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# Comparison of efficacy of neem, tea and chlorhexidine mouthwashes on dental plaque and gingival health in patients of Gingivitis attending Rama College- A clinical study

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## Abstract

**Aim:** The study aimed to examine the efficacy of neem, tea and chlorhexidine mouth washes in the reduction of plaque and periodontal inflammation.

**Methods:** This study was conducted in the department of Public Health Dentistry, Dental College, Hospital and Research Centre, India. The study included 60 adult patients fulfilling inclusion and exclusion criteria were randomly divided into three groups. In Group A 0.12% Chlorhexidine Mouthwash, in Group B – 5% Neem Mouthwash and in Group C- 10% Tea mouthwash was given to the patients. Plaque index, gingival index and Periodontal pocket depth was measured before starting and after competition of study. Any side effect experienced by the patients was also recorded at the end of study period.

**Result:** plaque Index, Gingival Index and Periodontal pocket depth significantly decreases during the study ($P<0.05$) in all the groups. However the indices values showed non-significant differences between groups at baseline and after completion of study. Significantly more percentage of patients finds the taste of white tea palatable in comparison to other mouthwashes. No major side effects was seen during the study.

**Conclusion:** Daily mouth rinsing using tea and neem mouthwash had beneficial effects on periodontal disease. These mouthwashes can serve as a good alternative for patients who prefer herbal products with less side effects.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

**Keywords:** Chlorhexidine, Mouthwash, Neem, Tea

## Introduction

Dental plaque is a broad term for the various microorganisms present on tooth surfaces. It is incorporated in a polymer matrix of salivary and microbiological origin. Plaque has a substantial impact on the oral health-related quality of life. In India, the frequency of oral diseases is relatively high, with dental caries and gingivitis being non-life threatening ubiquitous pathologies.(1)

Periodontitis is a common dental disease marked by inflammatory deterioration of the periodontal ligament. Plaque-induced gingivitis is the root cause of this disease. The gold standard of periodontal treatment is mechanical plaque control. Mechanical plaque management, such as as brushing and flossing, is often not totally successful.(2) Adjunctive application of chemical plaque control agents demonstrated improved effectiveness in plaque and gingival inflammation reduction.(3)

Mouthwashes are utilised in dentistry for both prevention and treatment. They disturb plaque by chemomechanical action, with chlorhexidine being the most effective chemotherapeutic agent. It is regarded as the gold standard in lowering mutans streptococci and regulating plaque. It is bacteriostatic at low concentrations and bactericidal at high concentrations. Because the occurrence of side effects such as unpleasant taste, tooth discolouration, burning sensation, and mouth dryness discourages patients from using this mouthwash in the long run, thus natural alternatives derived from botanicals are being investigated.(4)

Neem, scientifically referred to as Azadirachta indica, is a plant of Meliaceae family. The first known use of neem by the Harrappa culture in ancient India dates back 4500 years. It has antifungal, antibacterial properties. The antibacterial action can be explained by “Azadiachtin”

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

that is known to destroy bacterial cell wall and thus inevitably inhibit the growth of bacteria and also the breakdown of cell wall disturbs osmotic pressure which leads to cell death.(5)

Tea is the most popular non-alcoholic beverage. With 1.2 million tonnes of tea produced, India is the world's second largest producer. It is derived mostly from the plant Camellia sinensis. It has been demonstrated to have several positive benefits on our dental health. It has shown to have many beneficial effects on our oral health. The most abundant components in green tea are polyphenols, in particular, flavonoids such as the catechins.(7) Studies have shown that green tea polyphenols inhibit the growth of oral and periodontopathic bacteria thereby preventing dental caries, halitosis.(8)

However not much research has been done on this matter. However, barely any research has been conducted on this subject. The current study aimed to examine the efficacy of 0.12% Chlorhexidine, 5% Neem and 10% Tea mouth wash s in the reduction of plaque and periodontal inflammation.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

**Methodology**

The present comparative study was done in the Department of Public Health Dentistry of Dental College, Hospital & Research centre after taking approval from the Institutional ethical committee of college. The study population comprised of adult patients between age of 18 to 30 years having periodontitis free from systemic diseases attending the OPD of public Health Dentistry. Written informed consent was taken from the patients before their enrollment in study. The participants were selected for the study should not have any physical illness, does not consume any type of tobacco products, should not gone for treatment for periodontal problems since last 6 months and have pocket depth of 4 to 5 mm. The patient wearing oral appliances or prostheses was excluded from study. Pregnant women are also excluded from the study.

