



Full Length Review Article

ROLE OF PILU (TOOTHBRUSH TREE) IN PERIODONTAL HEALTH

\*,<sup>1</sup>Tripathi, V. D. and <sup>2</sup>Tiwari, R.

<sup>1</sup>MDS, Periodontology, Rama Dental College, Hospital and Research Centre, Kanpur, U.P, India

<sup>2</sup>Major S D Singh Ayurvedic Medical College, Fatehgarh U.P, India

ARTICLE INFO

Article History:

Received 14<sup>th</sup> May, 2015  
Received in revised form  
29<sup>th</sup> June, 2015  
Accepted 01<sup>st</sup> July, 2015  
Published online 31<sup>th</sup> August, 2015

Key words:

Chewing stick,  
Pilu, Oral health,  
Toothbrush,  
Salvadora persica.

ABSTRACT

Meticulous plaque control on a daily routine basis is the single most important step to achieve good oral health. Herbal chewing sticks, commonly known as pilu are among the ancient and traditional oral hygiene aids popular in India, Pakistan, most of the Arabian countries, and several African countries. But nowadays, because of low cost, free availability, unique chemical composition, and spiritual beliefs, Pilu is being used worldwide. A large number of studies have proved that Pilu is as effective as, or even superior to the present day's most common oral hygiene aid, i.e., toothbrush. The aim of this review article is to discuss various pharmacological and therapeutic aspects of Pilu and also to compare the effectiveness of Pilu with modern toothbrushes in terms of oral hygiene practice.

Copyright © 2015 Tripathi and Tiwari. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

An old but time-tested proverb "If the eyes are a window to the soul, then the mouth is the doorway to the body" reflects the importance of oral health. Even the evidences from the early civilizations like the Babylonian, Assyrian, and Sumerian suggest an interest in cleanliness of the mouth. Medical books of ancient India, Susruta Samhita and Charaka Samhita, have also stressed on oral hygiene and brushing teeth with herbal sticks. Teeth-cleaning sticks, commonly known as Pilu or Siwak, are popular oral hygiene aids in India, Pakistan, most of the Arabian countries, and several African countries whereas toothbrushes with nylon bristles are the most common oral hygiene aid in most of the developed countries. Because of free availability, unique chemical composition and religious beliefs, the use of Pilu and other herbal products are increasing at an exponential rate in both developing and developed countries. The World Health Organization (WHO) has also recommended and encouraged the use of miswak as an effective tool for oral hygiene (WHO, 1984). Recently, various authors have concluded that these chewing sticks or their extracts have therapeutic effect on gingival diseases (Wu *et al.*, 2001 and Al-Obaida *et al.*, 2010). Sofrata AH *et al.* Studied the antibacterial effect of Pilu pieces and found it most

effective against *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, and H. influenza whereas less effective against *Streptococcus mutans* and least effective against *Lactobacillus acidophilus*. (Sofrata *et al.*, 2008) A very recent study by Patel PV *et al.* showed significant improvement in plaque score and gingival health when miswak was used as an adjunct to tooth brushing (Patel *et al.*, 2012). It is quite surprising, despite the widespread use of Pilu since ancient times; relatively little scientific attention has been paid to its oral health beneficial effects. So, the aim of this review article is to discuss various pharmacological and therapeutic aspects of Pilu and also to compare the effectiveness of this traditional oral hygiene aid with that of modern toothbrushes.

**Pilu (*Salvadora persica*) -chemical composition and unique properties**

Pilu is basically a pencil-sized stick 15 to 20 cm long with a diameter of 1 to 1.5 cm from Arak (*Salvadora persica*) or the Toothbrush tree. But, in areas where it is not available, sticks from other local shrubs/trees like orange (*Citrus sinensis*), lime (*Citrus aurantifolia*), and neem (*Azadirachta indica*) can also be used as teeth-cleaning aid. The use of Pilu for oral hygiene serves dual function, i.e., mechanical plaque control by friction between plant fibers and tooth surface and chemical plaque control due to its chemical composition. Each of these

components has some specific role in oral health and its unique pharmacological and therapeutic properties can also be explained on the basis of its composition (Al-Sadhan *et al.*, 1999). Silica acts as abrasive material that removes stains and deposits from the tooth surface. Sodium bicarbonate has mild abrasive and germicidal effect. Tannic acid has astringent effect on mucus membrane and found to be good anti-plaque and anti-gingivitis. Resins serve a physical function and form a layer over the enamel which protects it from microbial action. Alkaloids show bactericidal effect and stimulate the gingiva. Essential oils have anti-septic effect and stimulate the flow of saliva. Vitamin C helps in healing and repair. Calcium and fluoride ions promote remineralisation of tooth structure and have mild anti bacterial action.

