970.

The presence of a smear layer in root canals can both harbour bacteria during the instrumentation phase of therapy, and reduce the effectiveness of the final obturation. Unfortunately, the smear layer is produced iatrogenically during the cleaning and shaping procedures. Removal of the smear layer during the preparation of root canals facilitates more effective debridement of micro-organisms, and thereby more predictable success in the endodontic treatment. In this article, the authors consider the clinical significance of the smear layer and, using scanning electron microscopy, evaluate the effectiveness of two EDTA pastes, used in conjunction with a sodium

hypochlorite irrigant.

They found that both pastes completely removed the smear layer from the coronal and middle thirds of the root canal, although only partially in the apical third. It is recommended that such EDTA pastes form an integral and essential part of all root canal preparation techniques.

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CHALLENGING THE AETIOLOGY OF ORAL CANCER

Is Alcohol Responsible for More Intra-oral Cancer? I. Hindle, M.C. Downer, D.R. Moles and P.M. Speight. *Oral Oncology* 2000; **36**: 328-333.

The carcinogenic effects of tobacco smoking and alcohol on the oral mucosa have long been known both independently and, more importantly, synergistically in combination. However, the relative risks of each of these risk factors is difficult to assess independently. While the effects of tobacco are well investigated and documented, the effect and risk of

alcohol is less clear. Also, a worrying trend of an increased incidence of oral cancer in the UK is being observed, particularly in males, despite an overall decrease in tobacco consumption.

This study used the surrogate markers of two well-known diseases caused by smoking and alcohol, lung cancer and liver cirrhosis, respectively. The authors attempted to correlate these diseases with data related to intra-oral cancer. They demonstrated in males that there was a negative association between smoking and oral cancer but a strongly positive correlation between alcohol and oral cancer. This was not observed in females. They suggest that a rise in alcohol consumption in the 1950s may account for the increasing incidence of oral cancer in males.

In the light of these observations, we should perhaps counsel at-risk male patients about their alcohol consumption equally or more so than their tobacco intake.

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