The sample size was calculated on the basis of the result of study conducted by Singh SK et al.(10) It is calculated by the given formula.

$$n1 = \frac{({\sigma_1}^2 + {{\sigma_2}^2}/{K})(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2}$$

The Confidence interval was taken at 95% and power of study was 80%. Mean difference in pocket depth was 0.36 mm, standard deviation ($\sigma_1$, $\sigma_2$ ) of a pervious study was 0.30 mm and k which is ratio of sample per group is 1. The minimum sample size calculated for each group was 12. The sample size was increased by 10% to compensate for the loss to follow-up. The final sample size taken was 20 participants in each group. Therefore total 60 participants were included in the study.

The participants were randomly assigned to different groups. The simple randomization process consisted of previously shuffled sealed envelopes with numbers with an equal allocation ratio placed in bowl. Each participant randomly chooses an envelope number virtually, giving them an

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

equal chance of being placed in either group. The sealed envelope was opaque and numbered in sequence to ensure allocation concealment. Double blinding method was used in study.

The participants were assessed two times: T1 prior to intervention and T2 for follow up one month later to assess the effectiveness of intervention. The single examiner has performed all tests during the study after being trained and calibrated in the department in order to decrease the diagnostic variability. The study included 30 patients having chronic periodontitis.

Baseline data was taken before starting the procedure. Scaling and Root planning was performed after examination. For the next 30 days, subjects were instructed not to use interdental tools. Subjects were instructed to use the allotted mouthwash twice a day at a specific time during the day for 1 minute with 10 ml of arbitrarily designated rinse. At each rinsing, 10 cc of the solution was swung around the lips for about 60 seconds before being expectorated.

In Group A patients 0.2% chlorhexidine mouthwash while in Group B 5% Neem mouthwash and in Group C 10% Tea mouth wash was used.

Clinical examinations of patients were done at baseline and after 1 months interval. Plaque Index given by silness and Loe, (11) Gingival Index by Loe and silness,(12) and pocket depth was assessed at baseline and after 30 days. Adverse effects such as burning sensation, altered taste, and desquamation of gingival epithelium if any were also evaluated at the end of study period.

**Statistical Analysis**

The job of data entry from precoded survey form and preparation of results (as per analysis plan) were done using the SPSS version 23.0 (IBM Corporation, Statistical Package for the Social Sciences. N.Y., USA). One Way ANOVA test was used to compare various indices values between groups while paired t test was used to compare indices value before and after the treatment within the group.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

**Result**

The Plaque index scores at baseline were 2.11±0.26 in the chlorhexidine group, 2.08±0.23 in Neem mouthwash group and 2.03±0.28 in the tea mouthwash group with non-significant difference between them. The mean Gingival index at baseline in chlorhexidine group was 2.26±0.27, 2.24±0.28 in Neem mouthwash group and in tea mouthwash group was 2.28±0.24 with non-significant difference between them. The mean PPD at baseline in chlorhexidine group was 4.06±0.79 mm, 3.89±0.70 in Neem mouthwash group and in tea mouthwash group was 4.10±0.70mm with non-significant difference between them. (Table 1)

The Plaque index scores after competition of study was 0.62±0.24 in the chlorhexidine group, 0.66±0.25 in Neem mouthwash group and 0.63±0.22 in the tea mouthwash group with non-significant difference between them. The mean Gingival index after competition of study was 0.87±0.28 in chlorhexidine group, 0.82±0.22 in Neem mouthwash group and 0.80±0.24 in tea mouthwash group was with non-significant difference between them. The mean PPD after competition of study was3.26±0.70 mm in chlorhexidine group, 3.15±0.65 in Neem mouthwash group and 3.19±0.59 mm in tea mouthwash group with non-significant difference between them. (Table 2)

There was significant improvement in oral health in during the treatment period in chlorhexidine group. The mean plaque index at baseline was 2.11±0.26 significantly decreased to **0.62±0.24** after 30 days of treatment. The mean Gingival index at baseline was 2.26±0.27 significantly decreased after treatment to 0.87±0.28 with t value 16.83 and p value 0.001. The significant difference was also seen in Pocket Probing depth. The mean PPD at baseline was 4.06±0.79mm decreased to 3.26±0.70 after completion of treatment. (Table 3)

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

There was significant improvement in oral health in during the treatment period in Neem mouthwash group. The mean plaque index at baseline was 2.08±0.23 significantly decreased to 0.63±0.25 after 30 days of treatment. The mean Gingival index at baseline was 2.24±0.28 significantly decreased after treatment to 0.82±0.22 with t value 16.83 and p value 0.001. The significant difference was also seen in Pocket Probing depth. The mean PPD at baseline was 3.89±0.70 mm decreased to 3.15±0.65 after completion of treatment. (Table 4)