*Streptococcus mitis* in the miswak than in the toothbrush group (Darout *et al.*, 2002). But, Al-Otaibi M *et al.* observed that the use of miswak, in contrast to toothbrush, significantly reduced the amount of *A. actinomycetemcomitans* in the subgingival plaque, which indicated that extracts from *Salvadora persica* might interfere with the growth and leukotoxicity of *A. actinomycetemcomitans*. The difference in results of these two studies could be explained on the basis of the different study design (Al-Otaibi *et al.*, 2004). Benzyl isothiocyanate, a major component of *Salvadora persica*, exhibited rapid and strong bactericidal effect against oral pathogens involved in periodontal disease as well as against other Gram-negative bacteria, while Gram-positive bacteria mainly displayed

Distribution	This species is globally distributed from Africa to Malaysia. Within India, it is said to be distributed in the drier parts, on saline lands and in coastal regions.
Cultivation	The tree is cultivated in gardens for its large panicles of yellow flower. It is propagated by seed and is quick growing.
Part (S) Used	FRUIT, SEED, LEAF, ROOT
Dose	Seed churna 1 - 3 gm, Kwath 50 - 100 ml
Chemical Constituents	Salvadorine, Tri-methylamine
Ayurvedic Properties	
Guna (Quality)	Laghu, Snigdha, Tikshan
Rasa (Taste)	Tikta, Madhur
Vipak (Metabolism)	Katu
Virya (Potency)	Ushan
Prabhav (Impact)	Virechanopag
Therapeutic Uses	Cough · Micturitive · Anti-pyretic · Abdominal disorders Chronic cold

### Oral microorganisms and Pilu

Dental plaque, which is mainly composed of various aerobic and anaerobic bacteria, is the main etiological agent for initiation and progression of periodontal disease. Certain species, such as *A. actinomycetemcomitans*, *P. gingivalis*, *Prevotella intermedia*, and *Treponema denticola*, are more commonly associated with destructive periodontal disease (Van der Weijden *et al.*, 1994). It has been found that the bacteria cultivated from healthy sites consist predominantly of Gram-positive facultative rods and cocci (approximately 75%). The recovery of this group of microorganisms is decreased proportionally in gingivitis (44%) and periodontitis (10 to 13%). These diseases are accompanied by an increase in the proportion of Gram-negative rods, from 13% in health to 40% in gingivitis and 74% in advanced periodontitis (Slot *et al.*, 1992). Al-Lafi and Ababneh in 1995 reported that the use of pilu inhibits the formation of dental plaque chemically and also exerts antimicrobial effect against many microorganisms (Al-Lafi *et al.*, 1995).

Later on, Almas and Al-Bagieh in their *in vitro* study demonstrated that aqueous extract of pilu has growth-inhibitor effect on several microorganisms (Almas *et al.*, 1999). In 2002, Darout *et al.* used checker board DNA-DNA hybridization and stated that pilu has selective inhibitory effect on salivary bacteria. They found that there were significantly higher levels of *A. actinomycetemcomitans*, *Prevotella melaninogenica*, *Campylobacter rectus*, *Peptostreptococcus micros*, *Veillonella parvula*, *S. mutans*, *Streptococcus anginosus*, *Actinomyces israelii*, *Capnocytophaga sputigena*, and *P. gingivalis*, and significantly lower levels of *P. intermedia*, *Fusobacterium nucleatum*, *C. sputigena*, *Eikenella corrodens*, *L. acidophilus*, *Streptococcus sanguis*, *Streptococcus salivarius*, *Streptococcus oralis*, and

