

REMINERALIZING EFFECT OF TRICALCIUM PHOSPHATE ON CARIES-LIKE LESION IN ENAMEL OF PRIMARY TEETH (IN VITRO STUDY)

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INTRODUCTION

Non-invasive management using remineralizing agents is the modern therapeutic approach of non-cavitated lesions (1). The study aimed to evaluate the remineralizing effect of tricalcium phosphate (TCP), silver diamine fluoride (SDF) and sodium fluoride (NaF) varnishes in carious enamel lesions in primary teeth. The null hypothesis was that there would be no significant difference in the mineral content and topographic structure of artificial initial carious primary enamel lesions between the three varnishes.

METHODOLOGY

Forty-eight primary teeth with standardized windows (4x4 mm.) were immersed in a demineralizing solution for 4 days to initiate caries like lesions on their enamel surface. They were washed with deionized water and kept in artificial saliva. They were divided randomly into four groups of 12 teeth each and were treated according to manufacturer's instructions with the following varnishes: group I: Clinpro™ White varnish (TCP), group II: e-SDF (SDF), group III: Profluorid varnish (NaF) and group IV: no treatment. The varnishes were removed using a cotton swab saturated with acetone. Teeth were washed and stored in artificial saliva for 24 h. They were subjected to pH cycles over a period of ten days. Teeth were immersed daily in demineralizing solution for 6 h. Then, they were immersed in remineralizing solution for 18 h. They were washed thoroughly with deionized water and prepared for assessment. Teeth were evaluated quantitatively using energy dispersive X-ray spectrometer (EDX) and qualitatively using scanning electron microscope (SEM).

RESULTS AND DISCUSSION

The quantitative analysis (EDX) of the Ca, P level, and Ca/p ratio of this study revealed that after remineralization, the group I showed the highest mean percent change of Ca level (8.56 ± 8.64) then group II (-16.09 ± 13.41), group III (-16.49 ± 15.91) and group IV (-23.38 ± 15.39) with statistically significant difference between the study groups ($P < 0.0001$). The highest mean percent change of P level was significantly highest in group I (7.67 ± 6.50) followed by group III (-12.93 ± 17.77), group IV (-13.03 ± 19.21) and group II (-14.85 ± 15.61) with a statistically significant difference between them ($P < 0.0001$). The mean percent change of Ca/p ratio of group I and II is significantly higher than group IV with no significant difference with group III, Table (1). SEM confirmed EDX results. Scanning electron microscopic examination of tricalcium phosphate varnish showing uniform re-establishment of surface integrity of enamel. A decrease in the porosities and surface irregularities was an important feature in this group.

Table (1): Comparison of Ca, P content and Ca/p ratio between the study groups

		Group I	Group II	Group III	Group IV	P value
		Mean (SD)				
Ca	Baseline	28.69 (3.27) ^A	31.94 (3.47) ^A	31.52 (3.31) ^A	32.28 (4.38) ^A	0.077
	Demineralization	22.35 (3.55) ^B	23.68 (3.29) ^B	24.23 (5.83) ^B	21.87 (4.97) ^B	0.624
	Remineralization	31.03 (3.47) ^{BC}	26.70 (3.20) ^{BB}	26.05 (4.39) ^{BB}	24.18 (2.85) ^{BC}	<0.0001*
	P value	<0.0001*	<0.0001*	0.001*	<0.0001*	
	% Change	8.56 (8.64) ^A	-16.09 (8.69) ^B	-16.49 (15.91) ^B	-23.38 (15.39) ^B	<0.0001*
P	Baseline	15.19 (0.94) ^A	16.11 (0.84) ^A	16.00 (1.01) ^A	16.02 (1.30) ^A	0.120
	Demineralization	12.68 (2.32) ^B	12.95 (3.33) ^B	12.96 (2.90) ^B	12.63 (2.59) ^B	0.986
	Remineralization	16.31 (0.62) ^{BC}	12.15 (2.53) ^{BB}	13.88 (2.75) ^{ABAB}	13.76 (2.44) ^{AB}	0.016*
	P value	<0.0001*	0.010*	0.006*	0.002*	
	% Change	7.67 (6.50) ^A	-14.85 (15.61) ^B	-12.93 (17.77) ^B	-13.03 (19.21) ^B	<0.0001*
Ca/P ratio	Baseline	1.88 (0.13) ^A	1.97 (0.11) ^A	1.97 (0.13) ^A	2.00 (0.15) ^A	0.144
	Demineralization	1.77 (0.13) ^B	1.85 (0.16) ^B	1.86 (0.14) ^B	1.73 (0.18) ^B	0.137
	Remineralization	1.90 (0.18) ^A	1.99 (0.33) ^A	1.89 (0.16) ^{AB}	1.78 (0.18) ^C	0.158
	P value	0.001*	0.010*	0.003*	<0.0001*	
	% Change	0.90 (6.74) ^A	0.73 (14.95) ^A	-3.87 (3.86) ^B	-11.32 (6.10) ^B	0.002*

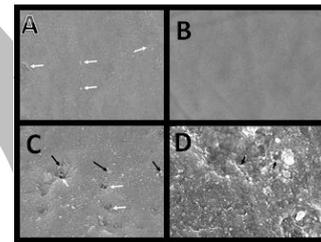


Figure (1): SEM photomicrographs from specimen of the study groups (A: group I, B: group II, C: group III and D: group IV) (mag. X 4000).

The regenerated crystals on the enamel surface formed a homogeneous and dense layer of mineralized tissue. In group II, relatively re-establishment of surface integrity of enamel and decrease in surface irregularities and filling of some porosities were evident. The roughened surface represents incomplete closure of the deep craters by microglobular deposits were shown in group III. In group IV, an irregular enamel topography. The enamel surface was rough with concavities and linear grooves intervening with non-symmetrical elevation. (figure1).

Results of the present study are in accordance with Wierichs et al (2018) (2), who compared the effect of TCP, SDF and NaF varnishes in artificial caries lesions. They concluded that all varnishes could prevent initial and further demineralization. It has been shown that Tricalcium phosphate possesses structural resemblance with the hydroxyapatite of tooth enamel (1). The results of the current study rejected the anticipated null hypothesis.

CONCLUSION

Tricalcium phosphate has a highest remineralization potential of the initial carious enamel of primary teeth.

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