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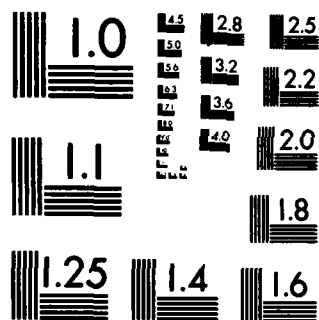
HUMAN PULPAL REACTION TO THE MODIFIED MCINNES BLEACHING 1/1
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HUMAN PULPAL REACTION TO THE
MODIFIED McINNES BLEACHING TECHNIQUE

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ABSTRACT

Thirty-six human teeth were examined to histologically determine if the Modified McInnes Bleaching Technique had any adverse effects on the pulp. Under the conditions of this study, there were no significant pulpal reactions to the bleaching technique even when a substantial amount of the enamel was removed from the facial surface of the crowns.

The Modified McInnes Bleaching Technique is one of the most commonly used methods for bleaching stained vital teeth. This technique has been specifically recommended and found successful for bleaching the teeth of patients with endemic fluorosis (1). The McInnes Technique was introduced by McInnes (2), and modified by Bailey and Christen (3), and Colon (4,5). The technique has been described as a combination of bleaching, disking, and chemical removal of the stain (3).

Although the technique may provide clinical success in terms of stain removal and patient acceptability, its biological effect on the pulp has not been determined. Varying degrees of pulpal inflammation may be present even in the absence of symptoms (6), and long-term pulpal changes may culminate in pulpal degeneration or pulpal necrosis (7). Although previous studies have examined the effects of other bleaching techniques on the pulp (8,9), no studies are available that investigate pulpal reaction to the Modified McInnes Bleaching Technique. The purpose of this study is to histologically determine the effects of the Modified McInnes Technique on the pulp.

MATERIALS AND METHODS

Nine patients, ages 11 to 17, were selected for this study. Each patient presented with four premolars scheduled for extraction in preparation for orthodontic therapy. All of the premolars were free of caries, restorations, and staining. For each patient, one maxillary and one mandibular premolar were treated with the Modified McInnes Technique while the contralateral premolars served as controls.

The control teeth were isolated and treated in exactly the same way as those treated with the Modified McInnes Technique except that saline was substituted for the bleaching solution.

Before the treatment of each patient, vitality tests and diagnostic radiographs of the teeth involved in the study were obtained. The results were all considered to be within normal limits. The teeth to be treated and the control teeth were then cleaned and polished with a pumice and water paste. The gingiva was protected with petrolatum and the teeth isolated with a rubber dam. Because of the caustic nature of the bleaching solution, each patient was protected with a plastic body drape and a facial towel drape. The clinician and assistant wore gloves, protective glasses, and a face mask. A fresh solution of the bleaching mixture was prepared for each patient in a dappen dish. The bleaching mixture consisted of 1 ml. of hydrochloric acid (36%), 1 ml. of hydrogen peroxide (30%), and 0.2 ml. of ether.

Using a cotton applicator, the bleaching mixture was applied to the facial surface of a maxillary and a mandibular premolar. Saline was applied to the contralateral premolars. The solutions were reapplied as often as needed to keep the tooth surface moist for a 5-minute period after which a wet, fine cuttle disk was used with very light pressure on the treated and the control teeth for 15 seconds. Reapplication of the solutions for another 5-minute period and the diskling of each tooth for 15 seconds was repeated for 2 more additional cycles. This gave a total solution application time for each tooth of 15 minutes and a total diskling time

for each tooth of 45 seconds. To neutralize the bleaching mixture, the teeth were then flooded with 5.25% sodium hypochlorite solution followed by a copious quantity of water (1).

The control and treated teeth were extracted after post-treatment intervals of 1, 3, 5, 7, 9, 11, 13, 17, and 19 days. (A 15-day interval was not obtained because of scheduling difficulties.) Immediately following tooth extraction, the apical one-third of the root was removed with a wire cutter to allow for good fixative penetration of the pulp (10). For microscopic orientation purposes, the facial surface of the roots was marked with a groove using a round bur in a high-speed handpiece having air-water coolant. At this time, the facial surface of the control and treated tooth was macroscopically examined for evidence of enamel being removed. The teeth were then placed in 10% buffered Formalin solution for pulpal fixation.

