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# Enamel Color Modifications by Controlled Hydrochloric Acid Pumice Abrasion: A Review with Case Summaries

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## Introduction

The introduction of acid etch bonding techniques has stimulated a growing interest among both dentists and the general public in cosmetic dentistry. However, because of the constant influx of new products and claims, some simple procedures which can be employed to improve the appearance of teeth without permanent alteration are often overlooked. This article reviews one of those techniques, called enamel color modification by controlled hydrochloric acid-pumice abrasion, and summarizes the results of its use in six representative patients of the more than 50 treated in the author's practice.

Interest in the procedure grew out of reports in the literature. The decision was made to use the technique for a private patient who had an overcontoured, leaking facial resin masking a creamy-white enamel opacity on a maxillary central incisor. The objective was to remove the white blemish while avoiding overcontour and significant enamel loss. When the resin restoration was removed, followed by conservative enamel modification, approximately 90% of the opacity had been eliminated. This indication of the potential benefits of the enamel modification procedure prompted its adoption in regular practice protocol. Recognition is extended to the investigators who have published articles on this procedure, especially Drs. Croll and Cavanaugh, whose work provided the impetus for both clinical utilization and the preparation of this article.<sup>1-3</sup>

## BACKGROUND

The first known use of hydrochloric acid-pumice abrasion was by Dr. Walter Kane of Colorado Springs, Colorado in 1916.<sup>4</sup> Since that time, numerous variations have been reported.<sup>5-13</sup> This

article focuses on one variation, termed the McCloskey technique, as reported by Croll and Cavanaugh.<sup>1,2</sup> Although the McCloskey technique was originally developed for use with young patients on fluorosis stains, it has proven effective on any blemish that lies in the superficial layer of enamel. Since most of the patients treated by the author have been over 21 years of age, it appears that the procedure need not be limited to pediatric situations.

Five main advantages make the McCloskey technique especially attractive for both dentists and patients.

1. No anesthetic is required and no drilling. The procedure does not elicit pain and is relatively stress-free for both doctor and patient.
2. There is insignificant tooth loss. Bailey and Christen,<sup>14</sup> in a study on extracted teeth, reported only 0.1 mm of surface enamel loss in a controlled series of applications (20 minutes total) of 30% HCL and anesthetic ether without heat.
3. There is no detectable damage to the dental pulp. Griffin, Ayer, and Grower<sup>15</sup> have reported that "the calcium and phosphorous salts dissolved by the acid may precipitate in the dentinal tubules. The precipitated salts also may act as buffers and neutralize acid in the dentin."
4. The treatment usually requires only 30 to 45 minutes, depending upon the number of teeth involved.
5. The results are immediate and permanent. Unlike the bleaching of dentinal stains that require periodic touch-ups, this procedure gives a lasting result.

Since the level of success depends

largely upon the depth of the color stain in the enamel surface, the more superficial stains offer a better chance of complete removal. However, determining the depth of stain can be difficult. This problem of accurately predicting results should be stressed with each patient before any attempt at color modification is made in order to avoid creating undue expectations and resulting disappointment.

Since hydrochloric acid is extremely caustic, adequate safety barriers must be provided for the patient, assistant and dentist. The following precautions are recommended by Croll and Cavanaugh.<sup>2</sup>

1. Protect the eyes of the patient, assistant, and dentist with eyeglasses.
2. Do not lift the container with the acid-pumice compound above the patient's face, and do not pass any instrument over the face.
3. Keep water spray and high-speed suction readily available for rapid lavage of any contaminated areas.
4. Never attempt the procedure without a completely sealed, well adapted rubber dam.
5. To avoid splatter, do not apply the acid-pumice compound with a rotary rubber cup.
6. Both dentist and assistant should wear rubber gloves and the patient a protective drape.
7. Do not attempt hydrochloric acid color modification with an uncooperative child.
8. The acid pumice solution should be neutralized with a sodium bicarbonate-water paste before being dis-

carded.

9. If floss is used to anchor the rubber dam, the ends should be cut and anchored above the working field to prevent wicking of the acid solution. *Note: This final precaution was added by the author.*

Most reports on the hydrochloric acid-pumice abrasion procedures recommend limiting treatment to approximately 15 applications of 5 seconds each, to minimize loss of tooth structure.<sup>1,2</sup> If success is not obtained at this point, alternative methods such as bleaching and bonding should be considered.

## Case Summaries

On routine prophylaxis recall examinations, six of the author's private practice patients were selected for the removal of various white to brown stains on the enamel surfaces of the maxillary anterior teeth. These patients exhibited good oral hygiene, no caries, and no other detectable oral pathosis. Upon completion of treatment, the estimated percent of stain removal ranged from 80 to 100%.

For illustration purposes, the first of the six cases is presented according to the sequence recommended by Croll and Cavanaugh,<sup>2</sup> as modified by the author.

Two separate mixtures, one of 18% HCL acid and fine flour pumice and

the other baking soda and water, were prepared and set aside. Petroleum jelly was placed on the tissue adjacent to the working area to create an internal seal of the rubber dam. The rubber dam was placed, inverted and sealed externally with a cavity varnish. The teeth were then surrounded by the baking soda and water mixture, creating a halo barrier to neutralize any excess acid. The ends of the floss were anchored in the paste above the working field to prevent wicking of the acid solution.

The following illustrations show the step-by-step procedure used with this patient:

**Figure A** - The 18% HCL acid and pumice mixture was applied to the tooth on a popsicle stick with a firm abrading action, while either a cotton swab or **high speed suction** removed any excess HCL acid.

**Figure B** - The enamel surface was rinsed with a copious water stream for 10 seconds after each 5 second HCL acid application. Care was taken to keep the acid container well away from the patient. The water and high speed suction were kept readily available in case of an inadvertent acid contamination.

The alternating applications of pumice and water rinses were repeated up to 15 times, or until the desired color correction was achieved.

**Figure C** - After a thorough 60 second rinse with water, a 1.1% neutral

sodium fluoride gel (Prevident, Colgate - Hoyt Laboratories, Norwood, MA) was applied to the enamel surface and left on the tooth for 3 minutes.

