THE CHANGES OF SALIVARY PH BEFORE AND AFTER BRUSHING WITH FLUORIDE CONTAINING TOOTHPASTE AND WITHOUT TOOTHPASTE IN 6 TO 12 YEARS OLD CHILDREN IN WEST BENGAL, INDIA

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ABSTRACT

In oral cavity Saliva acts as a buffering system. When pH is high saliva help in remineralization and causes demineralization during low pH condition. This study helps to estimate the salivary pH difference before and after brushing with fluoridated toothpaste and without toothpaste. Sixty children were divided into two groups. One group was instructed to brush with fluoridated toothpaste and another to brush without toothpaste. Salivary pH increases significantly after brushing with fluoride containing toothpaste and in a small amount after brushing without toothpaste.

Keyword: Saliva, pH, Fluoridated toothpaste, Brushing.

INTRODUCTION:

Dental caries is the most common disease affects oral health. Dental caries have a negative impact on children's lives like, chewing, smiling and speech impairment, irritability, trouble in sleeping. School performance may be poor due to severe form of caries[1]. Composition of saliva is 99% water and remaining 1% of organic and inorganic molecules. Saliva acts as a buffer. If the pH of the oral cavity decreases then the thermodynamic conditions become unfavourable and hydroxyapatite dissolution or demineralization occurs. If the pH increases, thermodynamic conditions become favourable and hydroxyapatite precipitation or remineralization occurs. Demineralization of hydroxyapatite crystals occur at or below pH 5.5 but for fluroapatite or flurohydroxyapatite crystals demineralization occur at a pH of around 4.7. Saliva also helps in deglutition, mastication, speech, taste sensation and initial digestion of the carbohydrates. For prevention of dental caries fluoride has been used widely. The fluoride is applied

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through two ways - systemic and topical. The systemic application is done through water, milk, salt etc and the topical application is done through toothpaste, gel, mouth wash, varnish etc[2]. Fluoridated tooth paste is used most commonly than water fluoridation. According to Bratthall[3] in modern countries like united state water fluoridation is commonly found than the third world countries. The cost of water fluoridation is high and long term use of fluoridated water creates higher dosage[4]. Topical fluoride is more effective than systemic fluoride in prevention of dental caries[5]. If fluoride is used correctly in a small amount per day, it reduces the chance of dental caries of almost all groups. Plaque reduction as well as strengthening the tooth structure is occurred by brushing with fluoridated tooth paste.

MATERIALS AND METHODS:

All experiments were performed after taking the permission from institutional ethical committee. Six to twelve years old of sixty children coming to the pedodontia department were selected for this study. Children were free from any kind of systemic disease. They were divided in to two groups, one group brush their teeth with fluoride containing dentifrices and another group brush without any dentifrices.

By informing parent about the steps of the study and its effect they were asked to fill the consent letters. Saliva was collected from the children by spitting method. Sample was collected one hour after meal. First the thirty subjects were asked to rinse the mouth to remove residual food particles and swallow the excess water. Then they were asked to collect saliva in closed mouth and standing position. They were instructed strictly no tongue movement and swallowing. After five minutes saliva was spitted into saliva collecting containers and pH was measured. Fluoridated tooth paste was given equally to all children and roll brushing technique was advised for two minutes. After brushing the subjects were instructed to rinse the mouth and collect saliva. Finally pH of saliva was measured. Another thirty subjects were instructed to follow the same process except brushing without dentifrices.

The instruments and materials were used in this study-digital pocket pH meter, 4 and 7 buffer solution for calibrating the pH meter, tissue paper, spirit, saliva collecting containers, tooth brushes, fluoridated tooth paste and saliva.

RESULT AND DISCUSSION:

Data were collected and statistically analyzed. Table 1 shows the different

salivary pH before and after brushing with fluoridated tooth paste. Table 2 shows the different salivary pH before and after brushing without tooth paste. Based on the result in table 1, it is found that the average salivary pH before brushing is 7.23 and standard deviation is 0.29. After brushing with fluoridated tooth paste the average salivary pH increases to 7.62 and standard deviation is 0.36. It is found that the difference of average salivary pH is 0.4 and standard deviation is 0.275. Table 2 result reveals that the average salivary pH before brushing is 7.2 and standard deviation is 0.16. After brushing without toothpaste the average salivary pH slightly increases to 7.3 and standard deviation is 0.15. The difference of average salivary pH is 0.1 and standard deviation is 0.07. Figure: 2 reveal the average pH level at before brushing, after brushing with fluoride containing dentifrices and without dentifrices. In this diagram S1 indicate pH before brushing, S2 after brushing without dentifrices and S3 after brushing with fluoride containing dentifrices.

