



## Comparative study to assess the effect of chewing stick and toothbrush on oral hygiene, gingival health and pocket depth among patients attending dental outpatient clinic in Udaipur, India

\*Agrawal A, Bhatt N, Shivlingesh KK, Singh K, Chaudhary H, Sen roy S

Department of Community Dentistry, Pacific Dental College and Hospital, Debari, Udaipur, Rajasthan, India

\*Correspondence: Agrawal A

Email: dranilagrawal2008@gmail.com

### Abstract

**Objective:** The purposes of this study was to assess and compare the oral hygiene, gingival health and pocket depth among patients using miswak (*Salvadora Persica L*) and toothbrush.

**Method:** A total of 528 subjects participated in this study (63.6% females and 36.4% males), ranging in age from 20 to 45 years (mean =  $35.43 \pm 12.83$ ). After fulfilling the entry criteria participants were classified according to their oral hygiene habits as miswak users (group I), tooth brush and paste users (group II) or both miswak users and tooth brush and paste users (group III). All subjects were assessed using Simplified Oral Hygiene Index (OHI-S), gingival index, pocket depth and gingival recession.

**Result:** There was no statistically significant difference of mean OHI-S scores between miswak ( $1.04 \pm 0.64$ ), toothbrush ( $1.08 \pm 0.71$ ) and combined users ( $1.09 \pm 0.74$ ). On the other hand, all the three groups differ significantly in relation to mean gingival index scores, miswak ( $0.95 \pm 0.63$ ), toothbrush ( $1.20 \pm 0.59$ ) and combined users ( $1.44 \pm 0.71$ ) ( $p=0.000$ ). Also, Group II ( $3.90 \pm 1.88$ ) demonstrated a significantly higher mean pocket depth than Group I ( $3.31 \pm 2.12$ ) ( $p=0.019$ ). However, gingival recession was significantly higher in Group I ( $2.17 \pm 1.64$ ) in comparison to Group II ( $1.37 \pm 1.35$ ) and Group III ( $1.30 \pm 1.58$ ) ( $P=0.000$ ).

**Conclusion:** This study demonstrated that, miswak (*Salvadora Persica L*) users exhibited good oral hygiene and gingival index score but they had higher gingival recession scores which may influence the periodontal health.

**Key words:** Tooth brush; Miswak; Oral hygiene; Gingivitis; Periodontal pocket; gingival recession

### Introduction

Oral hygiene measures have been practiced by different populations and cultures around the world since antiquity. The oral hygiene habits in a certain population depend on various factors, such as cultural background, religious norms, educational levels and socioeconomic status<sup>(1)</sup>. There are different methods available for the maintenance of oral health. These are mainly mechanical and chemical. Toothbrushes and dentifrices are widely used for cleaning the teeth. The traditional toothbrush or chewing stick called "Miswak" has been used since ancient history<sup>(2)</sup>. Chewing sticks were used by the Babylonians some 7000 years ago; they were later used throughout the Greek and Roman empires and have been used by Jews, Egyptians, and Muslims. Today they are used in Africa, Asia, the Eastern Mediterranean region, and South America<sup>(3)</sup>. It has different names in different societies for instance; miswak, siwak or arak is used in the Middle East, miswaki, in Tanzania, datan in India and Pakistan<sup>(4)</sup>. The World Health Organization has recommended and

encouraged the use of these sticks as a tool for oral hygiene in areas where their use is customary<sup>(5)</sup>. The promotion of good oral health by miswak is mainly attributed to mechanical cleansing efficacy, including the mechanical effects of its fibers. Also, the release of beneficial chemicals such as trimethyl-amine, salvadorine, mustard oil, vitamin C, resins, flavodine, saponins, sterol and fluoride might all play an important role<sup>(6)</sup>. Therefore, periodontal treatment need was found to be low in habitual miswak users<sup>(7)</sup>.

Contradictory data have been reported on the oral health of miswak users. Several reports have indicated that chewing sticks are effective in reducing plaque and gingival inflammation if properly used and miswak has been reported to be as effective as tooth brushing<sup>(8-10)</sup>. Moreover, miswak was found to have a clinical implication of enhancing the regenerative opportunity of periodontium and inhibiting root caries formation<sup>(11)</sup>. However, some studies found that there were more plaque formation and gingival bleeding in individuals who used chewing sticks in comparison with toothbrush users<sup>(12-14)</sup>.



