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Miswak: An Ancient Alternative To Modern Dentifrices

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Abstract:
Miswak (*Salvadora persica*) has been used for centuries as a natural oral hygiene agent. This study highlights the benefits of miswak in promoting oral health and preventing dental problems. Miswak contains various natural chemicals, including silica, calcium, fluoride, and alkaloids, which contribute to its antibacterial, anticariogenic, antiplaque, analgesic, and whitening properties. Studies have shown that miswak is effective in reducing plaque, gingivitis, and caries, and is a viable alternative to modern dentifrices. Additionally, miswak is available in various forms, including toothpaste, mouthwash, chewing gum, and probiotic spray, making it a versatile and accessible oral hygiene agent. The review concludes that miswak is a valuable tool in promoting oral health and preventing dental problems, and its use should be encouraged and further researched.

Keywords: Miswak, oral hygiene, antibacterial, anticariogenic, antiplaque, analgesic, whitening properties, natural dentifrice.

1. Introduction: Maintaining oral hygiene include keeping the tongue, gums, and teeth in good condition. Maintaining proper oral hygiene is essential to avoiding dental issues. Ancient Indian medicinal texts *Sushruta Samhita* and *Charaka Samhita* included instructions on using an herbal stick to wash teeth [1]. Plants have long been used to promote oral hygiene and dental health. The practice of cleaning teeth with a chewing stick has been observed all over the world [2]. Worldwide, over 182 plant species are utilized as chewing sticks. Salvadora Persica is the most used plant for this practice [3]. It is also known as the Miswak tree. *Salvadora persica* (*salvadoraceae)* is also called Arak in Arabic and Peelu in Urdu [4]. The miswak tree originated in many countries, including India, Pakistan, Iraq, Iran, Sri Lanka, Saudi Arabia, Nepal, and Malaysia [5]. Miswak contains more than ten natural chemicals, each of which plays a unique role in tooth protection. The chemical composition of miswak contains silica, calcium, fluoride, trimethylamine, sodium bicarbonate, saponins, flavonoids, resins, alkaloids, volatile oils, sulphur, vitamin C, tannic acid, and sterols. Miswak is a stick around 15-20 cm long with a diameter of 1-1.5 cm [6]. Historically, several portions of this tree were commonly utilized for oral hygiene. In addition, miswak roots have antioxidant, immunostimulant, and antibacterial properties.

1.1 Morphology: Salvadora persica is a huge, well-branched evergreen tree with soft whiteish yellow wood, leaves, greenish yellow flowers, and scarlet fruit when mature. Bark is drab grey or grey-white in hue. The leaves are elliptic ovate or ovate lanceolate. In loose panicles, flowers are pedicellate and greenish white or yellow.
In eastern tropical Africa, miswak tree leaves are consumed as a vegetable and used to make a and salad [7]. *Salvadora persica* contains salvadorine and trimethylamine, which influence cariogenic bacteria such as Streptococcus variants [8]. Several studies have shown that miswak extract is efficient against bacteria that contribute to the development of dental plaque [9]. Miswak has several qualities, including antibacterial, anticariogenic, anti-inflammatory, antimicrobial, analgesic, and antiplaque properties [10]. Salvadora persica roots have antibacterial and antioxidant capabilities, making them suitable food preservatives with no negative effects [11]. Miswak is supplied in a variety of forms, including mouthwash, toothpaste, chewing sticks, dental varnish, probiotic spray, aqueous extract, dental cement, and chewing gum, and is being employed as an endodontic irrigation solution in endodontic therapy [12]. Adult tooth loss is low in countries where miswak is commonly used, and miswak has been shown to help prevent periodontal disease and caries [13]. The World Health Organization recommends and encourages the use of these sticks as an effective oral hygiene tool [14]. Miswak helps to clean the tooth structure and prevent numerous dental disorders such as sensitivity, gingivitis, gum disease, bad breath, enamel erosion, root infection, and so on through the therapeutic effect of its chemical ingredients. It has been demonstrated that using miswak chewing sticks may contribute to a higher level of gingival recession [15]. The most utilized plant for oral hygiene in India is neem, followed by babul, mango, guava, and miswak [16]. Miswak is a great oral hygiene agent that is readily available in this region of the world and affordable, which benefits developing countries with limited financial resources [17]. Miswak can contribute to environmental sustainability by being biodegradable and renewable, reducing plastic waste. Nowadays, several manufacturers use herbal substances in their products to provide extra therapeutic benefits [18]. Miswak chewing sticks are suitable as a dental care instrument due to their mechanical capabilities and chemical properties [19].

