

Gingival Health and Plaque Removal Assessment by Neem Stick and Toothbrush: A Comparative Study

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ABSTRACT

Introduction: Oral hygiene measures have been practiced by different populations and cultures in a different way around the world. In various parts of the world where tooth brushing by modern method is uncommon or not possible, the practice of tooth cleaning by chewing sticks has been commonly observed.

Materials & Methods: 30 study subjects of age 18-30 years residing in village Farathiya, Jharkhand were selected and equally divided into two groups' Neem stick group and tooth brush group respectively. Plaque score and gingival scores were assessed at base line and after 3weeks separately for Neem stick group and toothbrush group.

Results: When comparison of the mean plaque score of Neem stick group at base line and after 3 weeks was done the result were found to be highly statistically significant ($p \leq 0.001$).

Conclusion: It can be concluded that the use of chewing stick fulfils the basic requirement of oral health care and can be a good alternative to the toothbrush as a means of preventing

oral diseases. It is suitable for cleaning almost all the teeth, is cheap, possesses various medicinal properties, and is easily available in most urban and rural areas of developing countries.

Key Words: Neem Stick, Tooth Brush, Plaque Removal, Gingival Health, Oral Hygiene.

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INTRODUCTION

Oral hygiene measures have been practiced by different populations and cultures in a different way around the world. In various parts of the world where tooth brushing by modern method is uncommon or not possible, the practice of tooth cleaning by chewing sticks has been commonly observed.¹ Oral hygiene can also be referred to as the general mouth cleanliness and there are various methods of cleaning to make it hygienic.²

The 80 percent of the population in India who live in rural areas still start their day with the datum (plant stick). There are at least six types of datum used in India viz., Neem, Babul, Mango, Guava, Dandarasa and roots of Pilu. Among all, Neem datum (Neem stick) is most commonly in use.¹

Neem (*Azadirachta indica*) tree, the "tree of a thousand uses" have been used for medicinal, cosmetic, agricultural and other purposes due to its antifungal, antibacterial, antiviral, pest-control, sedative and many more effects. Neem extracts can also be found in Ayurvedic and other toothpastes. This tree, (in Sanskrit, Nimba and Arishta) is a native of India, and is cultivated in all parts of the subcontinent on account of its medicinal properties.¹

The presence of gallotannins in Neem during the early stages of plaque formation could effectively reduce the number of bacteria available for binding to the tooth surface by increasing their physical removal from the oral cavity through aggregate formation. Additionally, the effective inhibition of glucosyl transferase activity

and the reduced bacterial adhesion, as seen with the presence of gallotannin extracts, suggest some potential anti-plaque activity. It can be hypothesized that tannins effectively bind to surface associated bacterial proteins, which results in the formation of bacterial aggregates and loss of glucosyl transferase activity.³

Neem is perhaps the most commonly used traditional medicinal plant of India. Only crude extracts of different parts of Neem have been used as traditional medicine for treatment of various diseases. Neem has been extensively used in Ayurveda, Unani, Homoeopathic and Siddha medicine and has become a cynosure of modern medicine.⁴ Different chewing sticks are widely used in Nigeria, and Asia, and in many Asian societies chewing Neem sticks still remain the only method used to clean the teeth among the various tree twigs.⁵

Tooth brushing is the most common mechanical method used to control plaque. Tooth brushing has become a universally accepted first line of defence against illness. When used correctly, at least twice per day, quality toothbrushes remove pathogens from the mouth. Toothbrushes, however, are routinely reused for months and sometimes for more than a year. As part of the Global Burden of Disease Study in 2010, researchers found that approximately 35% of the world has untreated cavities; and of the 291 major diseases and injuries studied, dental cavities are by far the number one non-lethal communicable disease. Billions worldwide suffer from major tooth decay.⁶

There are abundance of *in vitro* studies which demonstrate the beneficial effects of Neem extract on plaque bacteria but very few *in vivo* studies have been reported till date as per our literature search. Hence, this clinical trial was planned with an aim to compare the effect of Neem stick and toothbrush on plaque removal and gingival health.