The purpose of this study was to assess and compare the oral hygiene, gingival health and pocket depth among patients attending dental outpatient clinic of Udaipur city who used miswak, toothbrush or combined miswak/toothbrush in their daily routine.

### Materials and method

This study was conducted as an observational descriptive cross-sectional study to describe oral hygiene, gingival health and pocket depth among subjects with different oral hygiene habits attending the outpatient department in Pacific Dental College and Hospital, Udaipur, India from February 2009 to May 2009.

#### Study population

All the participants were recruited from Department of Oral Medicine and Radiology of Pacific Dental College and Hospital, Udaipur, India. All subjects were interviewed regarding their oral hygiene habits and use of miswak and conventional toothbrush. The participants were classified according to their oral hygiene habits as miswak users (group I), tooth brush and tooth paste users (group II) or both miswak users and tooth brush and paste users (group III). All the participants who were using miswak (*Salvadora Persica L*) were included in the study.

#### Inclusion criteria:

All participants fulfilled these criteria:

1. Non-smokers and non diabetics
2. No disability or physical handicap
3. No orthodontic treatment
4. No periodontal treatment or preventive dental visits for at least 3 months
5. Willing to participate in the study.

#### Clinical examination

Assessment of oral hygiene, gingival and periodontal conditions were performed using:

1. Simplified Oral Hygiene Index (OHI- S) of Green and Vermillion, 1964<sup>(15)</sup>

Oral hygiene index simplified scores calculus and debris together. Both debris and calculus were scored for each examined tooth. OHI-S was expressed as the sum of the mean debris index (DI-S) and calculus index (CI-S) of the examined teeth.

2. Gingival Index (GI) of Loe and Silness, 1963<sup>(16)</sup>

Clinical registration of gingival index (GI) (Løe and Silness 1963) were made at four sites per tooth (mesial, distal, mid-facial and mid-lingual) using a calibrated periodontal probe with a tip diameter of 0.5 mm (Vivacare TPS probe). Gingival Index for each individual was calculated as the mean score of the examined teeth.

3. Pocket Depth measurement (PD)

Probing Pocket Depth (PD) were also made at mesial, distal, mid-facial and mid-lingual surfaces of the present teeth using the same calibrated periodontal probe. The tip was inserted to the base of the periodontal pocket with a standardized probing force

of about 20g. Pocket depth for each individual equals the mean pocket depths of the examined teeth. Measurements were recorded to the nearest millimeter.

#### 4. Gingival Recession measurement (GR)

Recession of the gingival margin (GR) was measured by Vivacare TPS probe. It was recorded as the mean distance between Cemento Enamel Junction (CEJ) and gingival margin at the mid-facial surfaces of the present teeth. All the teeth were observed for gingival recession. Measurements were also recorded to the nearest millimeter.

#### Ethical issue:

All patients were informed about the purpose of the study and informed consents were obtained. The ethical clearance was obtained from ethical committee of Pacific Dental College and Hospital, Udaipur, India.

#### Validity and Reliability of examiners:

Two examiners carried out oral examination of the participants. The Cohen's Kappa values computed for examiners ranged from 0.86 to 0.89 for intra-examiner reliability and from 0.81 to 0.89 for inter-examiner reliability.

#### Statistical analysis:

Data were collected, presented and statistically analyzed using SPSS package system V115. Mean, standard deviation, ANOVA test and Scheffe test were applied according to need. The level of significance used was 5% level.

### Result

A total of 528 subjects (63.6% females and 36.4% males), ranging in age from 20 to 45 years (mean =  $35.43 \pm 12.83$ ) participated in this study.

One hundred and forty four subjects were miswak (*Salvadora Persica L*) users (48 females and 96 males), 216 subjects were conventional toothbrush and paste users (72 females and 144 males), 168 subjects used both miswak (*Salvadora Persica L*) and tooth brush and paste (72 females and 96 males). Age wise distribution of study population, showed that 122 (23.1%), 230 (43.6%) and 176 (33.3%) of the subjects belong to 20-29 years, 30-39 years and more than or equal to 40 years age groups respectively (**Table 1**). The mean age of miswak (*Salvadora Persica L*) group, toothbrush group, and miswak (*Salvadora Persica L*) /toothbrush group was 33.83 yr, 35.78 yr and 36.36 yr, respectively.

