

Control release of fluoride of the toothbrush with sodium fluoride coated bristles*

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Abstract—This study is to evaluate the control of fluoride releasing of four types of toothbrush with sodium fluoride (NaF) coated bristles. The *in-vitro* test was conducted using an electric powered toothbrush brushed against a ceramic tooth. The maximum measured fluoride release of coating group were at simulating day 1 (brush 2 times) and significant higher than other time periods. The diameter of the straight type bristles with 15% NaF coating and wavy type bristles with 10%, 15% NaF coating were significant reduced after 42 times brush. We conclude that a toothbrush with coating on surface modified bristles could control the fluoride releasing and act as a dental caries prophylactic device.

I. INTRODUCTION

For prevention and control of caries, the application of fluorides is the most effective method.^[1-2] There are advantages of fluoride, including enamel remineralization, anit-acid and inhibiting bacterial metabolism.^[3] Toothbrush with 1500ppm fluoride toothpaste is one of the most commonly used adjuncts for maintaining oral hygiene. However, concerning the potential risk of fluorosis and allergies to the toothpaste ingredients, for people desiring to brush their teeth without the use of toothpaste, a toothbrush can release fluoride from the bristles offers an advantage. Zimmer S *et al.* evaluated the fluoride concentration in unstimulated saliva after using a toothbrush with 9048ppm fluoride as sodium fluoride incorporated in the bristles. Although they found the fluoride concentration (3.81ppm) in the saliva was lower than the control (1.79ppm), which brushed using toothpaste with 1500ppm fluoride immediately after brushing and after 15 minutes. This study was to evaluate the fluoride concentration and pH value changes by different NaF coating on straight and wavy type of bristles.

TABLE I. SAMPLE CODES AND THE BRISTLE TYPE, DIAMETER

Sample codes	Bristle		
	Bristle type	Diameter	Coatings
0	Straight	0.15mm	N.A.
1-1	Straight	0.15mm	10% NaF
1-2	Straight	0.15mm	15% NaF
2-1	Wavy	0.15mm	10% NaF

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Four types of toothbrush head with two bristle types, two coating concentrations-10% and 15% sodium fluoride (NaF) coated bristles were provided by Blessing Co., Ltd, Japan. The samples were coded as shown in Table 1.

The *in-vitro* test was conducted using an electric powered toothbrush (changeable head); the bristle head was loaded with a force of 2N by an automatic handy stand to brush against a fixed ceramic tooth. The ceramic tooth was fixed in a glass disk with 15mL distilled water around and the brushing time was set as 2 minutes per test. A total of 42 tests were performed to simulate brush twice a day for 21 days.

II. RESULT

On the first day (after two tests), a significant fluoride release from the fluoride toothbrush could be detected when compared to the other time periods and the control group. The detected fluoride ion concentration of fluoride toothbrush after brushing for two times (1 day) ranged between 0.05~2.11ppm. The straight type bristles with 15% NaF coating (1-2 group) present a highest fluoride concentration as 2.11ppm which had been shown to have the caries preventive effect in earlier studies.^[4,5] The pH values after simulate brushed for 1(2), 7(14), 14(28), 21(42) days (times). All groups were similar and have a value around pH of 8. The diameter of the straight type bristles with 15% NaF coating and wavy type bristles with 10%, 15% NaF coating were significant reduced after 42 times brush.

III. CONCLUSION

It can be concluded that a toothbrush with coating on surface modified bristles could control the fluoride releasing and act as a dental caries prophylactic device. However more studies are needed to prove the caries prevention effective provided by the fluorinated toothbrush.

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