

# Comparative Effectiveness of Chewing Stick and Toothbrush: A Randomized Clinical Trial

Aeeza S Malik, Malik S Shaukat<sup>1</sup>, Ambrina A Qureshi, Rasheed Abdur<sup>2</sup>

Departments of Community Dentistry (DIKIOHS) and <sup>2</sup>Research, Dow University of Health Sciences, Karachi,

<sup>1</sup>Department of Science of Dental Materials, Multan Medical and Dental College, Multan, Pakistan

## Abstract

**Background:** With the increasing rate of oral diseases, the global necessity of effective and economical products for its prevention and treatment has intensified. **Aim:** This study was to compare the effectiveness of two oral hygiene aids: Chewing stick and manual toothbrush, for plaque removal and gingival health after one month of a randomized clinical trial. **Materials and Methods:** Dental students (age 18-22 years) of a public sector dental hospital were recruited. Sample size was determined using the American Dental Association guidelines. Participants were randomized into two interventional groups and provided with either chewing sticks or toothbrushes. Pre- and post-intervention examinations were executed by two blind and calibrated examiners using plaque and gingival dental indices. Statistical analysis included descriptive statistics, paired t-test, and two sample independent t-tests. **Results:** Fifty subjects were recruited with mean age  $20 \pm 0.66$  years (80% were females and 20% were males). Except for the mean plaque scores of toothbrush users (which increased at post-intervention examination), all other scores showed reduction. In contrast to the final mean gingival scores, a significant difference ( $P = < 0.0001$ ) in the final mean plaque score was observed for the two respective interventional groups. **Conclusion:** Chewing stick has revealed parallel and at times greater mechanical and chemical cleansing of oral tissues as compared to a toothbrush.

**Keywords:** Dental caries, Dental plaque, Miswak, Primary prevention, Tooth brushing

**Address for correspondence:** Dr. Aeeza S Malik, Department of Community Dentistry, DIKIOHS–Dow University of Health Sciences, A-262, Block 'C', North Nazimabad, Karachi, Pakistan. E-mail: aeezamalik@gmail.com

## Introduction

Oral health status has a major impact on the general feature of life and well-being. With the increasing rate of oral diseases, the global necessity of effective and economical products for prevention and treatment has intensified.<sup>[1]</sup> This calls for an understanding of traditional practices and oral health beliefs.<sup>[2]</sup> Use of modern toothbrushes and inter-dental cleaners has ignored the most effective primitive oral hygiene tool, that is, the chewing sticks also known as miswak.<sup>[3]</sup>

Chewing sticks of plants were prehistorically used by the early Arabs, Babylonian, Greek, and Roman

societies for cleaning teeth. Chemical examinations have revealed a new era of chewing sticks reimbursement, which established that these sticks contain natural ingredients, which are beneficial for oral health. It has been reviewed that it contains ascorbic acid, trimethylamine, chloride, fluoride, silica, resins, and salvadorine, which have proved potency to heal the inflamed and bleeding gums, produce stimulatory effect on gingiva, remove tartar, and other stains from the teeth, re-mineralize dental hard tissue, whitens teeth, provide enamel barrier, and increase salivary flow, respectively. In addition, chewing sticks also contains volatile oils, tannic acid, sulphur and sterols which attribute to anti-septic, astringent and bactericidal properties that help reduces plaque formation, provides anti-cariou effects, eliminates bad odor, improves the sense of taste, and cure many systemic diseases.<sup>[4-9]</sup> All these laboratory findings have discovered a new paradigm in the history of preventive dentistry and researchers aimed to bring back the focus on chewing sticks due to its diverse oral health benefits and orthodox adaptation of feasible structure.