MATERIALS AND METHODS

The present study was conducted over 30 subjects of age 18-30 years residing in village Farathiya, Garhwa, Jharkhand after the approval from Ethical Committee of the Vananchal Dental College and Hospital, Jharkhand. It was a single blind, randomized study to compare the effects of Neem stick and toothbrush on plaque and gingival scores. The participants were informed about the aim and purpose of the study.

The inclusion criteria for the study were a person without the evidence of periodontitis and participants without any orthodontic appliances and with good manual dexterity. The exclusion criteria include participants who have undergone any recent antibiotic therapy, participants with history of early onset periodontitis, ANUG, gross oral pathology, treatment for cancer and with serious medical conditions or transmissible disease.

Based on inclusion and exclusion criteria 30 participants were selected and then randomly allocated to two different groups:

1. Subjects using Neem stick group (n=15)
2. Subjects using Toothbrush group (n=15)

All participants were interviewed for their oral hygiene habits. One week before the start of the study, participants received an intraoral examination and oral prophylactic treatment. The participants were then instructed to continue their usual oral hygiene routine for the following week. One week later, participants underwent baseline registration of gingival inflammation and plaque deposits. Each participant was then provided with either new conventional toothbrush or fresh Neem

sticks available in market and instructed to use them twice daily in morning and in the evening continuously for the period of next three weeks and to refrain from other oral hygiene aids during the study period. After that, participants again underwent examination of gingival inflammation and plaque deposits.

The recording of clinical examination includes recording of Plaque and Gingival Indices :

Plaque Index

The plaque index (PI) used was described by Silness J and Loe H in 1964. The teeth used for index were dried and examined visually. An explorer was used to test the tooth surface. Teeth examined were 16, 12, 24, 36, 32, and 44. Following criteria were used for scoring the index teeth:

- 0- No plaque
- 1- A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on tooth surface.
- 2- Moderate accumulation of soft deposits within the gingival pocket or the tooth and gingival margin which can be seen with naked eye.
- 3- Abundance of soft material within the gingival pocket and/or on the tooth and gingival margin.

The plaque index was calculated using the formula as PI = sum of scores of index teeth / total number of teeth examined. Scores were interpreted as: 0 –Excellent, 0.1-0.9 –Good, 1-1.9 –Fair, 2-3 –Poor.

Gingival Index

The Gingival Index (GI) used was developed by Loe H and Silness J in the year 1963, to describe the clinical severity of gingival inflammation. Under natural lighting, teeth and gingiva were dried lightly with cotton rolls. A periodontal probe was used to assess the bleeding potential of the tissues. Teeth examined were 16, 12, 24, 36, 32 and 44. Following criteria were used for scoring the index teeth:

- 0- Absence of inflammation / normal gingiva
- 1- Mild inflammation, slight change in colour, slight oedema. No bleeding on probing
- 2- Moderate inflammation; glazing, redness and oedema. Bleeding on probing.
- 3- Severe inflammation; marked redness and oedema, ulceration. Tendency to spontaneous bleeding.

Gingivitis was evaluated at the same location points that were utilized for the assessment of plaque. It was measured on the tissues surrounding each tooth.

Each tooth was divided into gingival scoring units: distal facial papilla, facial margin, mesial facial papilla and the entire lingual gingival margin. The scores around each tooth are totaled and divided by four, and gingival index score for the tooth was obtained. Totalling all of the scores per tooth and dividing by the number of teeth examined provided the gingival index score per person.

Scores were interpreted as: 0.1-1.0 -Mild gingivitis, 1.1-2.0 -Moderate gingivitis, 2.1-3.0 -Severe gingivitis.

The data obtained was compiled, tabulated and subjected to statistical analysis using student paired't' test. The collected data was compared at base line and after 3 weeks. Statistical analysis was performed using Windows SPSS version 21 computer software. In addition, the significance level was set at 0.05.