The teeth were decalcified and prepared for microscopic examination of the pulp tissue following the techniques of Stanley and Weaver (10). The degree of pulpal reaction for each tooth was obtained by determining the amount of cellular displacement, superficial inflammatory response, and deep inflammatory response as recommended by Stanley (11,12). These responses were graded as mild, moderate, or severe.

RESULTS

Examination of Table 1 reveals that of the 36 pulps evaluated (18 control and 18 treated), 25 pulps (12 control and 13 treated) did not demonstrate any identifiable pulpal changes. Six control teeth and five treated teeth had mild to moderate pulpal inflammatory changes. No severe pulpal reactions were observed.

Clinical inspection revealed significant loss of enamel when the Modified McInnes Technique was used.

DISCUSSION

The Modified McInnes Bleaching Technique is specifically recommended for the treatment of teeth exhibiting endemic dental fluorosis because of its superficial nature (1,3). Although it is recommended that the technique should not be used on teeth with deep hypoplastic defects in the enamel or on paper-white areas, it is recommended that the application of the bleaching mixture and light disking be repeated until stain removal is accomplished (1,3). In this study three cycles, each consisting of a 5-minute application of bleaching mixture followed by 15 seconds of light disking, were used to determine the consequences of excessive treatment.

Histologic evaluation of the pulp revealed little or no pulpal reaction even after this extensive bleaching regimen. The minimal pulpal reactions noted were fairly evenly distributed between the teeth treated with the bleaching mixture and the control teeth. These pulpal reactions may be attributed to the disking procedure or to the effect on the pulp of tooth extraction (7).

The lack of significant histologic changes seems to confirm the work of Griffin and others (13). Using phosphorus 32, they demonstrated a lack of penetration of any of the agents used in the Modified McInnes solution into the pulp chambers and found a lower uptake of iodine¹²⁵ into enamel and dentin after treatment with either McInnes solution or hydrochloric acid. This suggested that calcium and phosphorus salts dissolved by the acid may have precipitated in the tubules thereby decreasing dental permeability (13).

Vojinovic and others (14) found that citric acid treatment of cavity preparations increased the permeability of dentinal tubules to bacteria. Eriksen (15) demonstrated increased pulpal response when a citric acid cavity cleanser was used prior to placing a composite resin cement. He believed the acid etching made the dentin more permeable to the deleterious agents in the cement. Stanley and others (16) agree that there is increased dentin permeability when acids are used on dentin and relate the degree of pulpal response to the remaining dentin thickness. In the present study, although a substantial amount of enamel was removed, the thickness of dentin remained intact in the treated teeth.

Griffin and others (13) recommended that clinicians should be cautious in using the McInnes solution because considerable etching took place after only 2 minutes. Others (1,3) state that only a negligible amount of enamel is removed with this technique. It was our clinical impression that some enamel was lost following the first 5-minute application of the Modified McInnes solution and 15-second disking. Following the third treatment cycle, it was clinically apparent that substantial enamel had been removed from the facial surface of the treated teeth (Fig. 1). Thus, although the excessive application of the bleaching mixture may not cause significant pulpal reaction, it can remove significant tooth substance which may affect the long-term prognosis of the pulp and tooth. Therefore, it is imperative that the clinician carefully monitor the amount of enamel being removed.

SUMMARY

The Modified McInnes Bleaching Technique has been recommended for removing the stain of endemic dental fluorosis. This study was designed to histologically determine if the bleaching technique produces a pulpal reaction. Two treated teeth and two control teeth were extracted at 1, 3, 5, 7, 9, 11, 13, 17, and 19 days following the bleaching technique. Microscopic examination revealed no significant pulpal reaction even when a substantial amount of enamel was removed from the facial surface of the crowns.

INFORMED CONSENT

"The informed consent of all human subjects who participated in the experimental investigation reported in this manuscript was obtained after the nature of the procedures and possible discomforts and risks had been fully explained."

"The opinions expressed herein are those of the authors and are not to be construed as those of the Department of the Army or the Department of Defense."

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Table 1. Microscopic observations of treated and control teeth.