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The discovery and apprehension for the alternate oral practices, in particular reference to these chewing sticks, was recommended in 1987 by The World Health Organization and is still being endorsed in order to support these as an effective tool for oral hygiene.<sup>[10,11]</sup> The use of chewing sticks also fulfils the fundamental requisite of primary health care and may be a proper substitute to the modern manual toothbrush to accomplish the goal of prevention of oral diseases, especially in countries with economic restraints and countries with restricted oral health care services for general population. It is affordable and easily available in majority of urban and rural areas of developing countries. In Pakistan, the main factor attributed to the selection of chewing sticks against toothbrush is its acquisition by more than 50% of its population living in rural areas.<sup>[12]</sup> It is observed that the affordability of toothbrush is low among rural (only 8%) than urban (38%) societies of Pakistan. Similarly, chewing sticks has been reported to be practiced by 90% of rural population in Nigeria and Tanzania, 50% of Saudi Arabians, and 65% rural, and 43% urban Indian population.<sup>[13-15]</sup>

In order to reestablish chewing sticks as an effective and exclusive oral hygiene tool in today's nylon toothbrush society where newer attractive products are being introduced everyday in market, clinical evidence proving not only its chemical but also its mechanical superior properties is of prime importance. Therefore, this study was conducted with a testing null hypothesis that "no difference in the mean plaque and gingival scores will be observed for different sites of the examined teeth among chewing stick and manual toothbrush users." The objective of this trial was to compare the effectiveness of two oral hygiene aids: Chewing stick and manual toothbrush, for plaque removal and gingival health after one month of a randomized clinical trial.

## Materials and Methods

Methodology of the present study was composed in line with Consolidated Standards of Reporting Trials (CONSORT) guidelines for reporting clinical trials<sup>[16]</sup> and pursued the ethical standards of World Medical Association for human experimentation 2008 version of Helsinki Declaration.<sup>[17]</sup> Permission to conduct the study was obtained from the Institutional Review Board (IRB) of Dow University of Health Sciences (DUHS), Karachi, Pakistan. A group of regularly attending dental students (age 18-22 years) of the same university were recruited for this trial over a span of 1 month (April 2013). The sample size was determined using the American Dental Association (ADA), Acceptance Program Guidelines for Chemotherapeutic Products for Control of Gingivitis, 2009.<sup>[18]</sup> A signed written consent informing about the

aim and benefits of the study was taken from each study subject. Subjects with any systemic or oral disease, dental prosthesis, poor manual dexterity, recent or current antibiotic coverage, and non-consenting cases were excluded from the study. Selected participants were then randomized into two interventional groups (Group A and Group B) using simple random number table. Details of randomized participants were enclosed in sequentially numbered, opaque, sealed envelopes (SNOSE). The examiners and trial statistician (outcome assessor) were blind to the treatment allocation, while the participants and principal investigator (AM) were not masked to group assignment.

Group A participants were provided with the new, soft textured, nylon manual toothbrushes while members of group B were given new fresh chewing stick of Neem tree measuring 20 cm (length) × 20 mm (diameter). Before the commencement of study a pre-trial workshop was conducted in which the participants of both groups were demonstrated about the appropriate and recommended use of manual toothbrush and chewing stick respectively. The recommendations for toothbrush users (group A) included brushing teeth according to BASS method with toothpaste application of full length on toothbrush and brushing teeth twice daily (after breakfast and before going to bed) for 2 minute.<sup>[19]</sup> The demonstrations and instructions for chewing stick users (group B) included the technique of preparation of working end of chewing sticks and its appropriate brushing technique. It was advised to prepare a new working end every day and brushing twice daily (after breakfast and before going to bed) for 2-5 minutes. The sticks which are not prepared are instructed to be refrigerated.<sup>[6,9]</sup>

Dental examination was conducted at baseline and later after 1 month, that is, pre-interventional and post-interventional phases, respectively. These examinations were executed by two blinded, trained and calibrated examiners. Training included the discussion sessions and practical exercises with the out patients from the Oral Diagnostic Department. Turesky Quigley Hein Plaque index (1962)<sup>[20]</sup> and Loe and Silness gingival index (1962)<sup>[21]</sup> were used as basic examination tools to assess dental plaque and gingival status respectively. Examination was performed on mobile dental units under day time sun light using sterilized mouth mirror and Community Periodontal Index of Treatment Need (CPITN) probe. Inter-examiner reliability for the two indices was attained between the two examiners on 10% of the total study subjects. After recording the gingival status, the participants were asked to dissolve the given plaque disclosing lozenges (with 1% fucoaslid) in the oral cavity in order to stain the overnight deposition of dental plaque which was then scored using Turesky Quigley Hein Plaque Index.