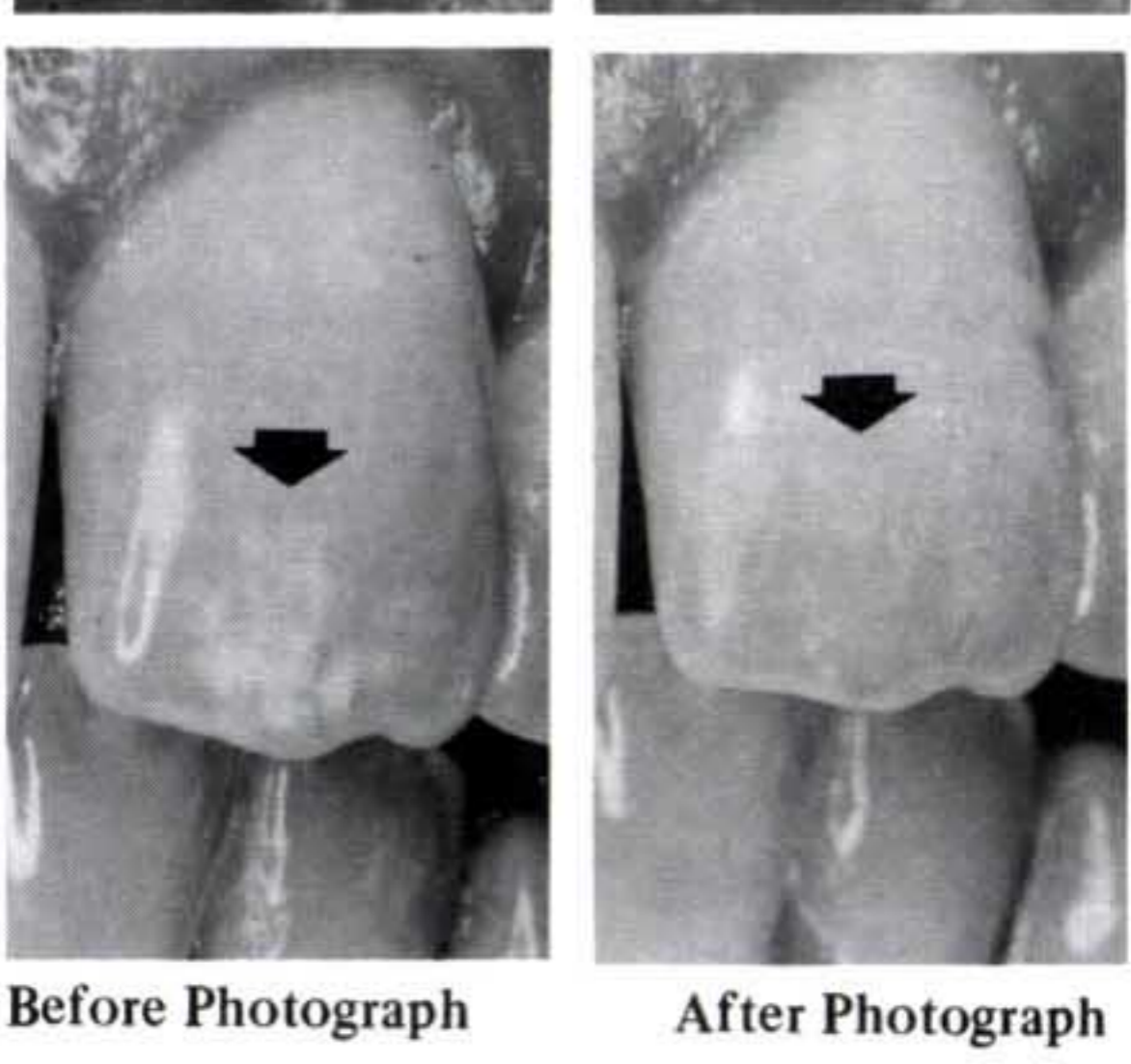
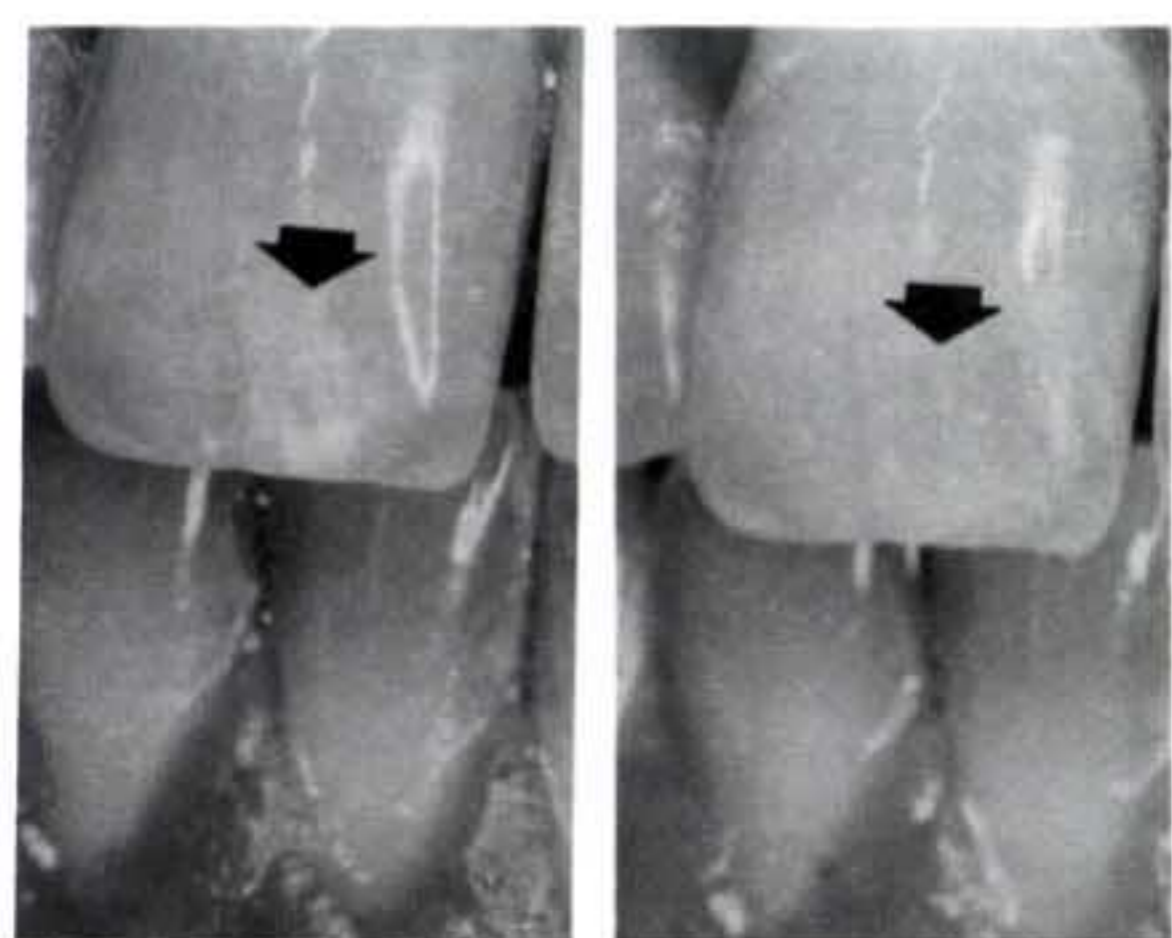
**Figure D** - A fine fluoridated prophylaxis paste was applied to the tooth surfaces that were in contact with the HCL acid pumice mixture. An aluminum oxide composite resin polishing disk was used to renew normal enamel luster.