growth inhibition or remained unaffected (Sofrata *et al.*, 2011). Mansour MI *et al.* compared the bactericidal activity of alcoholic and aqueous extract of miswak and found that alcoholic extract was more bactericidal than aqueous extract (Mansour *et al.*, 1996). Almas K *et al.* assessed the anti-microbial activity of eight commercially available mouth rinses (Corsodyl, Alprox, Oral B advantage, Floresept, Sensodyne, Aquafresh mint, Betadine, and Emoform) and 50% miswak extract against several microorganisms. It was observed that mouth rinse containing Chlorhexidine had maximum anti-bacterial activity while Cetylpyridinium chloride mouth rinse was with moderate and Pilu extract was with low anti-bacterial activity (Almas *et al.*, 2005).

### Toothbrushes Vs Pilu (miswak) in oral health

Bristle toothbrush, which is the most common and widely used aid for oral hygiene, was first time patented in America in 1887 and has since then undergone little change. The American Dental Association has described the range of dimensions of acceptable brushes: a brushing surface 1 to 1.25 inches (25.4 to 31.8mm long) and 5/10 to 3/8 inch (7.9 to 9.8 mm) wide, 2 to 4 rows of bristles, and 5 to 12 tufts per row (Accepted Dental Therapeutics, 1969-1970). The diameter of commonly used bristles ranges from 0.0071 inches (0.2 mm) for soft brushes to 0.012 inches (0.3 mm) for medium brushes and 0.014 inches (0.4 mm) for hard brushes (Hink *et al.*, 1956). These tooth brushes are usually used with dentifrices which aid in cleaning and polishing the tooth surfaces. Dentifrices are commonly available in the form of tooth pastes, tooth powders and gels. Dentifrices are made up of polishing/abrasive agents (calcium carbonate, silicon oxides, aluminium oxide etc.), binding/thickening agents (carrageenates, alginates, sodium carboxymethyl cellulose,

colloidal silica etc.), detergents/surfactants (sodium lauryl sulphate), humectants (sorbitol, glycerine, polyethylene glycol etc.), antibacterial agents (triclosan, metallic ions, Zn citrate trihydrate, delmopinol etc.), flavouring agents (peppermint/spearmint oil) and therapeutic agents (as fluoride and pyrophosphates). Most of the studies discussing the efficacy of pilu and modern tooth brush have shown a superior or comparable effect of Pilu over the use of tooth brushes. Danielsen *et al.* compared the efficacy of pilu and use of tooth brush and they found that the use of pilu was associated with a significant reduction of dental plaque and gingivitis along with comparable or superior oral hygiene effect (Danielsen *et al.*, 1989). Gazi *et al.* compared the periodontal status of habitual pilu and toothbrush users and showed that the former had lower gingival bleeding and interproximal bone height than the toothbrush users.

They also suggested that 5 times a day use of pilu might offer a suitable alternate for tooth brushing in reducing plaque and gingivitis (Gazi *et al.*, 1990). However, Eid *et al.* reported that there were no significant differences in gingival or bleeding indices between pilu and modern toothbrush users (Eid *et al.*, 1990). Sote EO also did not find any difference in plaque and gingival bleeding in chewing stick and toothbrush users (Sote, 1987). Darout IA *et al.* conducted a study on 213 males, aged 20 to 65 years, to evaluate the periodontal status of pilu and toothbrush users. They reported that periodontal status of pilu users in Sudanese population is better than that of toothbrush. (Darout *et al.*, 2000). In a single-blind cross-over clinical study, after professional instruction of the proper use of pilu and toothbrush, pilu was found to be more effective than use of tooth brush for reducing plaque and gingivitis in a sample of male Saudi Arabians (Al-Otaibi *et al.*, 2003). Although both pilu and toothbrush serve similar function, they vary in their design. Unlike a conventional toothbrush, the bristles of the pilu lie in the same long axis as its handle. Consequently, the facial surfaces of the teeth can be reached more easily than the lingual surfaces or the interdental spaces. The angulation in the toothbrush enables it to adapt more easily to the distal tooth surfaces, particularly on the posterior teeth (Al-Lafi *et al.*, 1988).