### Statistical analysis

Data was entered and analyzed using Statistical Package for Social Science (SPSS) version 16. Kappa statistics was used to describe the inter-examiner reliability. Descriptive statistics were used to calculate mean (standard deviation) scores of plaque and gingival indices. Paired t-tests were applied to compare the difference in mean plaque and gingival scores at the pre-intervention and post-intervention phases of examination separately for group A and group B, whereas the significant difference for post-intervention plaque and gingival scores between both the groups was calculated by employing two sample independent t-test. The *P* value for statistically significant differences in mean plaque and gingival scores was considered as < 0.05 at 95% confidence level.

### Results

A total of 50 subjects were recruited for the trial with a mean age of 20 ± 0.66 years, out of which 80% were females and 20% were males.

Mean Kappa value calculated as inter-examiner reliability was 0.97. Table 1 demonstrates the observed mean (standard deviation) of plaque and gingival scores for both group A and group B, which were calculated at pre-intervention and post-intervention examination phases. The same table illustrates the paired t-test values which imply comparative (pre and post intervention) differences in plaque and gingival mean scores within chewing stick users, as well as within toothbrush users. Similarly, the table also appreciates a significant difference (< 0.0001) in the final mean plaque scores ( $\Delta P$ ), where as a non-significant difference (0.166) in the final mean gingival scores ( $\Delta G$ ) of the two respective interventional groups.

### Discussion

The present trial was conducted to assess the comparative effectiveness of two oral hygiene aids that is, chewing

stick of Neem tree and manual toothbrush on dental plaque removal and gingival health.

Sample size and trial specifications for this research were followed using the ADA Guidelines, which recommend that “at least 25 patients for each product should be available for examination at the end of the study.” These guidelines also suggests to conduct a trial for at least 30-day period with measurements to be taken at baseline (prior to the study), 15 days (optional), and at 30 days. The subjects should report having not cleaned their teeth for 12-16 hours (overnight plaque formation).<sup>[18]</sup> All these guidelines were taken into consideration while conducting this trial. Moreover, the reason for conducting trials over a span of 1 month is that, a period of 9 to 21 days is reported to be required to appreciate excessive plaque deposits and mild gingivitis in the oral cavity.<sup>[22]</sup>

Trial standardizations in this study were made by holding a pre-trial workshop. Every participant of group A (tooth brush users), was individually taught the recommended brushing method. They were advised to brush with a full length amount of recommended fluoride toothpaste. These participants were allowed to use toothpaste on toothbrush for the reason that chewing sticks also releases chemicals (fluoride) that can maintain oral hygiene.<sup>[7]</sup> However, professional oral cleaning measures such as scaling, curettage or high-fluoride applications were strictly prohibited during the study period. The proper preparation, maintenance, and technique to use the given chewing sticks were also demonstrated in detail to the members of group B (chewing stick users) in order to prevent the gingival trauma.

For centuries the roots, twigs and stems of *Salvadora persica* (Arak tree) sticks have been used as oral cleaning aids and have superior chemical properties.<sup>[7]</sup> Due to its rare availability in South Asian countries these were not used in this study; instead, *Azadirachta indica* sticks taken from flexible branches of Neem tree, were used as an alternative having closest properties to Arak plant.