2. Pharmacological Action

2.1 Anticariogenic properties: Previous research has shown that miswak has strong anti-caries qualities, with those who use it having less plaque accumulation and caries progression than those who use artificial tooth

brushes. Miswak has been shown to have anti-caries properties due to its fluoride concentration, and the spicy flavour of miswak, combined with its chewing action, increases saliva flow, improving its buffer capacity. Miswak's bioactive component prevents bacterial development and regulates the accumulation of cariogenic (*streptococcus mutant*) bacteria on the surface of teeth [20].

2.2. Analgesic effect: Miswak is a more potent analgesic than artificial toothpaste. Miswak has been shown to alleviate severe pain and relieve oral discomfort mucosa by its hot activation of cutaneous pain receptors. This analgesic effect was also tested on patients with toothaches, who found that using Miswak regularly reduced their pain in comparison to using synthetic toothpaste [21].

2.3. Antiplaque effect: Given that S. persica contains an antibiotic ingredient that inhibits the growth of certain bacteria or germs that cause plaque, miswak is crucial in the prevention of plaque. the accumulation of many microorganisms on enamel, which leads to the production of plaque and various periodontal disorders. The tannins in miswak provide its anti-plaque activity against oral bacteria. Additionally, miswak controls the growth of plaque and inhibits the emergence of periodontal diseases. Miswak use resulted in a noticeably reduced plaque level[22] .

2.4. Whitening Effects: Teeth discoloration usually results from eating foods high in tannins, which allow substances to stick to the teeth and cause discoloration. Abrasive materials, such silica, which is present in miswak, can help reverse discoloration. The mechanical properties of miswak's fibres are assumed to be responsible for its cleansing properties. The miswak bark was peeled off, and the pulp was dried, ground, and made into a powder. This powder was then made into a paste, which was applied to teeth and compared to commercial whitening toothpaste [23].

2.5. Antibacterial Effects: Miswak contains metabolites that keep plaque from sticking to the mouth cavity. *Aggregatibacter Actinomycetemcomitans*, which causes periodontal infections, is more susceptible to the antibacterial activity of miswak extracts [24]. Zones of inhibition were seen on miswak twigs against various bacteria, such as *Aggregatibacter Actinomycetemcomitans*, *Lactobacillus Acidophilus*, and *Haemophilus influenzae* [25]. It has been demonstrated that Miswak's ethanol and aqueous extracts decrease bacteria by 40–45% [26]. Furthermore, it has been shown that those who use miswak powder have significantly fewer germs than those who use modern dentifrices, and that miswak powder has stronger antibacterial qualities when used immediately than an aqueous extract [27]. Miswak contains an alkaloid which has potent bactericidal properties [28].

3. Tooth tablets: A new innovation for dental hygiene

Tooth tablets are small sized chewable tablets that can be chewed to paste and the main concept behind tooth tablet is to reduce plastic waste [29]. The dental tablets are packaged in recyclable materials. While it is less messy than paste, it has the same cleaning benefits as toothpaste. Toothpaste contains preservatives like paraben and sodium benzoate to prevent drying and give it a creamy texture which is not required for tablets. Tablets are dry, so there is little or no preservatives used, making them both safe and environmentally friendly. These tablets are available in two forms: fluoride and non-fluoride. Sometimes toothpaste is pulled out, which does not happen with tablets. They are pre-portioned, so there is no waste because only the appropriate amount is utilized. Toothpaste tubes may be unsanitary since the tube touches everyone's brush without knowing who has a dental problem, and the risk of spreading germs from one to another is considerable[30].

