

**MISWAK: AN ALTERNATIVE APPROACH TO TRADITIONAL  
ORAL HYGIENE CARE**

An Undergraduate Research Scholars Thesis

by

MARIA MIRAKHMEDOV, SARAH LAREDO, and ANH VU TRAM NGUYEN

Submitted to the Undergraduate Research Scholars program at  
Texas A&M University  
in partial fulfillment of the requirements for the designation as an

UNDERGRADUATE RESEARCH SCHOLAR

Approved by Research Advisors:

Faizan Kabani, Ph.D.  
Lisa Mallonee, BSDH, MPH, RD, LD  
Maureen Brown, RDH, BSDH

May 2020

Major: Dental Hygiene, B.S.

# TABLE OF CONTENTS

	Page
ABSTRACT.....	1
DEDICATION.....	3
ACKNOWLEDGMENTS .....	4
KEY WORDS.....	5
INTRODUCTION .....	6
SECTION	
I.    AN OVERVIEW OF MISWAK.....	7
Objective 1 .....	7
II.   MISWAK VERSUS TOOTHBRUSHING.....	9
Objective 2 .....	9
III.  ADDITIONAL PROPERTIES OF MISWAK .....	11
Objective 3 .....	11
CONCLUSION.....	15
REFERENCES .....	16

## **ABSTRACT**

Miswak: An Alternative Approach to Traditional Oral Hygiene Care

Maria Mirakhmedov, Sarah Laredo, and Anh Vu Tram Nguyen  
Caruth School of Dental Hygiene  
Texas A&M University

Research Advisor: Faizan Kabani, Ph.D.  
Caruth School of Dental Hygiene  
Texas A&M University

Research Advisor: Lisa Mallonee, BSDH, MPH, RD, LD  
Caruth School of Dental Hygiene  
Texas A&M University

Research Advisor: Maureen Brown, RDH, BSDH  
Caruth School of Dental Hygiene  
Texas A&M University

Dental professionals recommend many methods such as tooth brushing, flossing and mouth rinse in order to maintain healthy teeth and gingival tissue. Patient compliance is crucial in implementing these three steps in an oral care and may be challenging to many patients. A simple regime requires a toothbrush and toothpaste, and still proves to be difficult for patients. Chlorhexidine is prescribed to patients who have abundant amount of biofilm, or even for just chronic gingival inflammation. This rinse carries many side effects and can be avoided by using another method to keep the oral cavity healthy. An alternative such as Miswak, is an effective natural tool, a solution to maintaining oral health and overcome the gold standards drawbacks. Miswak has been used as a toothbrush by the Babylonians since 7000 BC. Studies have extensively shown that Miswak contains several components that benefit the oral health,

including analgesic, antiplaque, antifungal, anticariogenic, and antimicrobial properties. Studies suggests that the individuals who use Miswak sticks have less biofilm than those patients who use regular toothbrushes. Comparing the efficacy of Miswak to a toothbrush was evaluated and associated with a significant reduction of dental biofilm and gingivitis. Based on the patient's preference, Miswak comes in different forms such as a mouth rinse that carries the effectiveness as if using the chewing stick. Overall, Miswak is an inexpensive oral hygiene regime, and can be a great recommendation for individuals who are eager for a natural and simple approach to incorporate in their oral health care.

## **DEDICATION**

We would like to dedicate the time and effort of this research to our families and beloved ones. As Zora Huston had said “Research is formalized curiosity, it is poking and prying with a purpose.” We have so much curiosity in us and without it, questions would remain unanswered.

## ACKNOWLEDGMENTS

We would like to thank our research course director Dr. Faizan Kabani, and our mentors Mrs. Lisa Mallonee, and Mrs. Maureen Brown, for their guidance and support throughout the course of this research. All the effort and time spent made a difference in the direction that the research has taken. We thank you.

A thank you to our friends, the department faculty and staff for making our time at Texas A&M College of Dentistry a great experience. We also want to extend our gratitude to each of the teams who have made this research a memorable experience.

Finally, we would like to thank our friends and families for the support they provided throughout the research. Maria would like to thank her husband Mirzafar Mirakhmedov for his encouragement, patience, and love. Anh would like to thank herself for loving herself in an unconditional way. Sarah would like to thank her family for being a great support system in the journey of making this research.