The accompanying photographs show the before and after situation in all six of the representative cases from the author's practice:

**Case No. 1** - A 24-year-old male with multiple snow-white opacities on the incisal one-third of the maxillary central incisors.

(Estimated by clinical observation)

Tooth	Application	Removal
No. 8	14X	90%
No. 9	12X	90%



**Case No. 2** - A 26-year-old white male had multiple snow-white opacities in the incisal one-third of teeth No. 8 and No. 9.

Tooth	Application	Removal
No. 8	14X	90%
No. 9	12X	90%

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## CONCLUSION:

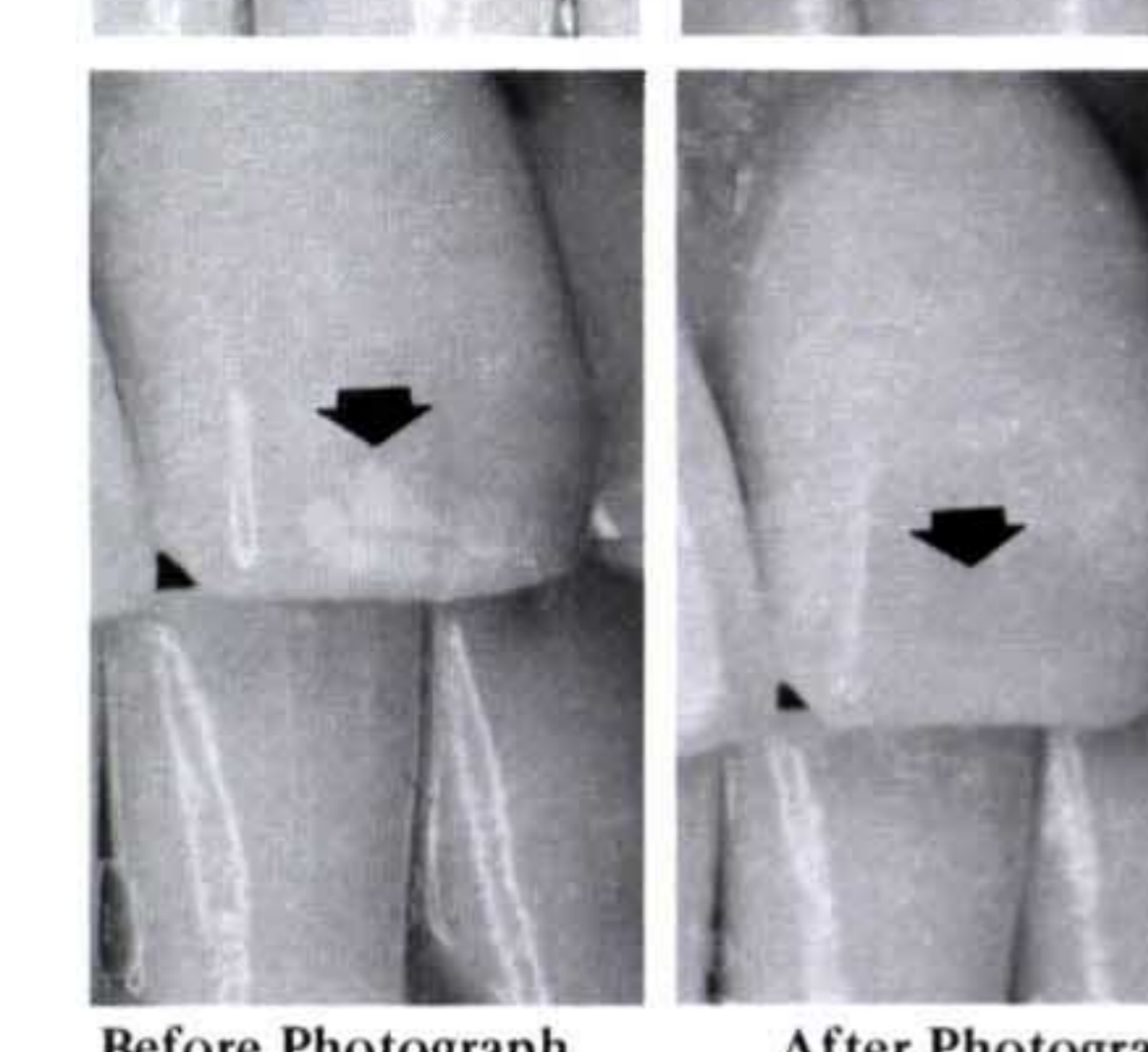
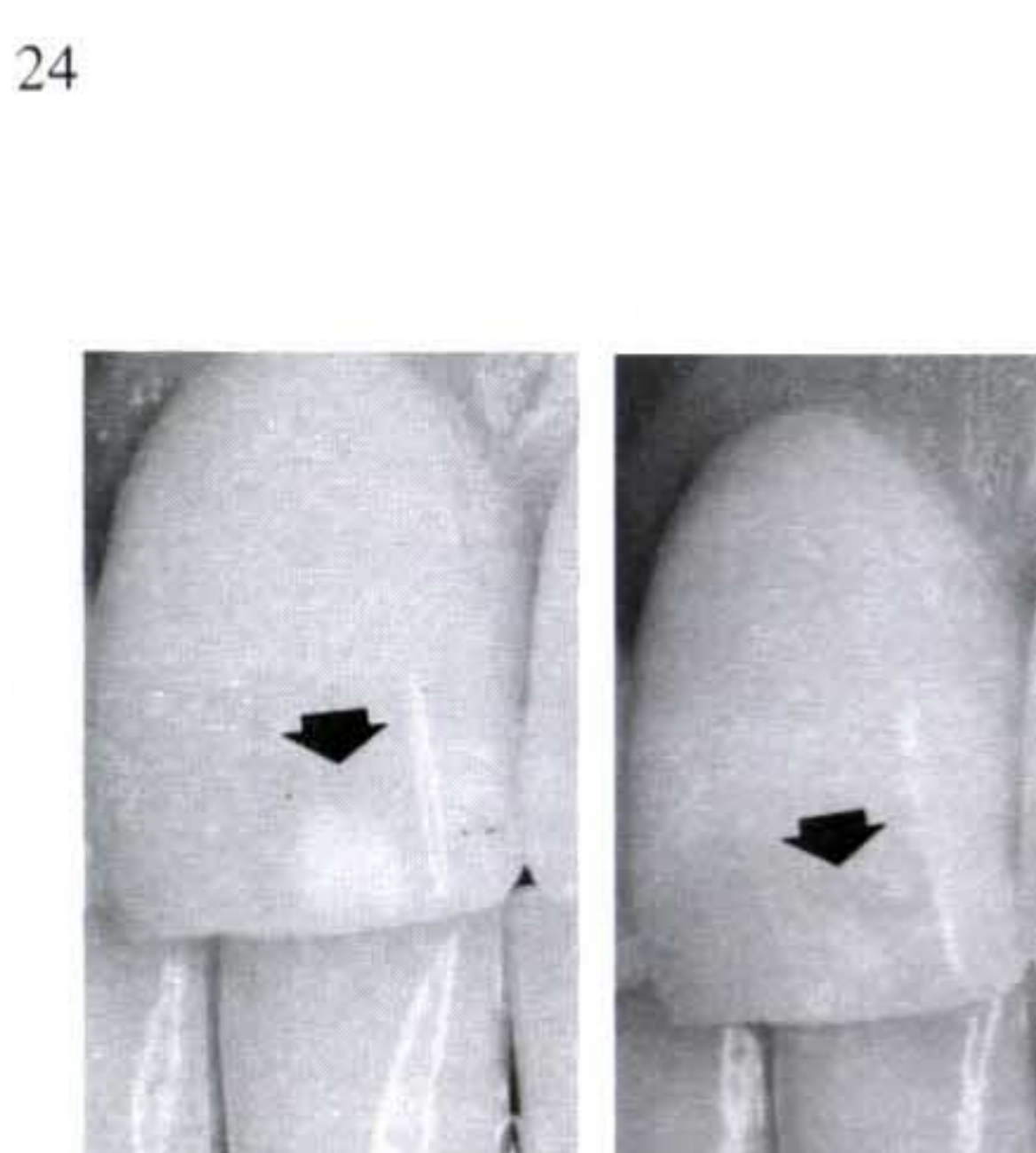
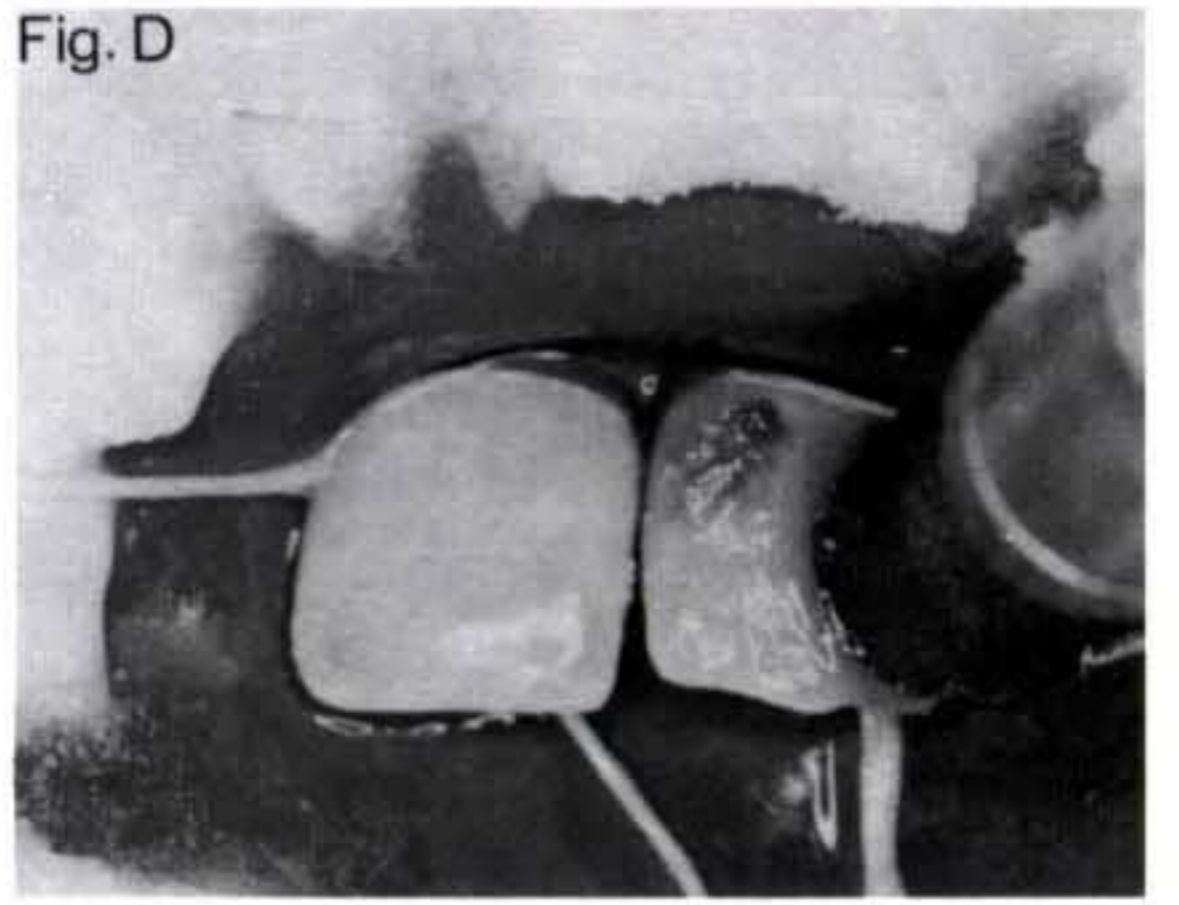
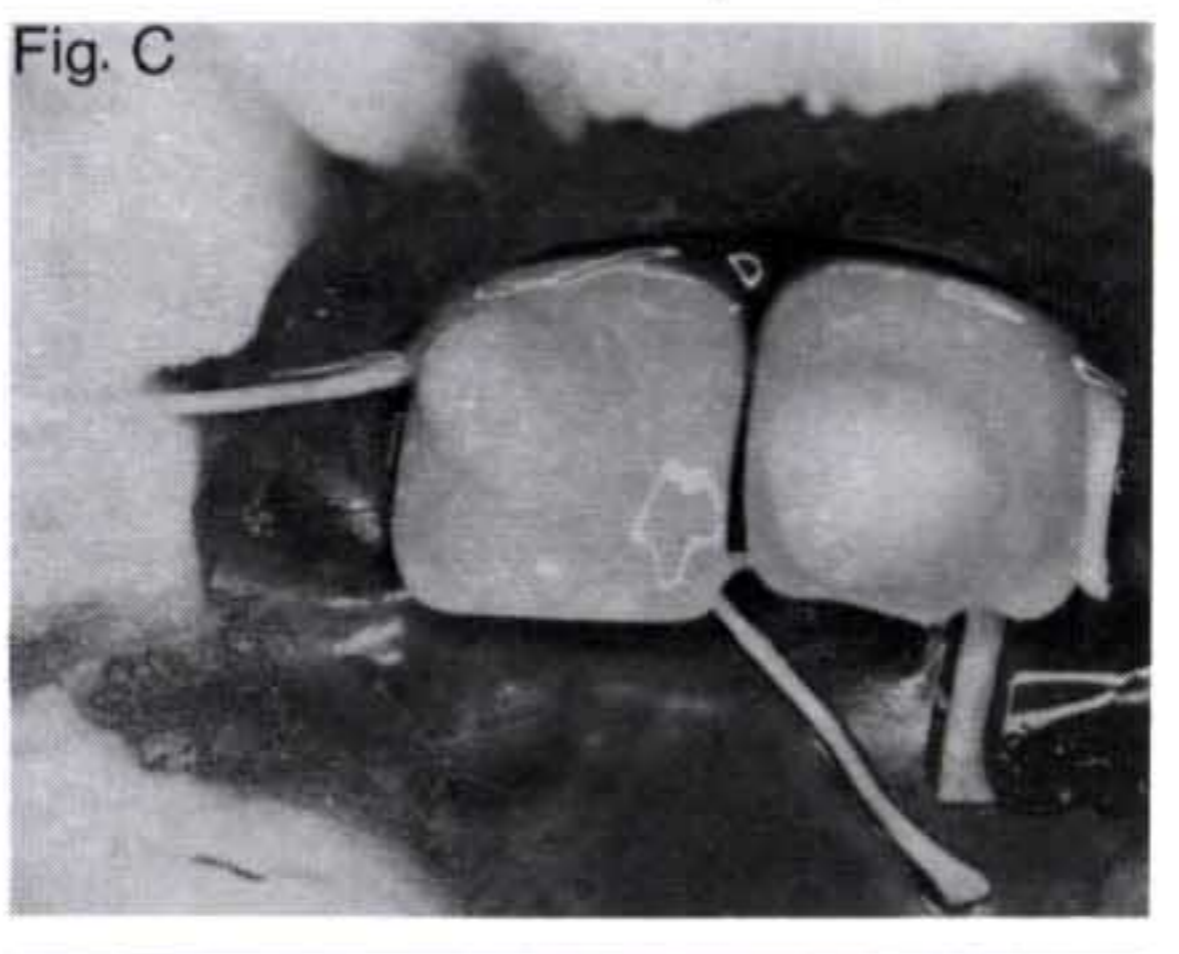
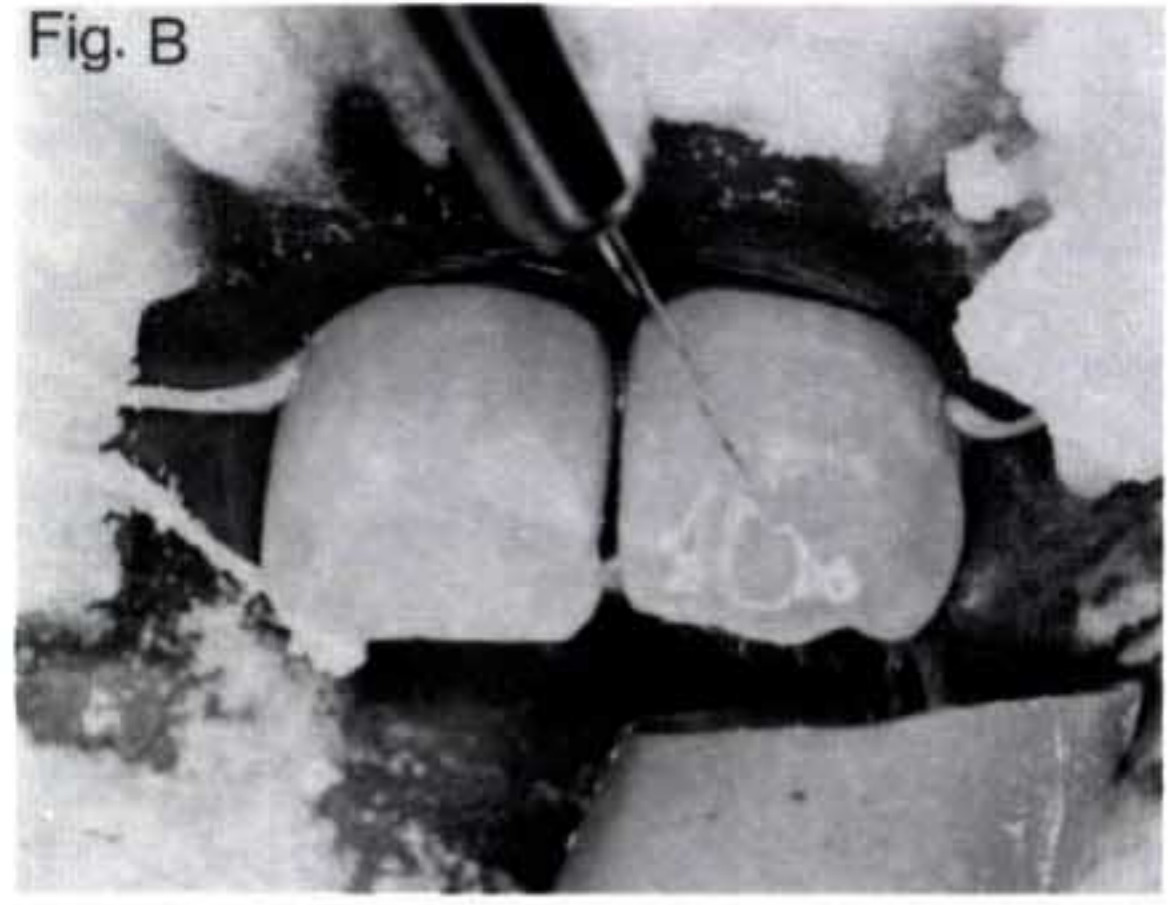
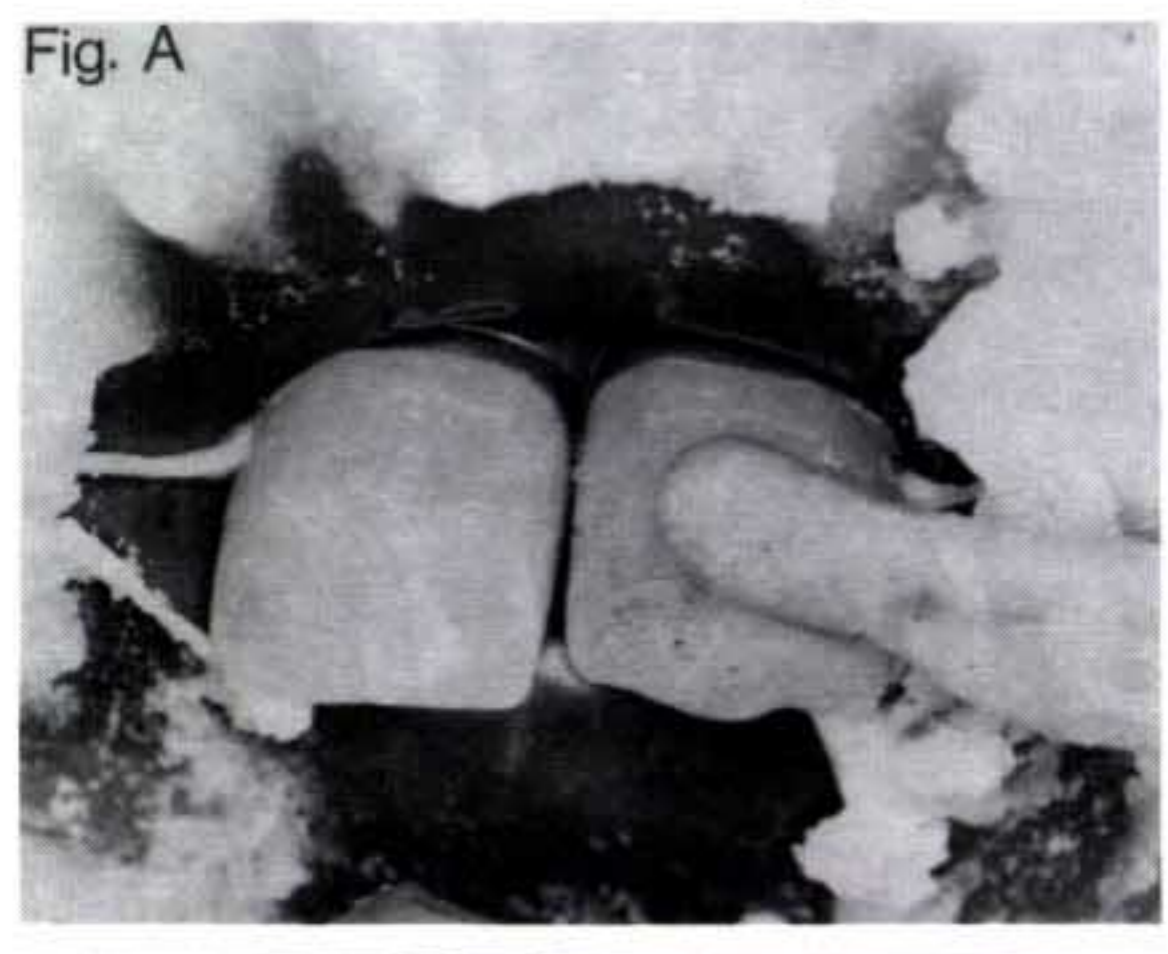
Enamel color modification appears to be a practical alternative, in selected cases, before any type of dental restorative material is added for cosmetic reasons or the tooth is significantly altered. It can be a valuable service for patients and an excellent addition to the armamentarium of dentists if proper caution is exercised.