3.1 Future of tooth tablet: The market for tooth tablets is anticipated to increase at a rate of 6.20% from 2021 To 2028, when it is projected to reach the value of USD 48.50 million. The market for the tooth tablets is expanding at an accelerated rate due to raising urbanisation. One of the key reasons propelling the market for tooth tablets is rise in health consciousness throughout the world. Increase demand of tooth tablets due to their portability and convenience, as well as their widespread use because they are one of the most important inventions in oral care and promote the idea of good oral hygiene and market expansion. The market is further impacted by the growing usage of products as zero waste alternatives to traditional paste, travel friendly and environmentally friendly [31].

4. Methodology:

Accessible databases were searched to find the studies about the benefits of miswak in different aspects of oral health. This study is conducted using the combination of miswak and those which represents the oral health. Some selected articles were summarized. From all these studies we can easily understand that how miswak is helpful in the oral health.

Table1. Effect of miswak on oral health

Articles	Research Model	Treatment	Summary	Result	Conclusion
Sofrata et.al 2011[32]	Double-blind, parallel arm, randomized controlled trial of 68 regular dental patient.	1.Brushing with chemically inactive miswak (n=34). 2.Brushing with chemically active miswak (n=34).	After the 3 weeks with assigned treatment changes in plaque index and gingival index is measured.	No significant difference in plaque index between groups and gingival index between groups.	Active and in active miswak have similar efficacy towards plaque and gingival reduction.
Gupta et al, 2012[33]	Triple-blind, parallel arm, randomized controlled trial of 330 health children.	1.Miswak contain toothpaste (n=165). 2.Triclosan polymer and fluoride of 1000 ppm containing toothpaste(n=165).	After 2 weeks and 4 weeks of brushing with assigned treatment changes in plaque index was measured.	Miswak containing toothpaste has significantly greater reduction in plaque index compared to conventional toothbrush.	Miswak has potential to reduce plaque in healthy children.
Malik et.al 2014[34]	Double blind, parallel arm, randomized controlled trial of 50 healthy dental student.	1.Nylon toothbrush with tooth paste(n=25). 2.Miswak chewing stick(n=25).	1 month of brushing with assigned treatment changes in PI and GI was measured.	Miswak significantly reduce PI. Both miswak and toothbrush is reducing GI but the difference is not statically significant.	Miswak reduce plaque better than tooth brush in healthy dental students.
Saha et.al 2012[35]	Prospective cohort observation among 297 individuals in Lucknow.	1.Miswak users (n=125). 2.Toothbrush and toothpaste users (n=93) 3.Miswak tooth brush and toothpaste users (n=79).	Interview was conducted to find out patient's oral habit and following observations were measured. 1)PI 2)GI 3)Oral hygiene index	Mean PI was lower in combined users of miswak and toothpaste and in GI miswak users has significantly lower GI. No statical difference in oral hygiene index.	Miswak users have lower level of plaque and gingivitis compared to toothbrush users.
Azaripour et.al 2017[36]	Double blind, parallel arm, randomized controlled trial of 66 non-smoking patient with gingival inflammation.	1.Miswak extract containing toothpaste (n=22). 2.Paradontax toothpaste (n=22) 3.Colgate toothpaste (n=22)	After 3 weeks of brushing with assigned treatment following changes were measured. 1)Sulcus bleeding index 2)PI	a) Reduction in SBI from highest to lowest were Paradentox, Miswak and Colgate b) PI was similar in all treatment.	Miswak showed a similar advantage as herbal toothpaste paradontax as compared to Colgate and can safely be used for

					gingivitis patients.
Sobouti et.al 2018[37]	Single-blind, parallel arm, randomized controlled trial of 54 patients who had received 4 months of fixed orthodontic treatment.	1.Miswak mouthwash (n = 18) 2.Chlorhexidine mouth-wash (n = 18) 3.Placebo mouthwash (n = 18)	After1 month of using assigned mouthwashes, the following changes were measured a) PI b) GI c) Gingival bleeding index (GBI) d) Pocket probing depth (PPD).	a) PI was significantly reduced with both miswak and chlorhexidine mouth-washes compared to placebo. b) GI was significantly reduced with miswak mouthwash compared to placebo. c)GBI was reduce with miswak and chlorhexidine mouthwash compared to placebo. d)PPD was reduce with chlorhexidine as compared placebo	Miswak can improve the deterioratin g gingival health resulted from orthodontic treatment.

