

## Treatment of fluorosis or fluorosis-like lesions with calcium sucrose phosphate gel

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### Abstract

*A method of improving the appearance of fluorosed teeth using calcium sucrose phosphate gel was evaluated. Seventeen patients with fluorosis or fluorosis-like lesions on their anterior teeth were treated. Treatment involved cleaning the affected teeth with pumice and glycerin, rinsing with water, and applying 37% phosphoric acid for 1½–2 min. This treatment was repeated followed by application of 2% sodium fluoride for 4 min. Finally, a thick layer of 40% calcium sucrose phosphate gel was placed on the treated teeth. The patient was instructed not to rinse or eat for 30 min. A standardized photographic system was used to take pre- and posttreatment pictures of the treated teeth.*

*Photographs of the teeth were evaluated by 3 examiners who were blind as to which was the posttreatment photograph. The examiners selected the posttreatment photograph as an improved enamel surface condition in 82% of the cases.*

Few techniques have been reported to improve the appearance of fluorosis or fluorosis-like lesions. External bleaching is an accepted procedure. However, when bleaching is used in conjunction with heat, postoperative discomfort often results. Cohen<sup>1</sup> reported esthetic improvement on maxillary anterior teeth using warmed 30% hydrogen peroxide solution. Suzuki<sup>2</sup> recommended acid etching of discolored teeth for 1 min prior to bleaching with 30% hydrogen peroxide.

Colon<sup>3</sup> reported on a method for treating brown stain and pitting using hydrochloric acid, hydrogen peroxide, and anesthetic ether. McCloskey<sup>4</sup> reported a technique using 18% hydrochloric acid and pumice.

Powell and Craig<sup>5</sup> reported the improvement of "fluorotic-like lesions" using a calcium sucrose phosphate gel. Their procedure involved etching the teeth for 2–3 min with 37% phosphoric acid followed by a 4-min application of 2% sodium fluoride. Forty per cent calcium sucrose phosphate then was applied to the etched tooth surface. If, in 4 weeks, significant

improvement was not noted, the treatment was repeated.

The purpose of this study was to attempt to confirm the findings of Powell and Craig using the same procedure. To assess the change uniformly a single treatment was used.

### Methods and Materials

Seventeen patients with fluorosis or fluorosis-like enamel surfaces on 44 teeth were treated in this study.

Informed consent was obtained prior to treatment. Pre- and posttreatment records were taken using 35 mm color film with standardized shutter speed and light using an electronic point flash. To check for possible variations in film processing, a photograph of a color spectrum was included on each roll as an internal control.

Treatment was initiated by a rubber cup polishing of the selected teeth using a mix of pumice and glycerin. Teeth were rinsed with water and the pretreatment photograph was taken. Thirty-seven per cent phosphoric acid was applied for 1½–2 min with a small brush. The teeth again were pumiced and the etchant reapplied for 1½–2 min. After rinsing and drying, a solution of 2% sodium fluoride was applied using a cotton pellet. The area was kept moist with the fluoride solution for 4 min. Next, a thick layer of 40% calcium sucrose phosphate gel (CSP) was placed over the treated teeth. The patient was instructed to allow the gel to dissolve in the oral fluids and not to rinse or eat for 30 min. The patient was instructed further to use a sodium monofluorophosphate or a sodium fluoride dentifrice at home.

Two to 4 weeks after the initial treatment, the patient returned and photographs were taken using the same standardized technique.

Three independent examiners, dentists with experience in rating tooth discolorations, graded the photographs independently at 2 different sessions.

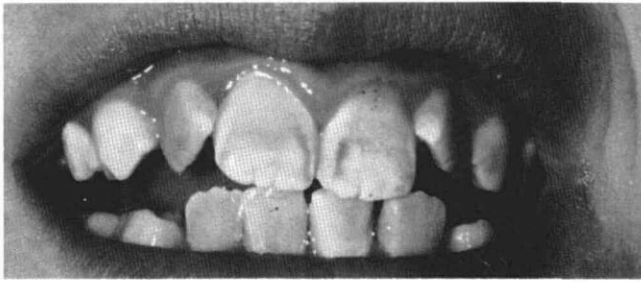


FIG 1a. Pretreatment photograph showing fluorosis-like lesions on the maxillary central incisors.



FIG 1b. Posttreatment photograph demonstrates improved appearance of the teeth.

At each session examiners viewed both pre- and posttreatment photographs on each patient. Photographs of the teeth were rated for improvement or no improvement. In this study, the term "improvement" meant either a decrease in stain and/or appearance of increased mineralization. Examiners were blind as to which was the posttreatment photograph. The actual sequence of photographs was altered between sessions to minimize the effects of each examiner's memory. The color transparencies (slides) were viewed on 2 Kodak Ektagraphic 200 Audio-Viewers in a darkened room.

## Results

Percentages for the intraexaminer reproducibility were based on their consistency rather than accuracy. For example, examiner 2 correctly chose the posttreatment slide in 14 of 17 cases in session 1 and 15 of 17 cases in session 2. Thus, only 1 decision was reversed, giving a 94% reproducibility score. The same was true for examiner 3. Examiner 1, however, reversed 3 decisions giving a reproducibility of 82%. Thus, the mean interexaminer reproducibility was 90%, while the mean for correctly selecting the posttreatment slide was 82%. All 3 examiners consistently rated 10 patients as having an improved appearance. Nine of these patients were between the ages of 7 and 15 years. Examiners consistently found no improvement on 2 individuals. Two of the 3 examiners consistently agreed on improvement in both sessions for 4 patients.

