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Effect of Green Tea as a Mouth Rinse on Streptococcus Mutans

Dr. Nandan N., Dr. Mythri Prasanna¹, Dr. Prem Kishore K²

Reader, Dept. of Pedodontics and Preventive Dentistry, Bangalore Institute of Dental Sciences, Bangalore, Karnataka, India. ¹Senior Lecturer, Bapuji Dental College and Hospital, Davangere, Karnataka, India. ²Professor, New Horizon Dental College and Hospital, Bilaspur, Chattisgarh, India.

ABSTRACT

Plant extracts have been widely used in topical and oral applications for disease treatment. The aim of the study was to assess the efficacy of green tea as mouth rinse for children on plaque streptococcus mutans and to compare it with that of a chlorhexidine mouth rinse. Plaque samples were tested for Streptococcus Colony Forming Units before and following a 21 day period of oral rinsing. A significant reduction in plaque S.mutans counts was observed with Green tea mouth rinse, which was not significantly different from that of the time tested chlorhexidine mouth rinse. The use of a green tea as a mouth rinse appears to be effective for regular use as part of a daily preventive regime in children.

Key words: Mouth rinse, Chlorhexidine, Alcohol free, Green Tea, Streptococcus mutans.

INTRODUCTION

Plant extracts have been widely used in topical and oral applications for disease treatment. Green tea (*Camellia sinensis*) which is not fermented during the drying process has numerous medicinal benefits mainly due to its antibacterial and antioxidant properties.^[1] Green tea contains flavonoids, tannin, vitamins, fluoride and other mineral salts. Some antioxidant and antimicrobial agents of green tea

could increase the life and efficiency of teeth.^[2,3] Tannins are biosynthetic materials which have a potent antibacterial effect.^[4] (Table 1)

Prevention of dental caries is one of the hallmarks of contemporary pediatric dental practice. The human oral cavity is an incubator which provides nutrition, shelter and facilitates growth of numerous microorganisms.^[5]

Streptococcus mutans is the chief culprit in initiating dental caries. Reducing the levels of Streptococcus mutans in the oral cavity will ensure prevention of dental caries. Although mechanical plaque control by tooth brushing is the most dependable and commonly practiced oral hygiene measure, numerous anti plaque agents have been tried for improving oral health.^[6] These agents are capable of preventing bacterial adhesion, colonization and metabolism and thus affect the bacterial growth. The efficacy of these antimicrobial agents depends on factors like vehicle used, concentration of active agents, substantivity of the agent and duration of the treatment. An ideal antiplaque agent for regular use in children should not interfere with biologic processes occurring in the mouth, be harmless to oral mucosa, should have low toxicity if accidentally swallowed, and should be both

Address for correspondence:

Dr. Nandan N.

Reader, Dept. of Pedodontics and Preventive Dentistry, Bangalore Institute of Dental Sciences and Hospital, Hosur Road, Bangalore - 560027, Karnataka, India.
E-mail: aradhya333@yahoo.co.in

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sugar and alcohol free. Fluoride is one of the most important and effective components of preventive dental programs in children.^[7]

This study assessed the efficacy of a newly introduced mouth rinse for children, in reducing plaque, levels of Streptococcus mutans and compared it with that of a chlorhexidine mouth rinse.

Table 1: Composition of Green Tea

Green tea is reported to have nearly 4000 bioactive compounds,

Proteins (15–20% dry weight) whose enzymes constitute an important fraction.
Aminoacids (1–4% dry weight) such as teanine or 5-N-ethylglutamine, glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, leucine, threonine, arginine, lysine.
Carbohydrates (5–7% dry weight) such as cellulose, pectin, glucose, fructose, sucrose.
Lipids (5-7% dry weight) as linoleic and linolenic acids.
Sterols as stigma sterol.
Vitamins (B, C, E).
Xanthic bases such as caffeine, theophylline and pigments as chlorophyll and carotenoids.
Volatile compounds as aldehydes, alcohols, esters, lactones, hydrocarbons, etc.
Minerals and trace elements (5% dry weight) such as Ca, Mg, Cr, Mn, Fe, Cu, Zn, Mo, Se, Na, P,Co, Sr, Ni, K, F and Al.

MATERIALS AND METHODS

Sixty normal children aged between 12 to 15 years and residing in a residential school were screened as part of a routine dental examination. These children had the same dietary pattern and followed similar oral hygiene practices. Prior to the study consent was obtained from the hostel authorities. Ethical clearance was obtained from the hostel management. To be

included in the study, each child had to have a DMFT score equal to or greater than 3.

Exclusion criteria

1. Medically compromised children
2. Children with a history of taking antibiotics three months prior to and during the study period.
3. Children undergoing orthodontic treatment or with an intra oral prosthesis.
4. Children who could not brush their teeth or rinse on their own.
5. Presence of any intra oral soft tissue pathology.

Sixty children formed the study group. The authorities of the school were instructed not to take these children for any dental treatment during the study period. At the onset of the study, each child was given a new soft toothbrush. They were instructed to brush once in the morning and once in the night after meals.

Prior to commencement of the oral rinse regime, autoclaved wooden toothpicks were used to take plaque samples from the buccal surface of a non carious permanent mandibular first molar. The plaque samples were taken 30 minutes following breakfast. It was transferred to an autoclaved ependroff tube containing 1ml of saline. The samples were taken to the laboratory within an hour, serial dilutions prepared and vortexed. One ml of the dilution was inoculated onto Mitis Salivarius agar and incubated at 37^o C for 48 hours. Colony forming units (CFU) of Streptococcus mutans were counted with the help of a digital colony counter.