Varma et.al 2018[38]	Singal-blind, crossover arm, randomized controlled trial of 24 healthy individuals.	1.Miswak tooth Paste. 2. tea tree oil toothpaste	After 24 hours use of miswak and tea tree oil toothpaste changes in PI was measured	Use of miswak toothpaste has significantly greater reduction in plaque as compared to tea tree oil.	Miswak was superior than tea tree oil in terms of plaque reduction.
Rezaei et.al 2016[39]	Double-blind, parallel arm, randomized controlled trial of 76 intubated patient in intensive care unit.	1.Herbal mouthwash containing 10 mg/ml 2.Salvadora persica and 2.940 mg/ml Aloe vera (n = 38). 3.0.2% chlorhexidine mouthwash (n = 38)	after 4 days of oral irrigation administered using different mouthwashes every 2–3 h daily, GI was measured	Irrigation with herbal mouthwash resulted in significantly greater GI reduction compared to irrigation with chlorhexidine	Combination of Salvadora persica and Aloe vera mouthwash reduces gingivitis among intubated patients.

Omidkhoda et.al 2015[40]	Closed connector and short connector orthodontic chain.	1.Artificial saliva. 2.0.2% chlorhexidine mouthwash. 3.Miswak mouthwash. 0.05%sodium fluoride mouthwash.	Orthodontic chains underwent 10 thermocycles between 5 and 55^0 C before they were immersed in different mouthwashes for 1 min daily. The chains were stretched on two post and the force of the chains were measured at initial time point, after 24 h, 1 to 4 weeks.	Orthodontic chains, both short connector and closed connector, experienced significantly reduced force-decay when immersed in miswak compared to all other mouthwashes.	Miswak mouthwash prevents force-decay in orthodontic chain.

Baeshen et.al 2017[41]	Single-blind, crossover arm, randomized controlled trial of 15 healthy individuals.	1.0.5% NaF-impregnated miswak. 2.Non-fluoridated miswak. 3.Toothbrush with non-fluoridated toothpaste. 4.Toothbrush with1450ppm fluoride toothpaste.	1 week after the use of all 4 interventions the following changes were measured a) PI b) Salivary fluoride content.	There was no significant difference in PI between miswak and toothbrush, with or without fluoride. Salivary fluoride con-tent was significantly greater with fluoridated miswak compared to the fluoridated toothpaste.	Fluoridated Miswak has greater fluoride release capacity than the fluoridated toothpaste.
Dorri et.al 2012[42]	9 male and 9 female Wistar rats with right mandibular first molar extracted.	1.0.2% chlorhexidine mouthwash (n = 6) 2. 10% miswak mouth-wash (n = 6) 3. Tap water (n = 6)	The test mouthwashes were administered twice daily for 7 days before and after extraction of the first molar. Formation of new bone in the mandibular socket was evaluated.	The mean new bone formation was significantly higher in miswak group compared to chlorhexidine group.	Consistent miswak used demonstrate d potential to enhance new bone formation following teeth extraction.

Kabil.et.al 2018[43]	Double-blind, parallel arm, randomized controlled trial of 60 young permanent molars with deep carious lesion from 35 children aged 6 to 9 years old	1.Glass ionomer cement (GIC) mixed with chlorhexidine gluconate (n=20). 2. GIC mixed with miswak extract (n = 20) 3.GIC mixed with deionized water (n = 20).	After 3,6,9 months following restoration of damaged teeth with ART assigned GIC, the community periodontal index of treatment needs was measured.	Restoration survival, from Highest to lowest were Miswak cement, chlorhexidine cement, and basic cement. Differences were significant at 6 and 9 months.	Miswak incorporation in glass ionomer cement increased the chance of restoration survival after ART.