The mean oral hygiene index (OHI-S) for the miswak (*Salvadora Persica L*) users, the tooth brush users and the combined miswak/brush users were 1.04, 1.08 and 1.09 respectively. ANOVA test showed that there was no statistically significant difference between groups regarding oral hygiene ( $F = 0.287, P = 0.751$ ) (**Table 2**).

The mean gingival index (GI) for groups I, II and III were 0.95, 1.20 and 1.44 respectively. There was a statistically significant difference of the mean gingival index among the studied groups as shown by ANOVA test ( $P = 0.000$ ). The difference of the mean gingival index was statistically significant between all the groups, miswak users and the conventional brush users



**Table 1. Showing the Socio-demographic characteristics of the study population**

Socio-demographic variables	No	(%)
<b>Gender</b>		
Male	336	63.6
Female	192	36.4
<b>Age</b>		
20-29 years	122	23.1
30-39 years	230	43.6
≥40 years	176	33.3
<b>Type of tooth cleaning method used</b>		
Miswak (Group I)	144	27.2
Toothpaste (Group II)	216	41
Miswak and toothbrush (Group III)	168	31.8
<b>Total</b>	<b>528</b>	<b>100</b>

**Table 2. Mean Oral Hygiene Index Score according to tooth cleaning method**

Study groups	Mean±SD	F	P
Miswak (Group I)	1.04±0.64		
Brush and paste (Group II)	1.08±0.71	0.287	0.751*
Miswak / brush and paste (Group III)	1.09±0.74		

\*not significant at 5% level:

**Table 3. Mean Gingival Index Score according to tooth cleaning method.**

Study groups	Mean±SD	F	P	Scheffe test
Miswak (Group I)	0.95±0.63			Gp I vs Gp II*
Brush and paste (Group II)	1.20±0.59	2243	0.000	GP I vs Gp III*
Miswak / brush and paste (Group III)	1.44±0.71			Gp II vs Gp III*

\*significant at 5% level  
Gp-group

**Table 4. Mean Pocket Depth Value (mm) according to tooth cleaning method**

Study groups	Mean±SD	F	P	Scheffe test
Miswak (Group I)	3.31±2.12			Gp I vs Gp II*
Brush and paste (Group II)	3.90±1.88	4.01	0.019	GP I vs Gp III*
Miswak / brush and paste (Group III)	3.49±2.13			Gp II vs Gp III*

\*significant at 5% level  
Gp-group

**Table 5. Relationship between gingival recession (mm) and tooth cleaning method**

Study groups	Mean±SD	F	P	Scheffe test
Miswak (Group I)	2.17±1.64			Gp I vs Gp II*
Brush and paste (Group II)	1.37±1.35	15.91	0.000	GP I vs Gp III*
Miswak / brush and paste (Group III)	1.30±1.58			Gp II vs Gp III*

\*significant at 5% level  
Gp-group

or between miswak users and combined users and between conventional toothbrush users and combined users as revealed by Scheffe test (Table 3). Regarding pocket depth measurement, the mean pocket depth of groups I, II and III were 3.31 mm, 3.90 mm and 3.49 mm respectively. The difference of the mean pocket depth between the miswak users (group I) and the brush users (group II) was statistically significant as shown by Scheffe test. However the mean pocket depth difference between the miswak users and the combined brush/miswak users or between the tooth brush users and the combined users did not reach the level of significance (P>0.05) (Table 4).

As shown in (Table 5), the mean gingival recession in the miswak users was 2.17mm, 1.37mm in the conventional tooth brush users and 1.30mm in the combined miswak/brush users with a statistically significant difference as revealed by ANOVA test (F= 15.91, P= 0.000). Scheffe test showed that there was a statistically significant difference of the mean gingival recession in between the miswak users and the tooth brush users (P= 0.000), as well as between the miswak users and the combined users (P= 0.000). Meanwhile, no statistically significant difference was detected between the combined users and the brush users.

**Discussion**

The use of chewing sticks is common in Asian countries, especially in the Indian subcontinent and the Middle East region. Furthermore chewing sticks are cheap, readily available in urban and rural areas of these countries. Despite the introduction of modern oral hygienic devices, miswak (*Salvadora Persica L*) have been used as a traditional toothbrush in many developing countries. Their taste is agreeable and not unpleasant and reported to have anti-plaque and many other pharmacological properties<sup>(9,17)</sup>.