Based on this study it is found that salivary pH increases significantly after brushing with fluoridated dentifrices. Acid production is occurred by carbohydrate metabolism of bacteria. Balzar et al. in 2001 investigated that fluoride reduced acid production by inhibiting carbohydrate metabolism of oral streptococci and lactobacilli[6]. In low pH environment F^- combine with H^+ (figure: 1) and form hydrofluoric acid (HF) which diffuses into bacteria. This HF further dissociate into H^+ and F^- . Due to continuous diffusion and disassociation large number of H^+ and F^- is present inside the bacteria and reduction of H^+ in saliva. This mechanism increases acidity of bacterial cytoplasm. The F^- inside bacteria interferes with enolase (glycolytic enzyme) activity. The acidic cytoplasm also interferes with enolase activity indirectly. Enolase enzyme increases the production of phosphophenol pyruvate which helps in glucose uptake. Thus F^- inhibits carbohydrate metabolism as well as glucose uptake.

Fluoride concentration affects the salivary pH may be due to reduction of streptococcous mutans, carbohydrate metabolism. When fluoride concentration is high, salivary pH is also high.

Salivary pH also increases after brushing without toothpaste but in a small amount. Salivary secretion is regulated by efferent parasympathetic and sympathetic nerve fibre of Autonomic nervous system[14]. Parasympathetic nerve fibre is mainly responsible for secretion of water and electrolyte through the M_1 and M_3 subtype of muscarinic cholinergic receptors (mAChRs). Salivary protein production is

occurred by sympathetic nerve fibre. Hoek et.al[7] investigated the effect of brushing on salivary flow rate and its composition. The Bass method of brushing technique was used for this study. The result showed that salivary flow increased during initial five minutes after brushing and it continued for fifteen minutes. No significant change was found at salivary protein and amylase concentration. In hypothesis it was suggested that brushing increase salivary flow rate from parotid gland not from sublingual or submandibular gland. Ligtenberg et.al[8] revealed the effect of brushing on salivary secretion, pH and buffering capacity. It was found that brushing with water increased salivary secretion significantly for sixty minutes. Brushing with dentifrices increased more salivary secretion than brushing with water due to gustatory stimulation of toothpaste. In gustatory stimulation sour stimuli secret largest amount of saliva where bitter stimuli secret least amount. In a study it was found that salivary secretion increased after brushing with fluoridated tooth paste. In a study[7] it was found that brushing increased salivary albumin concentration five times more than baseline value. After 45 minutes of tooth brushing albumin concentration was still increased. Another salivary component IgA was decreased 40% during initial 5 minutes after brushing and it may be due to increased salivary secretion. Salivary amylase concentration was not significantly affected after brushing.

Salivary flow rate also affects salivary pH. If salivary flow rate is high, saliva becomes alkaline. Saliva becomes acidic in nature during slow flow rate. Before secretion of saliva, it is slightly acidic in nature. At the time of secretion saliva become alkaline due to loss of carbon dioxide. When salivary flow increases, bicarbonate concentration increase[8] and this mechanism help to increase salivary pH.

Body position affects salivary flow. Saliva secretion increases in standing rather than sitting position[9]. For these reason children was advised to collect saliva in standing position. Salivary flow rate is high at day time[10].

In this study saliva was collected one hour after meal to remove the effect of food stimulus. Spitting method for saliva collection is best method because it is simple method with high accuracy value and saliva is collected in a non stimulated condition.

CONCLUSION:

This study shows that the salivary pH increase significantly after brushing with fluoridated toothpaste. Depend on this

study we can say that proper brushing and using fluoride containing toothpaste help to increase salivary pH as well as prevent dental caries in children. Previously cariostatic effect of fluoride was ascribed the incorporation of fluoride to hydroxyapatite and formation of fluroapatite or hydroxyfluroapatite. Recently laboratory and clinical findings describe that mode of caries preventive action of fluoride is mainly topical. Calcium fluoride (CaF_2) is the main reservoir for fluoride release during cariogenic challenge. CaF_2 is formed during presence of 100 to 10,000 ppm fluoride concentration. Toothpaste with 1000 ppm fluoride is effective to prevent dental caries in children.

