Decalcification Under Orthodontic Bands

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INTRODUCTION

At present, decalcification and decay under and adjacent to orthodontic bands present a very real problem to the orthodontist. In an attempt to reduce the caries susceptibility of human teeth, dental researchers have tested a variety of topically applied fluoride solutions.[1,3,5,6,13,17] Indeed, stannous fluoride and acidulated phosphate-fluorides are presently being used clinically and have enjoyed a degree of success.[8] Unfortunately, decalcification is still a common sequela of orthodontic therapy.

Recently, however, reports from European laboratories have suggested that organic fluoride solutions such as "Elmex" may have advantages over the various inorganic fluoride solutions currently employed in this country.[6,9,10,11,12,13,14,16] "Elmex" is an amine fluoride gel suitable for topical application in both the dental office and at home. It is commercially marketed in Europe, but has not, as yet, been made available in this country.

The purpose of the present study is to examine the clinical effectiveness of this organic fluoride as compared with that of an acid phosphate-fluoride and stannous fluoride.

METHODS AND MATERIALS

Six males and six females, twelve to sixteen years of age, were selected randomly from among those patients who presented themselves for orthodontic treatment at Case Western Reserve University. The only criteria, other than consent, established for selection were: (1) the absence of restorations or clinical caries on the buccal surfaces of the first premolar teeth, and (2) the necessity of first premolar extractions as determined by standard diagnostic procedures.

The nature of the study, its significance, and its potential hazards were explained in detail to each subject and to his or her parents. Permission was, in each case, granted in writing.

Three of four permanent first premolar teeth in each patient were treated with one of three topical fluoride solutions; the fourth tooth served as a control. A table of random numbers was used to assign treatment-combinations to the various patients. The fluoride solutions used were: (1) stannous fluoride (eight per cent), (2) "Thera-flur" an acidulated phosphate-fluoride, and (3) Elmex gel, an amine fluoride (Table 1).

For each fluoride, three four-minute treatments were performed within a one week period. Immediately preceding the first application of fluoride, the teeth were thoroughly pumiced, air dried, and isolated with cotton rolls. The teeth were also air dried before the second and third fluoride applications, but were not pumiced.

Over-sized premolar bands were cemented on each tooth. Carboxylate cement was applied only to the lingual and proximal leaving the band loose-fitting and cement-free on the buccal, a configuration reminiscent of a com-

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TABLE 1

TREATMENT SUMMARY*

Patient	Quadrant			
	Right		Left	
	Upper	Lower	Upper	Lower
1	Control	Stannous Fluoride	Thera-flur	Elmex
2	Elmex	Control	Thera-flur	Stannous Fluoride
3	Control	Elmex	Stannous Fluoride	Thera-flur
4	Elmex	Control	Stannous Fluoride	Thera-flur
5	Stannous Fluoride	Control	Thera-flur	Elmex
6	Stannous Fluoride	Thera-flur	Elmex	Control
7	Control	Thera-flur	Elmex	Stannous Fluoride
8	Thera-flur	Elmex	Control	Stannous Fluoride
9	Elmex	Thera-flur	Stannous Fluoride	Control
10	Thera-flur	Stannous Fluoride	Control	Elmex
11	Stannous Fluoride	Elmex	Control	Thera-flur
12	Thera-flur	Stannous Fluoride	Elmex	Control

*Randomization was "restricted" in that each treatment appears with equal frequency in any given quadrant.

mon orthodontic mishap and, presumably, conducive to decalcification.

Eleven weeks later the bands were removed, and the teeth extracted. A gauze pad was placed over each tooth to minimize forcep marks on the buccal surface. The teeth were wiped with damp gauze and stored in a humidifier.

The extent of buccal decalcification was scored blindly and independently by four observers. The amount of decalcification was rated from zero to three in half-unit increments. Inasmuch as an ordinal scoring system was employed, the data were analyzed by means of the Friedman two-way analysis of variance by ranks, a nonparametric test.[15]

Results

The degree of decalcification (the sum of the ratings by the four scorers) and the within-subject rankings are shown in Table 2. Overall treatment effects were statistically significant ($X^2=9.88$; $P<.02$). Note the similarity between Thera-flur and Elmex, both in terms of total decalcification scores and ranks.

TABLE 2

COMBINED DECALCIFICATION RATINGS AS SCORED BY FOUR OBSERVERS

Patients	Treatments							
	Control		Acid PO_4-Fl		Stannous Fluoride 8%		Elmex	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	6.5	3	4.5	1.5	7.0	4	4.5	1.5
2	7.5	3	7.0	1.5	8.5	4	7.0	1.5
3	9.0	3	8.0	1	10.0	4	8.5	2
4	7.0	4	3.0	1.5	5.5	3	3.0	1.5
5	7.0	4	3.5	1.5	4.0	3	3.5	1.5
6	7.0	4	4.5	1.5	4.5	1.5	5.5	3
7	7.0	2.5	7.0	2.5	10.0	4	6.0	1
8	7.5	3	6.5	1	7.5	3	7.5	3
9	7.5	4	5.5	3	4.0	1	5.0	2
10	7.5	2	8.0	3	7.0	1	9.0	4
11	11.0	4	10.5	3	10.0	1.5	10.0	1.5
12	3.0	3	1.0	2	4.0	4	0.5	1
Rank Total	39.5		23.0		34.0		23.5	
Median Rank	3.3		1.7		3.4		1.7	

Discussion

Although decalcification was produced in all subjects, it was somewhat less extensive than expected. Perhaps the bands were too loose and, as a result, permitted the buccal surfaces still to be somewhat self-cleansing.

There is, however, no particular reason to suspect that the present findings do not apply to the degree of pathosis associated with cement-failure under tight, well-contoured bands.

The results of the present orthodontic study are consistent with a variety of reports in which amine fluorides and acidulated phosphate-fluorides have been evaluated, both *in vivo* and *in vitro,* and found effective in reducing enamel decalcification.[5,6,10,12,13,14,17]

By way of contrast, stannous fluoride, in addition to bad taste, poor stability, and tendency to produce gingival irritation,[4,7] proved almost completely ineffective.

Obviously, the present experimental design has several potential drawbacks: the use of a relatively subjective scoring system and the possibility of cross-contamination among quadrants. Indeed, a negative result would have defied interpretation. The findings, however, were positive and probably represent a conservative underestimation of the true among-treatment differences: both Elmex and acidulated phosphate-fluorides seem to provide a measure of clinical protection.

Of the two, however, only the acidulated phosphate-fluorides are currently available in the United States.

Summary and Conclusions

To test the efficacy of three fluoride compounds in the reduction of decalcification, the four first premolars in twelve extraction cases were randomly assigned the following treatments: stannous fluoride (eight per cent), amine fluoride (Elmex gel), acid phosphate-fluoride (Thera-flur), and control. After receiving three four-minute treatments (during a period of one week), each tooth was banded in a manner conducive to decalcification: the bands were loose-fitting and were not cemented on the buccal surface. As part of the regular orthodontic therapy, the experimental and control teeth were extracted eleven weeks later, and the extent of buccal decalcification scored (blindly and independently) for four observers.

Statistical analysis of ratings indicated that both Elmex and Thera-flur reduced the amount of visible decalcification as compared with the untreated teeth ($P<.02$). Treatment with stannous fluoride (eight per cent) did not produce a significant decrease in decalcification.

Accordingly, it may be concluded that both Elmex and Thera-flur, applied topically, were effective in reducing decalcification of teeth under orthodontic bands.

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