There was significant improvement in oral health in during the treatment period in tea mouthwash group. The mean plaque index at baseline was 2.03±0.28 significantly decreased to 0.63±0.22 after treatment. Paired T test showed significant difference with t value 43.17 and p value 0.001. The mean Gingival index at baseline was 2.28±0.24 significantly decreased after treatment to 0.80±0.24with t value 37.05 and p value 0.001. The significant difference was also seen in Pocket Probing depth. The mean PPD at baseline was 4.10±0.70 mm significantly decreased to 3.19±0.59 mm after completion of treatment. (Table 5)

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

Table 1: comparison of Plaque index between groups at baseline

| Indices | Chlorhexidine | **Neem** | Tea | F value | P value |
|---|---|---|---|---|---|
| Plaque index | 2.11±0.26 | 2.08±0.23 | 2.03±0.28 | 0.29 | 0.82 |
| Gingival Index | 2.26±0.27 | 2.24±0.28 | 2.28±0.24 | 0.21 | 0.88 |
| Pocket Probing Depth | 4.06±0.79 | 3.89±0.70 | 4.10±0.70 | 0.45 | 0.76 |

Table 2: comparison of Plaque index between groups at baseline

| Indices | Chlorhexidine | Neem | Tea | F value | P value |
|---|---|---|---|---|---|
| Plaque index | 0.62±0.24 | 0.66±0.25 | 0.63±0.22 | 0.29 | 0.82 |
| Gingival Index | 0.87±0.28 | 0.82±0.22 | 0.80±0.24 | 0.21 | 0.88 |
| Pocket Probing Depth | 3.26±0.70 | 3.15±0.65 | 3.19±0.59 | 0.45 | 0.76 |

Table 3: comparison of indices between baseline and after completion of study in Chlorhexidine Mouthwash group

| Indices | Group | Baseline | Paired difference | T value | P value |
|---|---|---|---|---|---|
| Plaque index | Baseline | 2.11±0.26 | 1.49±0.30 | 19.44 | 0.001** |
| | **30 days** | 0.62±0.24 | | | |
| Gingival Index | Baseline | 2.26±0.27 | 1.39±0.33 | 16.83 | 0.001** |
| | **30 days** | 0.87±0.28 | | | |
| Pocket Probing Depth | Baseline | 4.06±0.79 | 0.80±0.56 | 6.43 | 0.001** |
| | **30 days** | 3.26±0.70 | | | |

Table 4: comparison of indices between baseline and after completion of study in Neem Mouthwash group

| Indices | Group | Baseline | Paired difference | T value | P value |
|---|---|---|---|---|---|
| Plaque index | Baseline | 2.08±0.23 | 1.42±0.27 | 18.59 | 0.001** |
| | **30 days** | 0.66±0.25 | | | |
| Gingival Index | Baseline | 2.24±0.28 | 1.42±0.30 | 17.74 | 0.001** |
| | **30 days** | 0.82±0.22 | | | |
| Pocket Probing Depth | Baseline | 3.89±0.70 | 0.74±0.44 | 5.82 | 0.001** |
| | **30 days** | 3.15±0.65 | | | |

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

Table 5: comparison of indices between baseline and after completion of study in tea Mouthwash group

| Indices | Group | Baseline | Paired Difference | T value | P value |
|---|---|---|---|---|---|
| Plaque index | Baseline | 2.03±0.28 | 1.40±0.19 | 43.17 | 0.001* |
| | 30 days | 0.63±0.22 | | | |
| Gingival Index | Baseline | 2.28±0.24 | 1.48±0.17 | 37.05 | 0.001* |
| | 30 days | 0.80±0.24 | | | |
| Pocket Probing Depth | Baseline | 4.10±0.70 | 0.91±0.51 | 9.00 | 0.001* |
| | 30 days | 3.19±0.59 | | | |

**Discussion**

The study was carried out to assess and compare the effectiveness of 0.5% tea, 2% neem, and 0.2% chlorhexidine mouthwashes on oral health. This was a triple-blind study where in the investigator, study subjects as well as the statistician was not aware to which group the subjects belonged and coding was done for each group and individuals. No side- effects or miss happenings were seen during study procedure.

Comparison with other studies could not be carried out as the material and concentrations used are different as well as the age group for the study and time intervals varied for every study. Since, the GI has been the most widely used index in studies investigating oral hygiene products, (9 – 11) it was included in this study to permit comparison between studies.

