

## The Effect of Zinc and Fluoride on Artificial Smooth Surface Lesions of Permanent Teeth

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### Abstract

**Introduction:** Zn keeps surface-zone porosity for more time, and that's help in more diffusion of Ca, P and F into the subsurface lesion; permit subsurface remineralization to occur. Consequently, Zn has the capability to affect both demineralization and remineralization. This study investigated the efficacy of F and Zn toothpaste on enamel caries of permanent teeth in vitro.

**Methods:** 60 extracted sound premolars were painted with a nail polish leaving a 4 x 4 mm window on the buccal and lingual surface. The teeth then were dipped in demineralizing solution for 72 hours at room temperature, to get an early enamel lesion. The crowns were separated from the roots. The crowns were divided in mesio-distal direction. Specimens were randomly divided into two groups (I and II) (n = 60), group I; was treated by daily brushing with fluoride and zinc tooth paste and group II; was treated with fluoridated toothpaste for 4 weeks. SEM was used for evaluation.

**Results:** In the comparison between the 2 groups indicated better results for group I (P = 0.0001).

**Conclusions:** Zinc and fluoride toothpaste improved the remineralization of subsurface lesion more than fluoride alone.

**Keywords:** Zinc; Fluoride; Surface Lesions; Permanent Teeth

### Introduction

Caries is a multifactorial and slowly progressive disease. The initiation of caries is linked by demineralization. Enamel demineralization is the loss of Ca and P loss of subsurface enamel and manifested visually as a white spot. Demineralization and remineralization are an active dynamic process, recognized by the flowing of Ca and P in and out of enamel, which should be stable to inhibit the development of dental caries. Remineralization is an important natural repair process; therefore, it is importance to promote the remineralization of caries lesions [1].

For the last 25 years fluoride was used widely as a non-invasive treatment for healing of white spot non-cavitated caries lesions, and this was a great cause in the decline of dental caries incidence [2].

Still, the main advantage of use of F toothpastes regularly is the reduction in dental caries incidence. F forms the fluorapatite instead of hydroxyapatite which affects the pass of dental caries, aids in the remineralization process and blocks the bacterial glycolysis [3].

Zn is one of the ingredients of many fluoride toothpastes for its effect to reduce calculus as an anti-bacterial agent and to reduce oral malodor. The effects of Zn on the dynamic of demineralization and remineralization have been studied, and it is known that Zn keeps

surface-zone porosity for more time, helping in more diffusion of Ca, P and F into the subsurface lesion; permit subsurface remineralization to occur [4].

Therefore, this study investigated the efficacy of fluoride and Zn toothpaste on smooth enamel caries like lesions in permanent teeth.

### Materials and Methods

This research was *in-vitro* experimental. 60 extracted sound premolars, collected from Alexandria University and the Ministry of Health hospitals. The selected teeth had inclusion criteria to be used, the smooth surfaces of the teeth examined clinically by air drying and showed no change in enamel translucency and that was scores 0 according to ICDASII [5]. The teeth were also examined by DIAGNOdent (KaVo CO, Biberach/Riss, GmbH, D-88400 Germany) and showing reading less than 10 which manifested as sound enamel [6].

Periodontal tissues and extrinsic deposits were totally removed from the teeth with scalar, polished with fluoride free pumice and kept in saline solution. The crowns of the 60 teeth were painted with a nail polish except a 4x4 mm window on the buccal and lingual surface [7]. The teeth were dipped in demineralizing solution which consist of; 50 mM Acetic acid, 2.2 mM Potassium dihydrogen phosphate, 2.2 mM Calcium chloride with pH 4.4 [8] for 72 hours at room temperature, to create white spot lesion, then the teeth were rinsed with deionized water and dried.

The crowns were removed from the roots and divided in mesio-distal direction into 2 specimens, so one half was treated and the other was kept without treatment.