The proportion of miswak and tooth brush users in this study is similar to that of other study conducted by Asadi and Asadi, 1997<sup>(1)</sup>. On the other hand prevalence of miswak use detected in this work was less than that reported by Al-Otaibi et al.<sup>(10)</sup>, 2003 who found that 73% of rural population used a toothbrush daily, while the miswak was used daily by 65% in an urban area in Saudi Arabia<sup>(18)</sup>. This might be due to the younger age group of the participants in the present study with less deeply-rooted social and cultural influences emphasizing the importance of miswak use.



The present study revealed that, there was no statistically significant difference in oral hygiene index between miswak users, toothbrush users and the combined users ( $p > 0.05$ ). This demonstrates that miswak users were able to control oral hygiene as effectively as those who used a toothbrush which was in accordance with the results of the previous studies<sup>(8, 9, 19)</sup>. This may be explained by the fact that the miswak, in addition to its mechanical cleansing effect, releases a variety of beneficial chemicals such as fluoride, saponins and sterol which possess antibacterial properties that inhibit plaque formation<sup>(6, 20)</sup>. Additionally, the miswak is generally used for longer periods of time than the toothbrush<sup>(20)</sup>. These combined mechanical and chemical plaque control properties of miswak could compensate for its limited anticalculus effect compared to toothbrush<sup>(21)</sup>. This in turn was reflected in the nearly equal levels of OHI-S measuring both plaque and calculus among either miswak users, conventional brush users or combined miswak and brush users.

The results of the present study demonstrated that there was significant difference between all the groups regarding gingivitis, miswak was more effective in reduction of gingivitis compared to tooth brush alone or combined users ( $p < 0.05$ ). This findings was in a contrast with several previous studies<sup>(8-10)</sup>, in which the difference observed was between miswak users and toothbrush users but no difference was observed between miswak and combined users and between tooth brush users and combined users. This may be explained by the fact that the miswak possesses several properties that inhibit plaque formation. In addition to its mechanical effect, the enzyme inhibitory properties of miswak may play a significant role in deactivating the virulence effects of subgingival species (*E. coli*, *peptostreptococcus*, *lactobacillus*, *bacteroides*) that are associated with periodontal disease<sup>(22)</sup>. Also, miswak possesses an inhibitory action on protease and peptidase enzymes which are produced by periodontopathic bacteria as suggested by Homer et al, 1992<sup>(22)</sup>. In the present study it was found that the combined users possess more gingivitis than the miswak users alone.

Furthermore, Darout et al, 2002<sup>(19)</sup>, identified several anionic components, including thiocyanate from miswak. Thiocyanate has potent promoter effects on the salivary peroxidase antimicrobial system and increase unspecific and specific resistance mechanisms of the tissues against the infection. Moreover, in vitro studies have shown that extracts from miswak inhibited growth of various oral aerobic and anaerobic bacteria and *candida albicans*<sup>(23, 24)</sup>.

On the other hand this study showed that gingival recession significantly increased in miswak users in comparison to toothbrush users or combined users ( $p < 0.05$ ). This was in accordance with Eid et al, 1990 who noticed that the severity of gingival recession was significantly more pronounced in the miswak users than it was in the toothbrush users<sup>(13)</sup>. Also, the results of the present study paralleled that of Norton and Addy<sup>(12)</sup>, and Mumghamba et al<sup>(25)</sup>, who reported that miswak is frequently accompanied by a marked gingival recession.

Gingival recession induced by miswak is partly due to improper technique or due to trauma from hard fibers of miswak on the gingival tissues as proposed by Akhter and Ajmal,<sup>(20)</sup>.

Despite its wide use, few studies have examined its effects on gingival and periodontal health<sup>(8-10)</sup>. Since the findings of this survey is mainly based on cross-sectional study and in a specified population (patients attending dental outpatient clinic), more longitudinal studies are required to find the actual differences between all the three groups.

### Conclusion

This study demonstrated that miswak users exhibited good oral hygiene and less gingival index or periodontal pocket depth scores when compared to tooth brush users, but miswak users exhibited higher values of gingival recession which may influence the periodontal health. So, further research about gingival recession in miswak users is required.

### Recommendation

It is recommended that miswak should be encouraged in developing countries as an oral hygiene tool corresponding with socioeconomic, cultural and religious background. However, to obtain significant oral hygiene gains, proper technique of using miswak should be taught to the habitual miswak users.