Microscopic observations*		Maxillary treated	Maxillary control	Mandibular treated	Mandibular control
1 day	C.D. S.R. D.R.				
3 day	C.D. S.R. D.R.				
5 day	C.D. S.R. D.R.				
7 day	C.D. S.R. D.R.	mild	mild		
9 day	C.D. S.R. D.R.				
11 day	C.D. S.D. D.R.				
13 day	C.D. S.R. D.R.	mild mild moderate	moderate	mild mild mild	moderate
17 day	C.D. S.R. D.R.		mild		
19 day	C.D. S.R. D.R.	mild	mild	mild	mild

*C.D. - cellular displacement (mild, moderate, severe)

S.R. - superficial inflammatory (mild, moderate, severe) response

D.R. - deep inflammatory (mild, moderate, severe) response

LEGEND

Fig. 1 Clinical photograph showing the amount of enamel removed from buccal surface of a mandibular bicuspid following exaggerated use of bleaching solution.

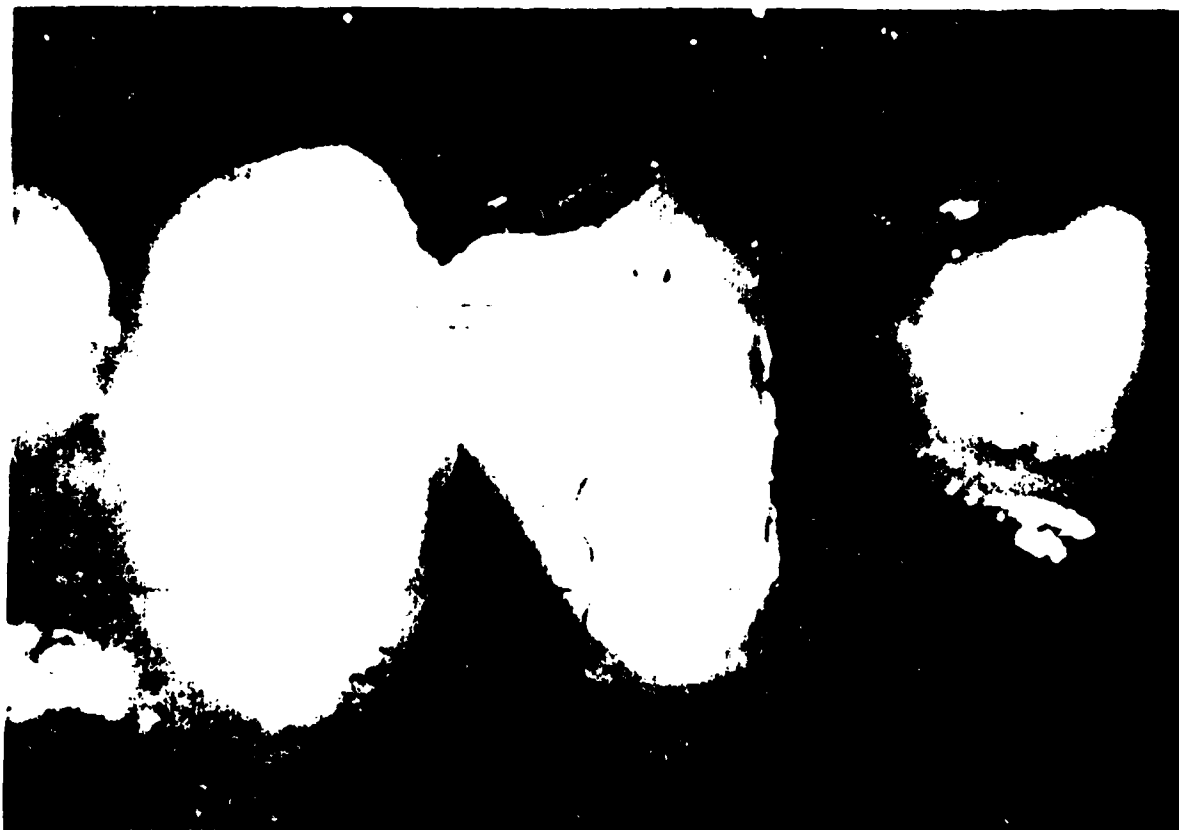


FIGURE 1

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