Two basic holds for pilu: pen-grip (three finger grip) and the palm-grip (five finger grip) have been documented in literature. In each case, the aim is to ensure firm but controlled movement of the brush end of the pilu within the oral cavity, so that every area of the mouth is reached with relative ease and convenience. The basic technique employed for removing plaque mechanically are similar to that for toothbrush and the chewing stick, i.e., vertical and horizontal brushing. The cleaning movement should always be directed away from the gingival margin of the teeth (away from the gums) on both the buccal and lingual surfaces (Almas *et al.*, 1995). Pilu chewing sticks have been found to be associated with high level of gingival recession and tooth wear. Eid MA *et al.* reported high level of gingival recession in pilu chewing stick users. These findings could be explained on the basis of high frequency per day (5 times per day) and uninstructed manner of use of pilu (Eid *et al.*, 1991; Eid *et al.*, 1994). However, Johansson *et al.* correlated pilu use with high level of tooth wear (Johansson *et al.*, 1991). But despite these side effects, this traditional oral

hygiene practice is so common in our population that it needs further investigations on modern scientific lines.

## Conclusion

The present review article not only discusses the composition, prophylactic and therapeutic properties of pilu, but also describes the basics of toothbrush and dentifrices. Most of the studies on interaction of pilu with periodontopathogens favored the use of pilu as an oral hygiene aid. The indigenous system of medicine like herbal chewing sticks (pilu) has been popular since ancient times; further long-term clinical trials are needed to evaluate the therapeutic and pharmacological effects of various chemical components of pilu. More and more studies should focus on clinical effectiveness of pilu as compared with the toothbrush on clinical periodontal parameters such as probing depth, gingival bleeding, clinical attachment level, etc. Effect of pilu should be evaluated separately on periodontally healthy and diseased individuals. Efficacy of pilu should not be compared with toothbrush alone but also with various fluoridated and non-fluoridated dentifrices. The results from these studies would definitely open new vista in the field of dentistry in providing a foundation for various preventive oral health programs for rural and urban society of India.

## Footnotes

**Source of Support:** Nil.

**Conflict of Interest:** None declared.

## REFERENCES

- Accepted Dental Therapeutics. 3. Chicago: American Dental Association; 1969-1970.
- Al-Lafi, T., Ababneh, H. 1995. The effect of the extract of the Miswak (chewing sticks) used in Jordan and the Middle East on oral bacteria. *Int Dent J.* 45:218–22. [PubMed]
- Al-Lafi, T. 1988. M Sc. Thesis. University of London; Effectiveness of Miswak as a tool for oral hygiene.
- Almas, K., Al-Bagieh, N.H. 1999. The antimicrobial effects of bark and pulp extracts of miswak, *Salvadora persica*. *Biomedical Letters.* 60:71–5.
- Almas, K., Al-lafi, T. 1995. The natural tooth brush. *World Health Forum.* 16:206–10. [PubMed]
- Almas, K., Skaug, N., Ahmad, I. 2005. An *in vitro* antimicrobial comparison of miswak extract with commercially available non-alcohol mouthrinses. *Int J Dent Hyg.* 3:18–24. [PubMed]
- Al-Obaida, M.I., Al-Essa, M.A., Asiri, A.A., Al-Rahla, A.A. 2010. Effectiveness of a 20% Miswak extract against a mixture of *Candida albicans* and *Enterococcus faecalis*. *Saudi Med J.* 31:640–3. [PubMed]
- Al-Otaibi, M., Al-Harthy, M., Gustafsson, A., Johansson, A., Claesson, R., Angmar-Mansson, B. 2004. Subgingival plaque microbiota in Saudi Arabians after use of miswak chewing stick and toothbrush. *J Clin Periodontol.* 31:1048–53. [PubMed]
- Al-Otaibi, M., Al-Harthy, M., Soder, B., Gustafsson, A., Angmar-Mansson, B. 2003. Comparative effect of chewing