5. Miswak's different forms available in market:
Because miswak is so effective, there are now over ten different varieties on the market. The most popular ones for maintaining good dental hygiene include miswak toothpaste, miswak chewing gum, miswak mouthwash, and miswak chewing sticks. Miswak is frequently utilized due to its efficacy and ease of availability.

Figure 1 Miswak mouthwash[51]

5.1 Miswak mouthwash and Miswak chewing gum:
Even though mechanical plaque control is the most efficient way to remove plaque, brushing alone is usually not enough to control the plaque because some residue is usually left behind. It has been demonstrated that using mouthwash can effectively reduce plaque. When the effects of mouthwash made with miswak and mouthwash containing chlorhexidine were compared, it was discovered that the mouthwash made with miswak reduced plaque the most. Another strengthened form of miswak is chewing gum. Regarding the decrease of plaque, the miswak chewing gum study did not reveal any noteworthy variations [44]. According to several studies, using Miswak chewing gum dramatically increased the gingivitis reduction whether tooth scaling.

Figure 2 Miswak chewing gum[52]

5.2 Miswak Toothpaste: The growth of germs is effectively inhibited with Miswak toothpaste. For analysis, a clinical trial with forty students was carried out. Samples were collected three times a week using miswak and regular toothpaste combined with water and regular saline after two weeks of use. Miswak toothpaste thus lowers lactobacilli, but it doesn't show a significant decrease in streptococcus mutations until two weeks of use. Bacteria are not much affected by regular toothpaste. This led us to the conclusion that miswak toothpaste worked better at preventing the formation of cariogenic bacteria than ordinary tooth paste [45].

Figure 3: Miswak toothpaste [49]

5.3 Miswak chewing stick: Since ancient times, chewing sticks have been utilized by numerous tribes worldwide as a method of cleaning their teeth. The plant utilized in dental hygiene is used to make chewing sticks, which are created from the bark and twigs. Many people around the world still follow this method even though they use contemporary toothbrushes. Ancient people also used miswak chewing sticks. The plants that are typically used to make these sticks are chosen very carefully based on their taste, hardness, and foaminess. Miswak has all of these qualities, and it also contains chemical compounds that are important for chewing sticks, such as silica, fluoride, essential oils, volatile oil, and alkaloids, each of which has an impact on oral hygiene like silica which is act as abrasive that removes the stains. Fluoride is an ion which promotes the remineralisation and mild anti-bacterial activity and alkaloids which stimulate gingiva and act as bactericidal [46].

Figure 4 Miswak stick[50]

5.4 Miswak probiotic spray:
Oral hygiene benefits from Miswak probiotic spray as well, and a trial was conducted to determine its efficacy. Eighty patients with chronic gingivitis were randomly assigned to one of four groups: group A received a mixture of miswak and probiotics; group B received a miswak spray bottle; group C received a probiotic spray bottle; and group D received a placebo spray bottle. Each group was instructed to administer 12 puffs of spray twice daily, and after three days, one week, and two weeks, the plaque index, gingival index, and strain index were measured. Thus, group A was more successful in lowering gingivitis and plaque [47].

Figure 5 Miswak spray[53]

Conclusion: In conclusion, miswak (*Salvadora persica*) is a natural, organic, and sustainable ingredient that has been used for centuries in oral hygiene practices. Its antimicrobial, anti-inflammatory, and antioxidant properties make it an effective ingredient in dentifrices, offering numerous benefits for oral health including: Reducing plaque, gingivitis, and bad breath, whitening teeth, freshening breath, promoting gingival health, Providing a natural alternative to fluoride-based products. The use of miswak in dentifrices offers a unique combination of traditional wisdom and modern oral care benefits, making it an attractive option for consumers seeking natural

and effective oral hygiene solutions. As the demand for eco-friendly and sustainable products continues to grow, miswak is poised to play a significant role in the development of innovative and effective oral care products.

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51. https://images.app.goo.gl/oCmHuhc3F8vMi3Nv9
52. https://images.app.goo.gl/9wtuHwLmNVvpHf6VA