## ACKNOWLEDGMENTS:

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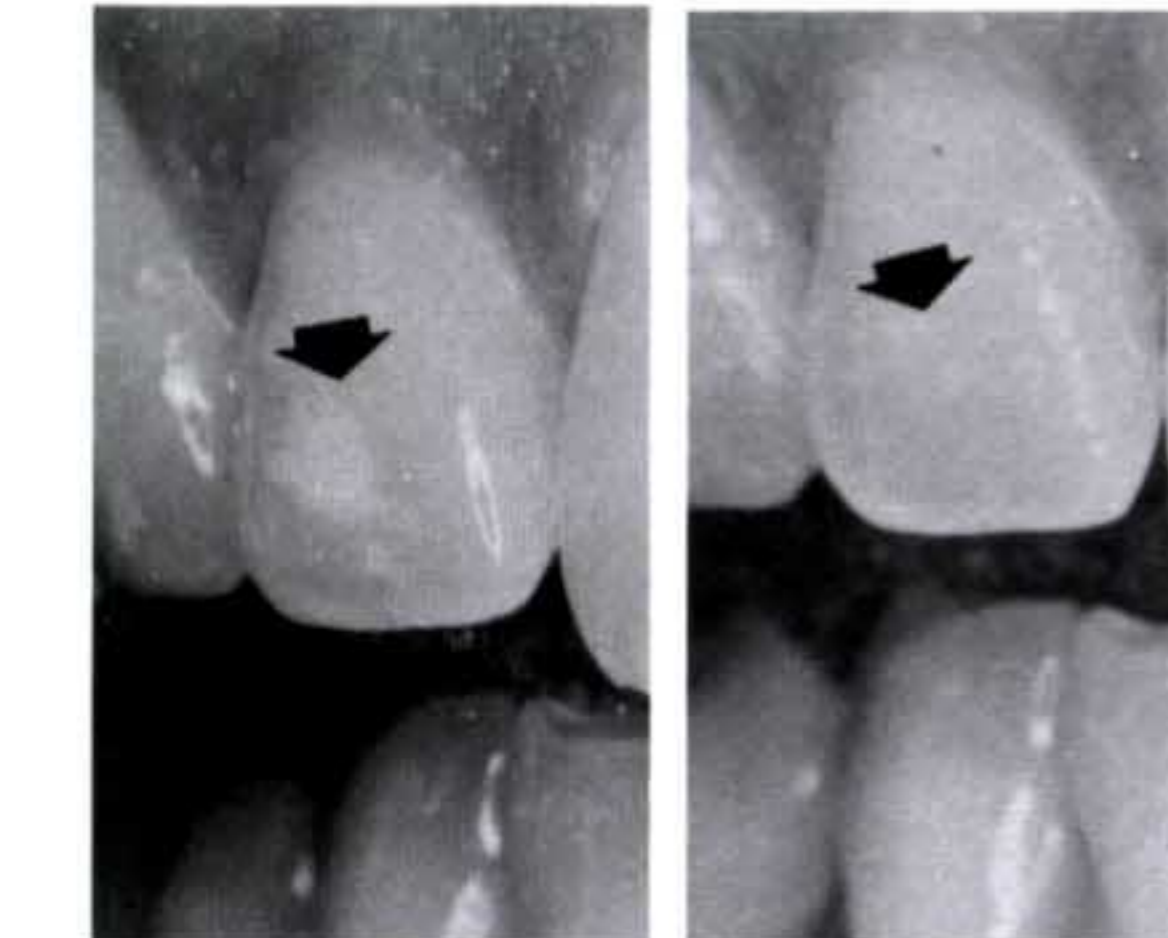
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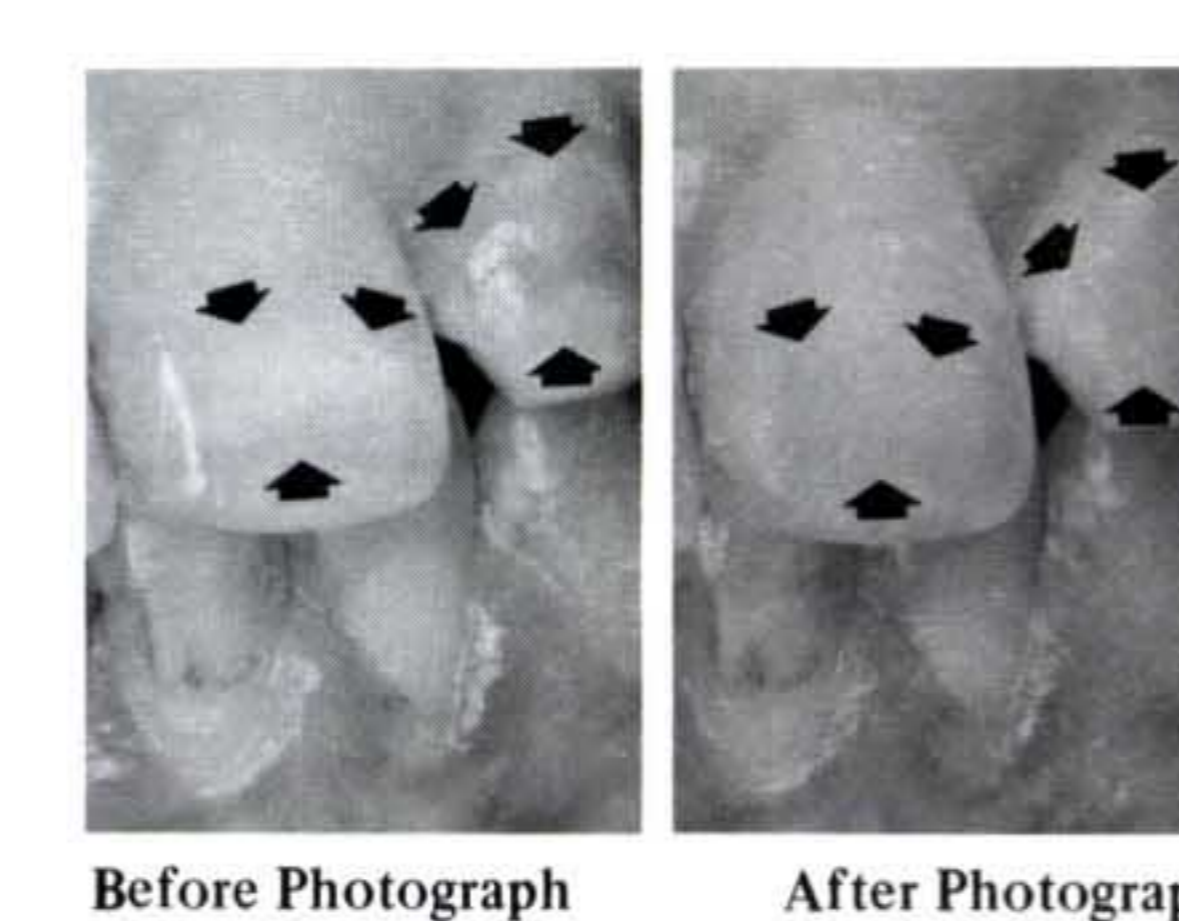
**Case No. 3** - A 39-year-old white female was seen with a single cloudy-white opacity in the incisal one-third of tooth No. 7.

