RESEARCH ARTICLE

Comparative study to assess the effect of chewing stick and toothbrush on oral hygiene and periodontal status among Indian population
Raghavendra M. Shetty; Sunaina Shetty; Sachin B. M; Ramesh Amirisetty; Abhishek Agrawal

Abstract
Aim: The purpose of this study was to assess and compare the oral hygiene, gingival and periodontal conditions among a group of Indian population who used miswak, toothbrush or combined miswak/toothbrush for their routine daily oral hygiene. Materials and Methods: 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 ± SD = 35.43 ± 12.83). All subjects were interviewed regarding their oral hygiene habits and use of miswak and conventional toothbrush. After fulfilling the entry criteria participants were classified according to their oral hygiene habits as miswak users (group I), tooth brush users (group II) or both miswak users and tooth brush users (group III). All subjects were assessed using Simplified Oral Hygiene Index (OHI-S), gingival index, pocket depth and gingival recession. Data was analysed using ANOVA test and Scheffe test according to need. The level of significance used was 5% level. Results: It showed that there was no statistically significant difference of OHI-S between groups (P= 0.751). On the other hand, all the three groups differ significantly in relation to mean gingival index (p= 0.000). Also, Group II demonstrated a significantly higher mean pocket depth than Group I (p=0.019). However, gingival recession was significantly higher in Group I in comparison to Group II and Group III (P=0.000). Conclusion: This study demonstrated that, apart from gingival recession that might be encountered in miswak users, the miswak exhibits a significantly higher improvement in gingival and periodontal conditions as compared to toothbrush.

Key Words: Tooth Brush; Oral Hygiene; Gingivitis; Periodontal Pocket; Gingival Recession; Chewing Stick; Oral Hygiene; Periodontal Status.

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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(1). 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(2). 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(3). 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(4). 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(5). 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 trimethyleamine, salvadorine, mustard oil, vitamin c, resins, flavodine, saponins, sterol and fluoride might all play an important role(6). Therefore, periodontal
treatment need was found to be low in habitual miswak users(7).

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(8-10). Moreover, miswak was found to have a clinical implication of enhancing the regenerative opportunity of periodontium and inhibiting root caries formation (11). However, some studies found that there were more plaque formation and gingival bleeding in individuals who used chewing sticks in comparison with toothbrush users(12-14). So, the purpose of study was to assess and compare the oral hygiene, gingival and periodontal conditions among a group of population of Rajnandgaon city who used miswak, toothbrush or combined miswak/toothbrush in their daily routine.

**Materials and methods**
Study design: This study was conducted as an observational descriptive cross-sectional study to describe oral hygiene, gingival and periodontal status among subjects with different oral hygiene habits.

Study population: 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 ± SD = 35.43 ± 12.83) participated in this study. All the participants recruited from department of Oral Medicine and Radiology of Chhattisgarh Dental College and Research Institute, Rajnandgaon city, 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), toothbrush users (group II) or both miswak users and toothbrush users (group III).

Screening criteria into study: All participants fulfilled these criteria:

1. Non-smokers and non diabetics
2. No disability or physical handicapping
3. No orthodontic treatment
4. No periodontal treatment or preventive dental visits for at least 3months
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: Oral hygiene index simplified (15) 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 Löe and Sillness 1963:* Clinical registration of gingival index (GI)(Löe and Sillness1963)(16) 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:* Recession of the gingival margin (GR) was measured by Vivacare TPS probe. It was recorded as the mean distance between CEJ and gingival margin at the mid-facial surfaces of the present teeth. 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 Chhattisgarh Dental College and Research Institute.

Inter-examiner reliability: Inter-examiner reliability of the examiners were attempted by undergoing a period of training together with repeated patients examinations before the start of the study to bring their diagnostic standards as close together as can possibly be managed (Kappa= 0.8).

Statistical analysis: Data were collected, presented and statistically analyzed using S.P.S.S. package system V.11.5 Mean, standard deviation, ANOVA test and Scheffe test were used according to need. The level of significance used was 5% level.

Results

One hundred and forty four subjects were miswak users (48 females and 96 males), 216 subjects were conventional toothbrush users (72 females and 144 males), 120 subjects were using both miswak and tooth brush (72 females and 96 males). The mean age of miswak group, toothbrush group, and miswak/toothbrush group was 33.83yr, 35.78yr and 36.36 yr, respectively.

Mean oral hygiene index (OHI-S) for the miswak users, the tooth brush users and the combined miswak\brush users were 1.04, 1.08 and1.09 respectively. ANOVA test showed that there was no statistically significant difference between groups regarding oral hygiene (F= .287, P= 0.751) (Table 1).

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I Miswak Users</td>
<td>1.04</td>
<td>0.64</td>
<td>0.287</td>
<td>0.751**</td>
</tr>
<tr>
<td>Group II Brush users</td>
<td>1.08</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group III Miswak/brush users</td>
<td>1.09</td>
<td>0.74</td>
<td></td>
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</tbody>
</table>

Table 1: Oral hygiene index among studied groups.
**not significant at 5% level

The mean gingival index (GI) for group I, group II and group III were 0.95, 1.20 and 1.44. 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 or between miswak user and combined users and between conventional toothbrush users and combined users as revealed by Scheffe test (P= 0.001), (P=0.000) and (P=0.002) consequently (Table 2).