- sticks and tooth brushing on plaque removal and gingival health. *Oral Health Prev Dent.* 1:301–7. [PubMed]
- Al-Sadhan, Almas, K. 1999. Miswak (chewing stick): A cultural and scientific heritage. *Saudi Dent J.* 11:80–7.
- Danielsen, B., Baelum, V., Manji, F., Fejerskov, O. 1986. Chewing sticks, toothpaste, and plaque removal. *Acta Odontol Scand.* 47:121–5. [PubMed]
- Darout, I.A., Albandar, J.M., Skaug, N., Ali, R.W. 2002. Salivary microbiota levels in relation to periodontal status, experience of caries and miswak use in Sudanese adults. *J Clin Periodontol.* 29:411–20. [PubMed]
- Darout, I.A., Albandar, J.M., Skaug, N. 2000. Periodontal status of adult Sudanese habitual users of miswak chewing sticks or toothbrushes. *Acta Odontol Scand.* 58:25–30. [PubMed]
- Eid, M.A., al-Shammery, A.R., Selim, H.A. 1990. The relationship between chewing sticks (Miswak) and periodontal health. 2. Relationship to plaque, gingivitis, pocket depth, and attachment loss. *Quintessence Int.* ;21:1019–22. [PubMed]
- Eid, M.A., Selim, H.A., Al-Shammery, A.R. 1991. The relationship between chewing sticks (Miswak) and periodontal health.III.Relationship to gingival recession. *Quintessence Int.* 22:61–4. [PubMed]
- Eid, M.A., Selim, H.A. 1994. A retrospective study of the relationship between miswak chewing stick and periodontal health. *Egypt Dent J.* 40:589–92. [PubMed]
- Gazi, M., Saini, T., Ashri, N., Lambourne, A. 1990. Meswak chewing stick versus conventional toothbrush as an oral hygiene aid. *Clin Prev Dent.* 12:19–23. [PubMed]
- Hink, M.K. 1956. Toothbrush. *Int Dent J.* 6:15.
- Johansson, A., Fareed, K., Omar, R. 1991. Analysis of possible factors influencing the occurrence of occlusal tooth wear in a young Saudi population. *Acta Odontol Scand.* 49:139–45. [PubMed]
- Mansour, M.I., Al-Khateeb, T.L., Al-Mazraoo, A.A. 1996. The analgesic effect of Miswak. *Saudi Dent J.* 8:87–91.
- Patel, P.V., Shruthi, S., Kumar, S. 2012. Clinical effect of miswak as an adjunct to tooth brushing on gingivitis. *J Indian Soc Periodontol.* 16:84–8. [PMC free article] [PubMed]
- Prevention Methods and Programmes for Oral Health. Report of a WHO Expert Committee Technical Report Series 713. Geneva: WHO; 1984. World Health Organisation. [PubMed]
- Slot, J., Rams, T.E. 1992. Microbiology of Periodontal disease. In: Slot J, Taubman MA, editors. Contemporary Oral Microbiology and Immunology. Mosby: St Louis
- Sofrata, A., Santangelo, E.M., Muhammad, Azeem, M., Karlson, A.K., Gustafsson, A., Putsep, K. 2011. Benzyl isothiocyanate, a major component from the roots of salvadora persica is highly active against gram- negative bacteria. *PLoS One.* 6:e23045. [PMC free article] [PubMed]
- Sofrata, A.H., Claesson, R.L., Lingström, P.K., Gustafsson, A.K. 2008. Strong antibacterial effect of miswak against oral microorganisms associated with periodontitis and caries. *J Periodontol.* 79:1474–9. [PubMed]
- Sote, E.O. 1987. The relative effectiveness of chewing sticks and toothbrush on plaque removal. *Afr Dent J.* 1:48–53. [PubMed]
- Van der Weijden, G.A., Timmerman, M.F., Reijerse, E., Wolffe, G.N., van Winkelhoff, A.J., Van der Velden, U. 1994. The prevalence of *A. actinomycetemcomitans*, *P. gingivalis* and *P. intermedia* in selected subjects with periodontitis. *J Clin Periodontol.* 21:583–8. [PubMed]
- Wu, C.D., Darout, I.A., Skaug, N. 2001. Chewing sticks: Timeless natural toothbrushes for oral cleansing. *J Periodontal Res.* 36:275–84. [PubMed]

\*\*\*\*\*