Tooth	Application	Removal
No. 7	16X	100%



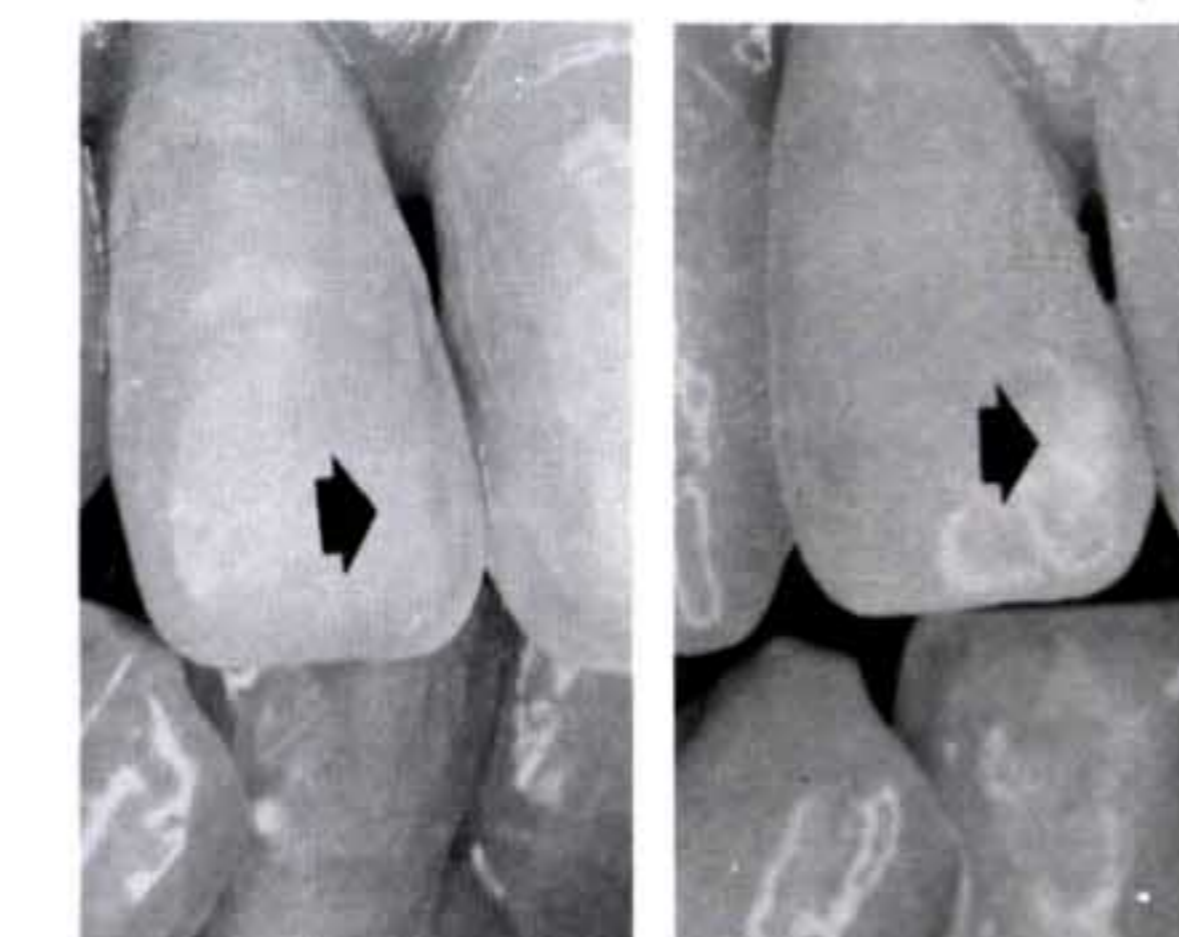
**Case No. 5** - A 28-year-old white female presented with multiple opacities on teeth No. 9 and No. 10 due in part to orthodontics and fluorosis. No. 9 had a single creamy-white opacity in the middle and incisal one-third. No. 10 had a diffuse brown to creamy-white opacity over the entire middle to incisal one-third.

Tooth	Application	Remove
No. 9	15X	80%
No. 10	12X	80%



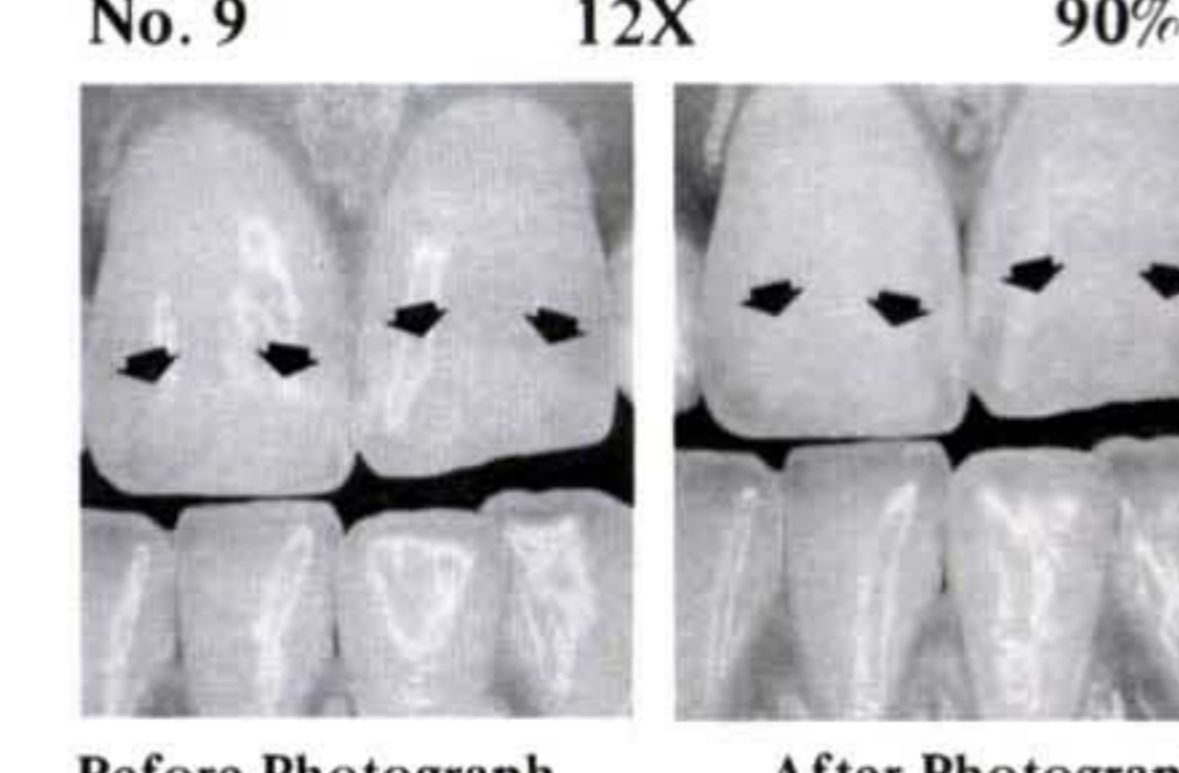
**Case No. 4** - A 77-year-old white female had a single creamy-white opacity in the incisal one-third of tooth No. 7.

Tooth	Application	Remove
No. 7	14X	100%



**Case No. 6** - A 29-year-old white male was seen with diffuse-snowy-white opacities over the incisal one-third on teeth No. 8 and No. 9.

Tooth	Application	Remove
No. 8	8X	90%
No. 9	12X	90%



It must be noted that not all cases are as successfully treated as those shown above. However, of the more than 50 patients that the author has treated to date, (during a 12-month period), only four, (cases were judged to result in less than 50% removal of the targeted blemish.