**Table 1: Comparison of mean plaque and mean gingival scores between the two interventional groups at pre- and post-examination phases**

Variables	Interventional groups	Examination phases	Mean (SD)	't'-value (Sig. p)	$\Delta P / \Delta G$
Plaque index	Chewing stick	Pre-intervention	1.87±0.86	3.09 (0.006)	<0.0001
		Post-intervention	1.36±0.44		
	Toothbrush	Pre-intervention	2.07±0.68	-1.09 (0.286)	
		Post-intervention	2.24±0.68		
Gingival index	Chewing stick	Pre-intervention	0.31±0.44	1.92 (0.069)	0.166
		Post-intervention	0.16±0.29		
	Toothbrush	Pre-intervention	0.32±0.59	0.05 (0.956)	
		Post-intervention	0.31±0.35		

$\Delta P$  - Difference in mean plaque scores of chewing stick and toothbrush users,  $\Delta G$  - Difference in mean gingival scores of chewing stick and toothbrush users



Also in a recent Indian study the Neem tree sticks were found to be similarly effective in removing plaque as modern toothbrushes.<sup>[23]</sup>

Negligible trials have been conducted so far those can be used to compare the results. However, a few available evidences have reported the effectiveness of chewing sticks against modern toothbrushes.<sup>[23-27]</sup> None of these studies have followed the Consolidated Standards of Reporting Trials guidelines (CONSORT), whereas the current trial was based on these international guidelines and hence maintain to prove a more reliable slant.

According to the results of this trial, it is interpreted that the testing null hypothesis has partially been accepted, as no difference in gingival scores was observed for different sites of the examined teeth among chewing stick and toothbrush users and therefore chewing stick was found to be equally effective as toothbrush in terms of gingival status. On the other hand, chewing stick had shown even better results in terms of reduction in plaque scores than in subjects using toothbrush. It may further emphasized that the results of this trial are in close proximity with the results of a previously reported literature by Bhambal *et al.*<sup>[23]</sup>, who also reported no significant difference in plaque and gingival scores between the miswak and toothbrush users. The increase in plaque scores of subjects using toothbrush has not been observed in any of the previous studies<sup>[23-26]</sup>, only a single study has reported the superior cleaning action of chewing stick in comparison to nylon toothbrush that too only for interproximal surfaces.<sup>[25]</sup> As far as the antimicrobial actions of chewing stick is concerned, literature has shown that the risk of dental caries identified was 9.35 times more in subjects using toothbrush than those using chewing sticks.<sup>[28]</sup> Also lower occurrence of dental caries due to less plaque deposits has been observed in populations using the Neem and Arak miswak sticks.<sup>[29]</sup> The current trial did not take dental caries into consideration, therefore, cannot suggest any effective equivalency of toothbrush and the chewing stick pertinent to dental caries. However, the superior chemical and antimicrobial effect according to the previous literature and the anti-periopathic result of this trial has made chewing stick no less than today's nylon toothbrushes.

## Conclusion

Chewing sticks (miswak) has revealed parallel and at times greater mechanical and chemical cleansing of oral tissues as compared to a toothbrush. The anti-plaque efficacy of chewing stick was significantly demonstrated in this study. This indicates that it may effectively and

exclusively replace the toothbrush. Therefore, it is suggested that advocacy may be planned to amplify the use of chewing sticks on the evidence of the current trial especially in the developing countries with financial limitations and restricted oral health care services for general population.