Table 1: Plaque scores and Gingival Scores at base line and after 3 weeks among Neem Stick Group

Sample (Neem stick group)	Plaque score at base line	Gingival score at base line	Plaque score after 3weeks	Gingival score after 3 weeks
N 1	1.7	0.7	1	0.9
N 2	1.4	0.8	1.3	0.5
N 3	1.6	0.6	.9	0.4
N 4	1.9	0.5	1.1	0.6
N 5	1.6	0.5	1	0.2
N 6	1.5	0.4	1.1	0.2
N 7	1.7	0.2	.9	0.2
N 8	1.8	0.4	.9	0.2
N 9	1.6	0.3	1.3	0.3
N 10	1.7	0.5	1.2	0.2
N 11	1.8	0.6	1.2	0.3
N 12	1.7	0.8	.9	0.4
N 13	1.8	0.7	.9	0.6
N 14	1.9	0.6	.9	0.5
N 15	.9	0.5	1.2	0.5

Table 2: Plaque scores and Gingival Scores at base line and after 3 weeks among Tooth Brush Group

Sample (toothbrush group)	Plaque score at baseline	Gingival score at base line	Plaque score after 3weeks	Gingival score after 3 weeks
T.B 1	1.9	1.7	1.2	1.3
T.B 2	0.9	0.8	0.6	0.5
T.B 3	1.6	1.5	0.6	0.7
T.B 4	1.4	1.2	0.8	0.6
T.B 5	1.5	1.4	0.9	0.8
T.B 6	1.5	1.6	0.9	0.8
T.B 7	1.6	1.6	0.7	0.8
T.B 8	1.7	1.4	0.8	0.7
T.B 9	1.6	1.5	0.8	0.9
T.B 10	1.7	1.6	0.9	0.8
T.B 11	1.7	1.5	0.9	0.8
T.B 12	1.7	1.6	0.9	0.8
T.B 13	1.7	1.6	0.9	0.8
T.B 14	1.7	1.6	0.9	0.8
T.B 15	1.7	1.6	0.9	0.8

Table 3: Comparison of Mean Plaque Score of Neem Stick Group at base line and after 3 weeks

Neem Stick Group	Mean±Standard Deviation	t-test	p-value
Base Line Plaque Score	1.6 ± 0.1		
After 3 weeks Plaque Score	1.0 ± 0.1	11.6	0.001*

*Highly statistically significant

Table 4: Comparison of Mean Gingival Score of Neem Stick Group at base line and after 3weeks

Neem Stick Group	Mean ± Standard Deviation	t-test	p-value
Base Line Gingival Score	1.4 ± 0.3		
After 3 weeks Gingival Score	0.8 ± 0.2	9.6	0.000*

*Highly statistically significant

Table 5: Comparison of Mean Plaque Score of Tooth Brush Group at base line and after 3 weeks

Tooth Brush Group	Mean ± Standard Deviation	t-test	p-value
Base Line Plaque Score	1.5 ± 0.2		
After 3 weeks Plaque Score	0.8 ± 0.1	16.8	0.000*

*Highly statistically significant

Table 6: Comparison of Mean Gingival Score of Tooth Brush Group at base line and after 3 weeks

Tooth Brush Group	Mean ± Standard Deviation	t-test	p-value
Gingival Score At Base Line	1.4 ± 0.2		
After 3 weeks Gingival Score	0.8 ± 0.1	19.6	0.000*

*Highly statistically significant

RESULTS AND DISCUSSION

The isolation of bioactive compounds from *Azadirachta indica*, commonly known as the Neem plant, has led to an expanding number of scientific reports on its other interesting biological properties and uses. Some of the observed anti-plaque activity of Neem chewing sticks is attributed to the fibrous nature of these sticks resulting in mechanical plaque removal; however, Neem plant also contain chemotherapeutic anti-plaque agents.²

Almost all parts of the Neem plant are endowed with medicinal properties and have been used as traditional medicine or household remedies against various human ailments, from antiquity. In this era, Neem is considered as a valuable source of unique natural products for development of medicines against various diseases.⁴

In 1942 Salimuzzaman Siddiqui first time extracted three bitter compounds from neem oil, named as nimbin, nimbinin, and nimbidin respectively. Azadirachtin is a chemical compound belonging to the limonoids. It is a secondary metabolite present in the Neem tree seeds.¹