The children were randomly divided into two groups of thirty children each. Group I was given a freshly prepared green tea (Green tea leaf, Tetley, Tata Global Beverages) and Group II was given a chlorhexidine mouth rinse (Nitra hex, Micro Labs Limited, Bangalore, India). Mouth rinse was alcohol free. None of the children had any knowledge of the contents of the rinse given. The children were asked to gather in a large room, where each child was given 10ml of the mouth rinse and asked to rinse for one minute. Mouth rinsing was carried out twice daily,

half an hour after breakfast and half an hour following dinner, for a period of 21 days under the supervision of the investigator. On the following morning, plaque samples were collected, processed and studied for Streptococcus mutans in a similar manner.

Data obtained was subjected to statistical analysis using student 't' test.

OBSERVATIONS AND RESULTS

In both groups, there was a significant reduction in the mean Streptococcus mutans count at the end of 21 days ($P < 0.001$). However no significant difference was observed between the two mouth rinses. (Table 2)

Table 2: Streptococcus mutans count in plaque samples.

Group	Mean CFU(X 10 ⁵ ml)		Mean Value P-Value	
	Before Rinsing	After Rinsing		
I Green Tea	23.11+/- 8.59	9.21+/- 3.39	13.90	<0.001
II Nitrahex	19.20+/- 6.93	3.56+/- 3.45	15.64	<0.001

P value is significant

DISCUSSION

Mouth rinses are widely used to maintain oral hygiene. They are recommended for only those who have the ability to swish and expectorate without swallowing. It is important for these products to be effective and safe for regular use in children. Most mouth rinses contain alcohol as one of their ingredients and they are also available 'over the counter'. Adair (2006) recommended the use of alcohol free preparations over those containing alcohol.^[7] The major side effects of alcohol containing mouth rinses include the presence of oral pain, burning sensation, difficulty of use in patients with oral sensitivity and the risk of accidental alcohol ingestion in children.^[8]

The extra hepatic metabolism of alcohol has been demonstrated in oral tissue. The metabolic enzymatic imbalance present in the human mouth during alcohol oxidation leads to accumulation of a toxic and irritating compound, acetaldehyde. The use of mouth rinses containing alcohol should be avoided especially for continuous use and especially in Asian populations who have a high risk of Aldehyde Dehydrogenase isoenzyme 2 (ALDH2) genetic deficiencies, hence in this study it was necessary to select two mouth rinses that were alcohol free.

Moghbel et. al. prepared a mouthwash from green tea extract and compared its antibacterial effects with chlorhexidine gluconate rinse on the mouth aerobic bacterial load. They concluded that the green tea mouthwash reported no evidence of irritation or burn, showed similar antibacterial effects as compared to chlorhexidine and was more safe and economical.^[9]

Streptococcus mutans plays an important role in causing dental caries. Green tea extract applied topically inhibits Streptococcus mutans bacteria. Tea leaves are rich in fluoride which is known to prevent dental caries. Besides fluoride, several green tea polyphenols have preventive effects on dental caries. Catechins present in tea are epicatechin gallate (ECG), epicatechin (EC), epigallocatechin (EGC) and epigallocatechin gallate (EGCG).^[10]

Among the catechins, EGC is most active in inhibiting the growth of 10 strains of cariogenic bacteria. Cariogenic bacteria synthesize watersoluble and insoluble glucans using glucosyl transferase (GTase). Highly branched glucans help the bacteria to adhere to the tooth surface. The most active and abundant catechin in green tea is epigallocatechin-3-gallate (EGCG). ECG and EGCG strongly inhibit GTase and thus inhibit adherence of the bacteria to tooth surfaces.^[10]

According to Zhang (1998), tea extract reduced α -amylase activity in human saliva and thus, green tea consumption exerts an anti-cariogenic effect which reduces the cariogenic potential of starch containing food.

In studies involving almost 800 Japanese children there was a significantly lower incidence of pits and fissures in the teeth of the juvenile tea drinkers who consumed one cup of 'bancha' tea daily compared to the control group. (Hattarki,2013) A more recent study from the UK by investigated the use of tea, and of sugared and carbonated drinks, on dental health in over 6000 children; they clearly established that the drinking of tea was associated with lower levels of caries.^[13] These studies provide a strong body of evidence to suggest that tea drinking has the capacity to lower the incidence of dental caries.

After fluoride, the most intensely researched preventive agent in dentistry has been chlorhexidine. It is an effective antiplaque agent and is widely available as a mouth rinse.

In the present study, a significant reduction in plaque S.mutans count was obtained with the 0.2% chlorhexidine mouth rinse. Chlorhexidine is a bis biguanide which is effective against Gram positive, gram negative bacteria and yeast. At relatively high concentration, chlorhexidine is bactericidal but in low concentration it is bacteriostatic. The positively charged molecules of chlorhexidine molecules bind readily to the negatively charged cell wall, mainly phosphate groups in liposaccharides and carboxyl groups in proteins. There is an interference with the membrane transport initiating a linkage of low molecular substances.^[14]

However, there was no significant difference between the chlorhexidine mouth rinse and the green tea as a mouth rinse, with regard to their ability to reduce plaque S.mutans count.

CONCLUSION

The use of green tea as mouth rinse appears to be effective for regular use as a part of a daily preventive regime in children.

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