

Rapid and Severe Tooth Erosion from Swimming in an Improperly Chlorinated Pool: Case Report

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ABSTRACT

This case report describes the almost complete loss of enamel by acid erosion, particularly from the anterior teeth, in a woman who swam daily for 2 weeks in an improperly chlorinated swimming pool in Cuba. It emphasizes the need for both swimmers and swimming pool staff to ensure that the water has been properly chlorinated and that the pH has been adjusted to 7.5.

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In 1982, Savad¹ first reported that swimmers in improperly maintained swimming pools may be susceptible to acid erosion of enamel. Since then, a few other reports have confirmed the suggestion.^{2,3} Although 3 books on enamel erosion have appeared recently,⁴⁻⁶ only one⁶ mentions acidic swimming pools as potentially damaging to teeth.

Public and “backyard” swimming pools are chlorinated to reduce bacterial and algal contamination. There are several ways to add chlorine, which should preferably have a concentration of 2–3 ppm⁷ (minimum concentration 1 ppm). The pH of the water is then adjusted to about 7.5 by the addition of acid or alkali. Sources of chlorine are sodium hypochlorite, which has an alkaline pH and, thus, no potential to cause erosion in teeth⁸; chlorine gas, which is used mainly in large public swimming pools; and “stabilized” chlorine, which is created by combining chlorine and the salts of cyanuric acid into a tablet form, usually about the size of a hockey puck. In solution, chlorine generates hypochlorous and hydrochloric acids, the former

having disinfectant properties. Cyanuric acid retards the rate at which hypochlorous acid is broken down by sunlight. Unless the acids are neutralized, usually with sodium carbonate, the pH of the water may be less than 3.^{2,3} A low pH may not be sensed by swimmers, although it may cause eye irritation in those not wearing goggles; however, acidic water in contact with the teeth will cause irreversible erosion of the enamel.⁸

Case Report

A 72-year-old woman had regularly visited one of the authors (CLB) for dental treatment. On February 5, 2007, a vertical composite restoration was placed on the facial surface of tooth 11 to hide a discoloured crack. After this, she was considered dentally fit, with no evidence of tooth erosion. On February 12, 2007, she left for a holiday in Guardalavaca, Cuba, returning on February 26. She reported that during that time, her teeth had begun to disintegrate and floss would catch and break when moved between the teeth.



Figure 1: Severe erosion, resulting in occlusal amalgam restorations in teeth 46, 45 and 44 standing well above the surrounding tooth structure, as are the cervical composite restorations in teeth 45, 44 and 43. Marked diastemas appear between all teeth and incisors show rounding of the occlusal angles.



Figure 2: Occlusal amalgam restorations in teeth 14 and 24 are standing well above the surrounding tooth structure, as are the cervical composite restorations in teeth 14, 11 and 23.

The patient is retired, a vegetarian and mainly in good health, except for asthma, which she has had for 14 years, and some environmental allergies of uncertain cause. She takes medication occasionally when she has difficulty sleeping. However, she is sufficiently well that she is able to swim for a few hours (about 3 km) nearly every day. She does not have diabetes and has never had depression, bulimia or heartburn.

She was asked to keep a food diary for one week, but this showed no exceptional consumption of acidic food or drinks, the main acid being from a half grapefruit, which she ate most days for breakfast. She reported that, while in Cuba, there was no great change from her normal diet.

On examination on March 8, her mouth appeared normally moist (**Fig. 1**) and she stated that she has never experienced dry mouth. Her unstimulated salivary flow rate, measured twice, was 0.10 mL/min. This value is on the low side, but within the normal range, given that she had taken ibuprofen and triamcinolone nasal just 2 hours earlier. These drugs tend to reduce salivary flow rate.

The loss of enamel from her teeth was striking, particularly on the anterior teeth (**Figs. 1** and **2**), and diastemas were present between most of the teeth. Her restorations were protruding from the tooth surfaces, including the composite placed on February 5 on tooth 11 (**Fig. 2**).

It was clear that something drastic had happened while she was on vacation. On questioning, she stated that each day in Cuba she swam for about 2.5 hours in the hotel swimming pool, which was chlorinated with stabilized chlorine. In previous years, she had swum in the same pool without any ill effects. While swimming, she

always did the “crawl” and she admitted that she regularly took in mouthfuls of water, which she spat out between strokes. She wore goggles and experienced no problems with her eyes. However, she stated that the water “tasted funny” and seemed to be greatly over-chlorinated, as there was a strong smell of chlorine around the pool.

As improperly chlorinated water may be very acidic,² this appeared to be the cause of her problem. As the patient had no idea that swimming pool water could cause enamel loss, she did not collect a water sample for analysis. The only good news was that the condition was unlikely to progress now that she was no longer using the over-chlorinated pool. However, she now needs veneer or crown coverage of her affected teeth, as the exposed dentin will be much more susceptible than enamel to future acid attack. In the meantime, fluoride varnish has been applied to the exposed dentin.

Discussion

This case is a tragedy that resulted from no act of dental neglect by the patient. It appears to be the first case of enamel erosion in a person who swam in a pool chlorinated with stabilized chlorine. In previous reports, patients had swum in pools chlorinated with gaseous chlorine.¹⁻³ In addition, the almost complete loss of enamel, particularly from her anterior teeth, in less than 2 weeks seems to be the most rapid and extensive loss from swimming ever reported.

This case emphasizes the need for both swimmers and swimming pool staff to ensure that the swimming pool they use or maintain has been properly chlorinated and water pH has been adjusted to 7.5. ♦

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