In modern era, toothbrush is the most effective tool for removing harmful plaque and bacteria from the mouth. On average, colonization of bacteria is reduced by 88.8% as a result of brushing. If not removed, these bacteria have been shown to contribute too many disease processes.⁶

The present clinical trial study was carried out, since no study had been conducted in this region earlier, to compare the efficiency of Neem stick and toothbrush in plaque removal and improving gingival health. All participants were asked to use either Neem stick or the toothbrush for a period of 3 weeks. Plaque scores and gingival scores were assessed at base line and after 3 weeks separately for each group. Plaque scores and gingival scores at base line and after 3 weeks among the subjects of Neem stick group has been shown in Table 1 while Table 2 describes plaque scores and gingival scores at base line and after 3 weeks among the group of subjects using tooth brush.

Table 3 describes the comparison of mean plaque scores of Neem stick group at base line and after 3 weeks which were 1.6 and 1.0 respectively. The result were found to be highly statistically significant ($p=0.001$). Comparison of mean gingival scores of Neem stick group at base line and after 3 weeks have been described in Table 4 which were found to be 1.4 and 0.8 respectively. The result were found to be highly statistically significant ($p=0.000$).

Table 5 describes the comparison of mean plaque scores of Tooth brush group at base line and after 3 weeks which were 1.5 and 0.8 respectively. The result were found to be highly statistically significant ($p=0.000$).

Table 6 describes the comparison of mean gingival score of Tooth brush group at base line and after 3 weeks which were 1.4 and 0.8 respectively. The result were found to be highly statistically significant ($p=0.000$).

When the reduction in plaque scores (Table 3 & Table 5) and gingival scores (Table 4 & Table 6) was compared among Neem stick and toothbrush groups, no significant difference was found.

The results of Table 3 and 4 can be compared with the study conducted by Bhambal A *et al*¹. In their study, the authors also found a statistically significant difference in mean plaque score of Neem stick group at base line and after 3 weeks. However in our study, we observed more reduction in plaque score 1.6 to 1.0 as compared to 0.52 to 0.46 in above study. Also we found more reduction in mean gingival score of Neem stick group 1.4 to 0.8 as compared to no reduction in Bhambal A *et al*¹ study as 0.32 to 0.32.

The results of table 5 and 6 can also be compared with the study conducted by Bhambal A *et al*¹. In their study, the authors also found a highly statistically significant difference in mean plaque score of Tooth brush group at base line and after 3 weeks. In our study we observed less reduction in plaque score 1.5 to 0.8 as compared to 0.53 to 0.12 in aforesaid study.

However, we found more reduction in mean gingival score of Tooth brush group 1.4 to 0.8 as compared to no reduction in Bhambal A *et al*¹ study as 0.13 to 0.13. The differences in the results of the studies may be due to the more co-operation and motivation of the subjects and the technique of using tooth brush and Neem sticks by them in our study.

This study was conducted on the subjects who belonged rural area, had low education, low income and were farmers by their profession. This population was chosen based on the fact that poor people, living in rural, backward areas are usually unable to access the dental care. The potential barriers could be the high dental costs, multiple appointments, time off work, child care, transportation costs etc. As the Neem stick used in this trial was easily accessible and available in most of the houses, they could be used to prevent dental diseases and were suitable for this population.

CONCLUSION

The findings of the present study imply that, the use of chewing Neem stick fulfils the basic requirement of oral health care and can be a good alternative to the toothbrush as a means of preventing oral diseases. It is suitable for cleaning almost all the teeth, is cheap, possesses various medicinal properties, and is easily available in most urban and rural areas of developing countries. The use of chewing sticks will be a great help in developing countries with financial constraints and limited oral health care facilities for their population.

However, further long term studies with larger sample size are suggested to test the herbal based product as an efficacious alternative to conventional tooth brush formulations. This study demonstrated that long term regular use of the Neem stick is as effective as a conventional tooth brush in controlling supra gingival dental plaque formation and in the prevention of gingivitis.

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