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## References

1. Wu CD, Darout IA, Skaug N. Chewing sticks: Timeless natural tooth brushes for oral cleansing. *J Periodontol Res* 2001;36:275-84.
2. Davidson N, Skull S, Calache H, Chesters D, Chalmers J. Equitable access to dental care for an at-risk group: A review of services for Australian refugees. *Aust N Z J Public Health* 2007;31:73-80.
3. Hyson JM Jr. History of the toothbrush. *J Hist Dent* 2003;51:73-80.
4. Tubaihat RS, Darby ML, Bauman DB, Box CE. Use of miswak versus toothbrushes: Oral health beliefs and behaviors among a sample of Jordanian adults. *Int J Dent Hyg* 2005;3:126-36.
5. Halawany HS. A review on miswak (*Salvadora Persica*) and its effect on various aspects of oral health. *Saudi Dent J* 2012;24:63-9.
6. Dahiya PD, Kamal RK, Luthra RP, Mishra RM, Saini GS. Miswak: A Periodontist Perspective. *J Ayurveda Integr Med* 2012;3:184-7.
7. Halawany HS. A review on miswak (*Salvadora persica*) and its effect on various aspects of oral health. *Oral Health Prev Dent* 2003;1:301.
8. Singh A, Purohit B. Tooth brushing, oil pulling and tissue regeneration: A review of holistic approaches to oral health. *J Ayurveda Integr Med* 2011;2:64-8.
9. Hooda A, Rathee M, Singh J. Chewing sticks in the era of toothbrush: A review. *Internet J Fam Pract* 2011;9.
10. Ababneh H. The effect of the extract of the miswak (chewing sticks) used in Jordan and the Middle East on oral bacteria. *Int Dent J* 1995;45:218-22.
11. Khalessi AM, Pack AR, Thomson WM, Tompkins GR. Extracts of *Salvadora persica*. *Int Dent J* 2004;54:279-83.
12. Asadi SG, Asadi ZG. Chewing sticks and the oral hygiene habits of the adult Pakistani population. *Int Dent J* 1997;47:275-8.
13. Mumghamba EG, Manji KP, Michael J. Oral hygiene practices, periodontal conditions, dentition status and self-reported bad mouth breath among young mothers, Tanzania. *Int J Dent Hyg* 2006;4:166-73.
14. Guile EE, Al-Shammery AR, El-Backly MN. Oral health survey of Saudi Arabia: Oral health knowledge attitudes and practice among adults. *J Dent Res* 1996;75.
15. Akhtar MS, Ajmal M. Significance of chewing sticks (Miswak) in oral hygiene from a pharmacological viewpoint. *J Pak Med Assoc* 2000;4:84-95.

16. Schulz KF, Altman DG, Moher D. CONSORT 2010. BMC Med 2010;8:18.
17. Ethical Principles for Medical Research Involving Human Subjects. World Medical Association Declaration of Helsinki, 2008 (Assessed January 5, 2013, at <http://www.wma.net/en/30publications/10policies/b3>).
18. Acceptance Program Guidelines Toothbrushes, American dental association, council on scientific affairs, 2009; 9-10.
19. Ganss C, Schlueter N, Preiss S, Klimek J. Tooth brushing habits in uninstructed adults-frequency, technique, duration and force. Clin Oral Investig 2009;13:203-8.
20. Quigley GA, Hein JW. Comparative cleansing efficiency of manual and power brushing. J Am Dent Assoc 1962;65:26-9.
21. Silness J, Loe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. Acta Odontol Scand 1964;22:121-35.
22. Theilade E, Wright WH, Borglum JS, Harald L. Experimental gingivitis in man. A Longitudinal Clinical and Bacteriological Investigation. J Periodontal Res 2006;1:1-13.
23. Bhambal AB, Kothari SK, Saxena SS, Jain MJ. Comparative effect of neem stick and toothbrush on plaque removal and gingival health - A clinical trial. J Adv Oral 2011;2:51-6.
24. Ezoddini-Ardakani M, Nouri Shadkam M, Fotouhi H, Bolouri FS. Study of the effects of natural toothbrush (*Salvadora persica*) in prevention of dental caries and plaque index. Health 2012;4:612-8.
25. Patel PV, Shruthi S, Kumar SK. Clinical effect of Miswak as an adjunct to tooth brushing on gingivitis. J Indian Soc Periodontol 2012;16:84-8.
26. Al-Otaibi M, Al-Harthy M, Söder B, Gustafsson A, Angmar-Månsson B. Comparative effect of chewing sticks and tooth brushing on plaque removal and gingival health. Oral Health Prev Dent 2003;1:301-7.
27. Batwa M. The effectiveness of chewing stick miswakon plaque removal. Saudi Dent J 2006;3:125-33.
28. Ezoddini-Ardakani F. Efficacy of Miswak (*Salvadora persica*) in preventing dental caries. Health 2010;2:499-503.
29. Islam B, Khan SN, Khan AU. Dental caries: From infection to prevention. Med Sci Monit 2007;13.

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