**0.2% Chlorhexidine**

Chlorhexidine digluconate is, to date, the most thoroughly studied and the most effective anti-plaque and anti-gingivitis agent. However, several side-effects associated with its use have stimulated the search for alternative agents. For this reason only it is taken as a benchmark control for various mouthwashes. The most commonly prescribed concentration is 0.2% hence, this was considered in the study. (12-14)

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

As expected the mean plaques scores reduced from baseline to competition of study. The drop was found to be significant. Same goes with gingival scores, were significant reduction of gingivitis was seen from score 2.26±0.27 at baseline to 0.87±0.28 at the end of study. The significant difference was also seen in Pocket Probing depth. The mean PPD at baseline was 4.06±0.79mm decreased to 3.26±0.70 after completion of treatment. Our studies are in concurrence with other studies. (12-14)

**2% Neem**

Neem contains trimethylamine, chlorides, nimbidin, azadarachitin, lectin, fluorides in large amounts and silica, sulfur, vitamin C, tannins, saponins, flavonoids, and sterols in small quantities. The antibacterial and antiseptic properties of neem have been proved in various studies on health.(15, 16)

In the present study, 2% neem was used so that the taste should not be a hindrance for its use with maximal inhibition of bacteria and plaque. It was seen that the significant reduction in plaque was seen from baseline to 30 days. The gingival index and periodontal pocket depth was also significantly reduced. The reduction was equal than that of chlorhexidine. Some studies have given same results. (11, 17)

**0.5% Tea**

Originating from China, tea has gained the world's taste in the past 2000 years. The economic and social interest of tea is clear and its consumption is part of many people daily routine, as an everyday drink and as a therapeutic aid in many illnesses. Ancient Asian cultures have consumed green tea as a beverage for over 4000 years. Drinking tea has become associated with life-style and living habits of more than 80% of the population, though it is brewed differently to suit one's

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

taste and life-style. The first clue to the oral health benefits of tea came from studies in the 1940 s to 50 s showing fluoride to be the active component. (18) Reports suggested not only fluoride but also tannins contributed to the inhibitory effect. (19 – 21 )

Tea mouthwash was used so that the concentration should not change the taste but should have maximum inhibition of variables. In the present study tea mouthwash had the maximum desired effect when compared to neem and chlorhexidine. The plaque level showed significant decrease in Tea group which was similar to the chlorhexidine and neem mouthwash. The gingival index and periodontal pocket had shown significant improvement during the study which was also in range of chlorhexidine and neem mouthwash. May be the catechins, tannins, and astringent effect present in the tea have carried out wonders to gingival health.

Comparison with the other studies could not be carried out as, tea as a mouth rinse has not been studied separately. In combination with other herbal mouth rinses, the effect is similar to our study (Soukoulis *et al*., 2004).(22) Study conducted by has Arweiler et al. been reported with that of tea tree oil with similar results and on the same variables, which we have seen the effect.(10) A human study investigated the effect of tea polyphenols in the form of chew candies on gingival inflammation over a 4-week period. The approximal plaque index and sulcus bleeding index were determined at the end of day 7 and 28. These authors suggested that tea polyphenols might exert a positive influence on gingival inflammation however, the results were not statistically significant. (23)

Various mechanisms have been explained for the effect of tea on gingival health. Green tea catechin has been shown to be bactericidal against *Porphyromonas gingivalis* and *Prevotella* spp. *in vitro*. Tea catechins containing the galloyl radicals possess the ability to inhibit both eukaryotic and prokaryotic cell-derived collagenase, an enzyme that plays an important role in

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

the disruption of the collagen component in the gingival tissues of patients with periodontal disease.(24,25) Catechin derivatives have been reported to inhibit certain proteases of *P. Gingivalis* and may reduce periodontal breakdown.(26) Green tea catechins have also been shown to inhibit protein tyrosine phosphatase in *Prevotella intermedia.*(27) EGCG has been reported to inhibit production of toxic metabolites of *P. Gingivalis* (Sakanaka S *et al*., 2004) (28) have shown that purified tea polyphenols inhibited *in vitro* growth and $H_2$ S production of *P. gingivalis* and *Fusobacterium nucleatum* associated with human halitosis.

**Conclusion:**

Daily mouthrinsing using tea and neem mouthwash had beneficial effects on periodontal disease. These mouthwashes can serve as a good alternative for patients who prefer herbal products with less side effects. The promotion of botanical herbs with fewer side-effects may motivate the patient for oral hygiene maintenance.

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ISSN: 0975-3583,0976-2833 VOL15, ISSUE 8, 2024

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