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TABLES:

Table 1: pH of saliva for before and after brushing with fluoridated tooth paste

Before brushing (average ± SD)	After brushing with fluoridated tooth paste (average ± SD)	Difference
7.23 ±0.29	7.62 ± 0.36	0.4 ± 0.275

Table 2: pH of saliva for before and after brushing with fluoridated tooth paste

Before brushing (average ± SD)	After brushing without tooth past (average ± SD)	Difference
7.2 ± 0.16	7.3 ± 0.15	0.1± 0.07

FIGURES:

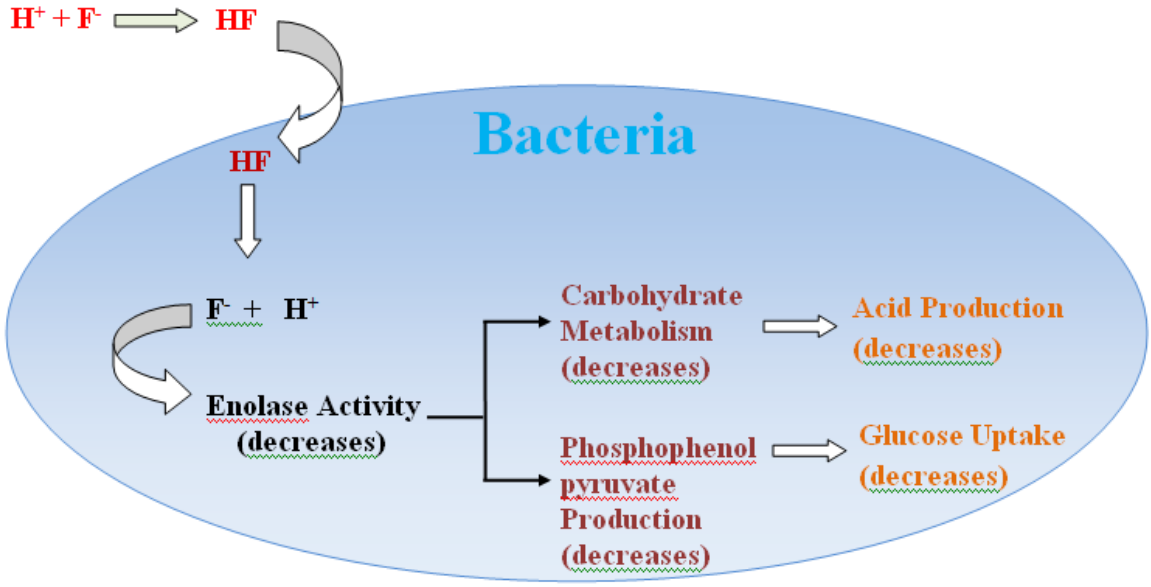

Fig. 1: Mechanism of antimicrobial activity of fluoride

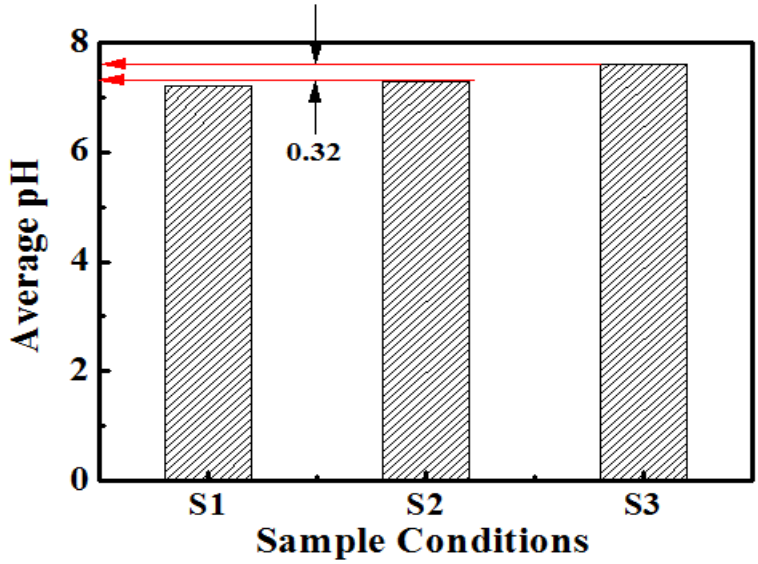

Fig. 2: Average pH of saliva before brushing, after brushing with fluoride containing tooth paste and without toothpaste