Pretreatment and posttreatment photographs of 2 patients demonstrate examples of stain removal (Figs 1, 2).

## Discussion

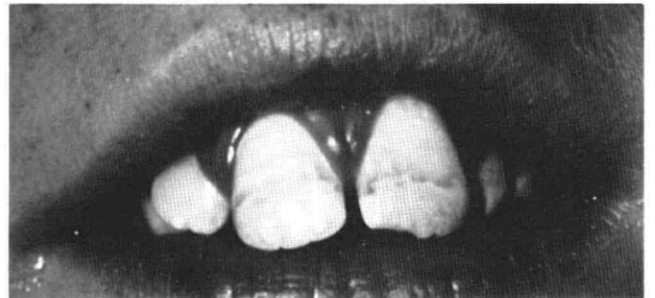
Most of the treated teeth showed an improvement in appearance. Two factors appear to be important, the first being the age of the patient. The teeth of younger children seemed to have responded better to treatment than those of adults. This difference may be due to the fact that newly erupted teeth are undergoing maturation and thus may respond more

favorably to the technique. Only 1 of 3 adults treated showed improvement.

The second factor was the presence of stain. Stain removal was most successful in those teeth with light brown discoloration. Little or no improvement was seen in 3 siblings with chalky fluorosis. Teeth that had a combination of chalky and light brown discolorations appeared to become more mineralized, as evidenced by a more natural tooth color.

Teeth with severe dark brown fluorosis showed little or no improvement with this 1-appointment procedure. Powell and Craig<sup>5</sup> treated patients with darker discolorations a second time and reported good results. A follow-up study is being conducted to determine if an improved appearance is evident after the second treatment.

The major difficulty in reporting these results is



FIGS 2a, b. Pre- and posttreatment photographs illustrating the effectiveness of the calcium sucrose-phosphate gel treatment.

the subjectivity of the evaluation. Although the human eye is quite an accurate instrument, different people see color in different shades. Also, even a slight change in angle can affect a tooth's appearance on a color slide. Although all the examiners agreed on 10 of the patients, only 2 of the 3 consistently agreed on improvement for 4 patients. Finally, 2 of the 3 examiners reversed their decision from 1 session to the next on 1 patient. These considerations account for the interexaminer reproducibility of 90%.

This technique has important clinical advantages. First, it is a simple 1-appointment procedure requiring no special safety precautions such as protective garments for the patient. Second, this technique uses equipment and supplies commonly found in dental offices so it is an inexpensive procedure for the practitioner. Finally, as suggested in the study by Featherstone,<sup>9</sup> the calcium sucrose phosphate enhances remineralization so that a hardened translucent tooth surface results. The fluoride ion has been shown to accelerate the remineralization process.<sup>7</sup> The calcium and phosphate ions in the presence of sugar phosphates have been reported to remineralize softened tooth enamel in minutes compared to hours required by solutions with lower concentrations of calcium and phosphate ions without sugar phosphates.<sup>8</sup>

## Conclusions

1. Three independent examiners selected the post-treatment slide as an improved enamel surface condition in an average of 82% of the cases.
2. Chalky-white fluorosis-like lesions appeared to become more mineralized, as evidenced by a more homogeneous enamel appearance.

3. Light brown fluorosis-like stains showed the most dramatic improvement with this technique.
4. Newly erupted teeth seemed to benefit more from this 1-appointment procedure than older teeth.

This study was funded in part by Baylor College of Dentistry research funds.

The authors wish to thank Creighton Pharmaceuticals, Doublebay, Australia, who generously supplied the calcium sucrose phosphate. An IND number was granted by the FDA to permit its use in this study.

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1. Cohen S, Parkins F: Bleaching tetracycline-stained vital teeth. *Oral Surg* 29:465-71, 1970.
2. Suzuki M, Jordan R: Clinical management of noncarious enamel defects. *Int Dent J* 32:148-58, 1982.
3. Colon P: Improving the appearance of severely fluorosed teeth. *J Mich Dent Assoc* 56:340-43, 1973.
4. McCloskey R: A technique for removal of fluorosis stains. *J Am Dent Assoc* 109:63-64, 1984.
5. Powell K, Craig G: A simple technique for the aesthetic improvement of fluorotic-like lesions. *J Dent Child* 49:112-17, 1982.
6. Cuttress T, Suckling G: The assessment of noncarious defects of enamel. *Int Dent J* 32:117-22, 1982.
7. Koulourides T, Cueto H, Pigman W: Re-hardening of softened enamel surfaces of human teeth by solutions of calcium phosphates. *Nature* 189:226-27, 1961.
8. Lilienthal B, Napper D, Smythe B: The hardening and softening of human tooth enamel. *Aust Dent J* 13:219-30, 1968.
9. Featherstone J, Cuttress T, Rodgers B, Dennison P: Remineralization of artificial caries-like lesions in vivo by a self-administered mouthrinse or paste. *Caries Res* 16:235-42, 1982.