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I Miswak Users</td>
<td>0.95</td>
<td>0.63</td>
<td>22.43</td>
<td>0.000</td>
</tr>
<tr>
<td>Group II Brush users</td>
<td>1.20</td>
<td>0.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group III Miswak/brush users</td>
<td>1.44</td>
<td>0.71</td>
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</table>

Table 2: The mean gingival index among study subjects.
*significant at 5% level

Regarding pocket depth measurement, the mean pocket depth of group I, group II and group 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 (P= 0.028). 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 3).
Table 3: Studied groups according to pocket depth.
*significant at 5% level

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
<th>Scheffe test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I Miswak Users</td>
<td>3.31</td>
<td>2.12</td>
<td>4.01</td>
<td>0.019</td>
<td>Gp I vs. Gp II*</td>
</tr>
<tr>
<td>Group II Brush users</td>
<td>3.90</td>
<td>1.88</td>
<td></td>
<td></td>
<td>Gp I vs. Gp III</td>
</tr>
<tr>
<td>Group III Miswak/brush users</td>
<td>3.49</td>
<td>2.13</td>
<td></td>
<td></td>
<td>Gp II vs. Gp III</td>
</tr>
</tbody>
</table>

As shown in table 4, the mean gingival recession of the miswak users was 2.17 mm, 1.37 mm of the conventional brush users and 1.30 mm of 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 between the miswak users and the toothbrush 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 in between the combined users and the brush users.

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
<th>Scheffe test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I Miswak Users</td>
<td>2.17</td>
<td>1.64</td>
<td>15.91</td>
<td>0.000</td>
<td>Gp I vs. Gp II*</td>
</tr>
<tr>
<td>Group II Brush users</td>
<td>1.37</td>
<td>1.35</td>
<td></td>
<td></td>
<td>Gp I vs. Gp III</td>
</tr>
<tr>
<td>Group III Miswak/brush users</td>
<td>1.30</td>
<td>1.58</td>
<td></td>
<td></td>
<td>Gp II vs. Gp III</td>
</tr>
</tbody>
</table>

Table 4: Relationship between gingival recession and oral hygiene habits among study subjects. *significant at 5% level

Discussion

The use of chewing sticks is most 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 the countries. Despite the introduction of modern oral hygienic devices, miswak 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 (9, 17).

In the present study, 59.1% of the subject was classified as miswak users either exclusively or combined, while 40.9% used the toothbrush alone which is similar to other study conducted by Asadi 1997 (1). On the other hand prevalence of miswak use detected in this work was less than that reported by Al-Otaibi et al., 2003 who found that 73% of rural population used a toothbrush daily, while a miswak was used daily by 65% in an urban area in Saudi Arabia (18). This might be due to the younger age group of the participants of 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 (8, 9, 19). This may be explained by the fact that the miswak, in addition to its mechanical cleansing effect, release a variety of beneficial chemicals such as fluoride, saponins and sterol which posses antibacterial properties that inhibit plaque formation (6, 20). Additionally, the miswak is generally used for longer periods of time than the toothbrush (20). These combined mechanical and
chemical plaque control properties of miswak could compensate for its limited anticalculus effect compared to toothbrush(21). 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(8-10) in which the difference obtained was between miswak users and toothbrush users but no difference was obtained 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 that are associated with periodontal disease(22). Also, miswak posses an inhibitory action on protease and peptidase enzymes which are produced by periodontopathic bacteria as suggested by Homer et al, 1992(22). In the present study it was found that the combined users possess more gingivitis than the miswak users alone this may be due to the fact that the mean age of combined users was more than miswak users alone.

Furthermore, Darout et al, 2002(19), identified several anionic components, including thiocyanate from miswak. Thiocyanate has potnet 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 (23, 24).

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(13). Also, the results of the present study paralleled that of Norton and Addy, 1989 and Mumghamba et al, 1995 who reported that miswak is frequently accompanied by a marked gingival recession (12, 25).

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, 1981(20).

Despite its wide use, few studies have examined it effects on gingival and periodontal health(8-10). The purpose of this study was to asses and compare the oral hygiene, gingival and periodontal conditions among Indian population who used regularly miswak in comparison with conventional toothbrush users.

**Conclusion**

Finally, this study demonstrated that, apart from gingival recession that might be encountered in miswak users as a result of improper technique, the miswak exhibit a significantly higher improvement in gingival and periodontal conditions as compared to tooth brush. Provided that miswak is available at low cost, it is strongly recommended that miswak should be encouraged in developing countries as an oral hygiene tool coinciding with socioeconomic, cultural and religious background. However, to obtain a significant oral hygiene gains, proper technique of using miswak should be taught to the habitual miswak users.

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