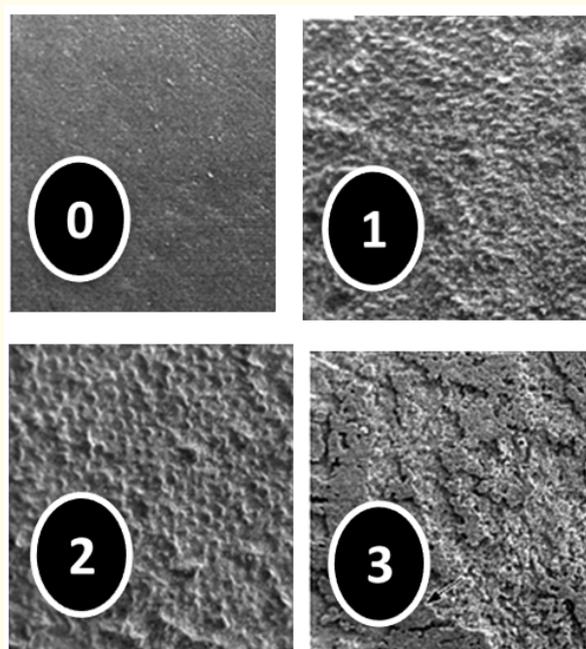
According to the treatment used, the specimens were randomly divided into two groups (I and II) (n = 60), group I; was treated by daily brushing with fluoridated toothpaste (Unilever Mashraq Personal Care (S.A.E) 6<sup>th</sup> October City, 4<sup>th</sup> Industrial Zone) for 4 weeks. Group II; was treated with F and Zn toothpaste (Unilever Mashraq Personal Care (S.A.E) 6<sup>th</sup> October City, 4<sup>th</sup> Industrial Zone). During treatment all the specimens will be kept in artificial saliva which contained; 1 mM Calcium chloride, 20 mM Sodium bicarbonate, 20 mM Sodium bicarbonate and 3 mM Sodium dihydrogen phosphate with pH 7 [8].

The solutions used in this research for remineralizing and demineralizing were prepared in biochemical laboratory, Faculty of Pharmacy, Alexandria University.

### Evaluation

A scoring system was used for scanning electron microscope assessment:

- 0= Enamel surface perfectly intact with no grooves, pits, and porosity.
- 1= Presence of surface irregularities on enamel surface, without demineralization of prismatic and/or interprismatic enamel.
- 2= Presence of wrinkles and demineralization of prismatic/interprismatic enamel.
- 3= Diffuse demineralization involved the rod core, with decomposition of morphology of prism.



### Statistical analysis

After data were collected, it were revised, coded and fed to statistical software IBM SPSS version 20 (SPSS Inc. Chicago, IL, USA).

Chi-square test was used for percentage comparison between the 2 groups.

### Results

Results show the change in enamel using scanning electron microscope. In the comparison between different test and control groups regarding score 0 and 1 ( $P = 0.0001$ ) which indicated better results for test groups (Table 1). In there were no specimens with score 2 nor 3 in the results.

	Test group	Control group	P value
	No (%)	No (%)	
Score 0	95%	15%	
Score 1	5%	85%	
Score 2	0 (0%)	0 (0%)	
Score 3	0 (0%)	0 (0%)	

Table 1

### Discussion

Nowadays prevention is considered the fundamental of dentistry, and dental caries can be hold and inhibited [9]. Quantitative data obtained from the scanning electron microscope demonstrated that there was significant differences in the percentage of specimens with score 0 favors the test group. This result was due to the presence of Zn in the content of toothpaste, and with the possibility of substitution among the Ca-Zn elements in the dental enamel [10] lead to decrease in Ca content on the enamel surface and subsequently decrease in Ca/P ratio. Zn keeps surface-zone porosity for more time, helping in more diffusion of Ca, P and F into the subsurface lesion; permit subsurface remineralization to occur [11].

### Conclusions

Toothpastes that contain Zn and F has better effect on remineralization of subsurface lesion than toothpastes only contain F.

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