### References

1. Asadi SG, Asadi ZG. Chewing sticks and the oral hygiene habit of the adult Pakistani population. *Int Dent J* 1997; 47: 275-278.
2. Almas K. Miswak (chewing stick) and its role in oral health. *Postgrad Dentist Middle East* 1993; 3: 214-218.
3. Lewis WW, Lewis ME. *Medical Botany - Willy Inter Science Publications*; London, 1977.
4. Almas K, AL Lafi TR. The natural toothbrush. *World Health Forum*. 1995; 16: 206-210.
5. World Health Organisation. *Prevention of oral disease*. Geneva: WHO 1987, 60-61.
6. Hardie J, Ahmed K. The miswak as an aid in oral hygiene. *J Phillip Dent Assoc* 1995; 47: 33-38.
7. Al-Khateeb TL, O Mullane DM, Whelton H, Sulaiman MI. Periodontal treatment needs among Saudi Arabian adults and their relationship to the use of the Miswak. *Community Dent Health* 1991; 8: 323-328.
8. Gazi M, Saini T, Ashri N, Lambourne A. Miswak chewing stick versus conventional toothbrush as an oral hygiene aid. *Clin Prev Dent* 1990; 12: 19-23.
9. Darout IA, Albandar JM, Skaug N. Periodontal status of adult Sudanese habitual users of miswak chewing sticks or toothbrushes. *Acta Odontol Scand* 2000; 58: 25-30.
10. Al-Otaibi M, Al-Harthy M, Söder B, Gustafsson A, Angmar-Minsson B. Comparative effect of chewing sticks and toothbrushing on plaque removal and gingival health. *Oral Health Prev Dent* 2003; 1: 301-307.
11. Almas K. Effects of miswak and chlorhexidine gluconate on human dentin. *J Contemp Dent Practice* 2002; 15: 27-35.





12. Norton MR, Addy M. Chewing sticks versus toothbrushes in West Africa. *Clin Prev Dent* 1989; 11: 11-13.
13. Eid M, Alshammery A, Selim H. The relationship between chewing sticks (Miswak) and periodontal health. II. Relationship to plaque, gingivitis, pocket depth, and attachment loss. *Quintessence Int* 1990; 21: 1019-1022.
14. Mengel R, Eigenbrodt M, Schunemann T, Flores-de-Jacoby L. Periodontal status of a subject sample of Yemen. *J Clin Periodontol* 1996; 23: 437-443.
15. Green JC, Vermillion JR. The simplified oral hygiene index. *J Am Dent Assoc* 1964; 68:13-17.
16. Silness J, Løe H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand* 1964; 22:121-135
17. Lewis ME. Plants and dental health. *J. Prevent Dent* 1990; 6: 75-78
18. Al-Otaibi M, Zimmerman M, Angmar-Månsson B. Prevailing oral hygiene practices among urban Saudi Arabians in relation to age, gender and socioeconomic background. *Acta Odontol Scand* 2003; 61:212-216.
19. Darout IA, Albandar JM, Skaug N, Ali RW. Salivary microbiota levels in relation to periodontal status, experience of caries and miswak use in Sudanese adults. *J Clin Periodontol* 2002; 29: 411-420.
20. Akhtar MS, Ajmal M. Significance of chewing sticks (miswak) in oral hygiene from a pharmacological viewpoint. *J Pak Med Assoc* 1981; 31:89-95
21. Babay N, Almas K. Effect of miswak extract on healthy human dentin: An in vitro study. *Saudi Dent J* 1999; 11: 46-52.
22. Homer KA, Manji F, Beighton D. Inhibition of protease activities of periodontopathic bacteria by extracts of plants used in Kenya as chewing sticks (Miswaki). *Arch Oral Biol* 1990; 35: 421-424.
23. AbdElrahman HF, Skaug N, Francis GW. In vitro antimicrobial effects of crude miswak extracts on oral pathogens. *Saudi Dent J* 2002; 14: 26-32
24. Al-Bagieh NH, Idowu A, Salako NO. Effects of aqueous extract of miswak on the in vitro growth of *Candida albicans*. *Microbios* 1994; 80: 107-113.
25. Mumghamba EGS, Markkanen HA, Honkala E: Risk factors for periodontal diseases in Ilala, Tanzania. *J Clin Periodontol* 1995; 22: 347-354.