## KEY WORDS

CHX	Chlorhexidine
OH	Oral Health
DC	Dental Caries
G	Gingivitis
TB	Toothbrushing

## INTRODUCTION

Maintaining healthy oral hygiene includes brushing and flossing, which is essential for individuals pursuing a healthier lifestyle. There are many oral hygiene products in stores that provide individuals with different needs to perform their daily oral care. An oral hygiene regimen cannot be completed without brushing teeth with a toothbrush in the western culture. Meanwhile, in Arabian and African countries, a chewing stick called Miswak is used for brushing instead.<sup>1</sup> Miswak has been studied extensively due to its beneficial properties to oral health.<sup>2,3</sup> The World Health Organization recommends Miswak as an adjunctive aid for patients who do not have access to oral hygiene products.<sup>2</sup> The purpose of the narrative review is to discuss the properties of Miswak and compare it to the gold standards such as toothbrushing and Chlorhexidine Gluconate. The updated information enables dental professionals in the US to be familiar with individuals who use Miswak as part of their daily routine. Moreover, the exploration of the properties and effectiveness of Miswak to oral health promises an alternative approach to the traditional one. The research on Miswak supports the current National Dental Hygiene Research Agenda priority area of Oral Health Care - Client level promotion where clinicians can promote another effective hygiene product to patients.



## SECTION I

### AN OVERVIEW OF MISWAK

#### Objective 1

The use of Miswak as an oral aid can be traced back to the Babylonians around 7000 BCE and then used by the Roman and Greek empires.<sup>2,3,4</sup> Miswak stems from a plant known as *Salvadora Persica* which is used by the pre-Islamic Arabia to keep their teeth white.<sup>2,4</sup> In different parts of the world, Miswak is also referred to as Sewak, Sewaki, Datun, and Mefaka. The Miswak is used to remove malodor, improve taste, strengthen gingiva and relieve toothaches.<sup>5</sup> The physiological effects that this natural plant has also assists in digestion, and improves eyesight.<sup>5</sup> *S. Persica* contains crystals and acts as an abrasive agent by removing the pigment and dental biofilm on tooth surfaces.<sup>5</sup> A Scanning Electron Microscope and Energy Dispersive X-ray Spectroscopy were used to examine *S. Persica* fibres. Researchers report that the fibres are of a spongy structure embedded with irregular-shaped crystals.<sup>6</sup> The fibres of the Miswak were ground into a fine powder without losing the shape of their crystals. These natural abrasive crystals found in Miswak are the silica and sodium bicarbonate which makes the stick more effective.<sup>3</sup> In 2017, Halib et al. showed the use of *S. Persica* in the form of a toothpaste and the whitening effect that it had on extrinsic tooth staining.<sup>6</sup> They took a sample size of eighteen extracted permanent teeth and exposed each tooth to a tea-infused solution and coffee- infused solution to stain the teeth. Based on the Vitapan shade guide, the concentrated *S. Persica* paste showed improved whitening effects within minutes from two to three shades. While commercial toothpaste reduced by only one shade. As a result of whitening, the commercial toothpaste can cause sensitivity in patients due to the hydrogen peroxide ingredient that the product contains

while *S. Persica* does not cause sensitivity. In religion and culture practices, some individuals choose Miswak as a part of their spiritual routine.<sup>2</sup> Prophet Mohammad (PBUH) used Miswak as well as other items as part of maintaining basic oral hygiene before sleeping, after rising, after entering the house, before and after meals, during fasting, and before recitation of prayers.<sup>2</sup> Although Miswak has been used as an ancient aid for many years, it is still being used today by many people in Africa, Asia, South America, and Central Asia regions.<sup>2</sup> Individuals used Miswak to care for their teeth in a similar manner to a toothbrush.

## SECTION II

### MISWAK VERSUS TOOTHBRUSHING

#### Objective 2

In comparison to the standardized toothbrush, Miswak is a fibrous stick tapered on one end and becomes frayed into a brush-like form.<sup>2</sup> When the brush-like edge of the stick starts to shred after being used several times, the stick becomes ineffective.<sup>2</sup> The end of the stick can be further cut off and chewed to expose a fresh new end.<sup>2</sup> The convenience of using the natural oral aid allows patients to use several times for a series of weeks or until the stick has reached its limit. Furthermore, the bristle-like fibers located on the stick allow patients with embrasures to get access to interproximal areas.<sup>2</sup> In other words, patients with embrasures of type II and III can benefit from Miswak instead of having to use an additional interproximal oral aid such as an end-tufted brush. Miswak stick is more than a toothbrush because it is a root that contains phytochemicals that replenishes the teeth with its natural properties. Miswak has therapeutic chemicals such as Chloride - an antiplaque chemical; vitamin C - a collagen stimulant speeding up the healing process of the gingiva. Benzyl isothiocyanate (BITC) is an important antibacterial component of Miswak.<sup>2</sup> A study by Sofrata et al.(2011) showed that BITC is bactericidal to gram-negative periodontal pathogens such as *Aggregatibacter actinomycetemomitans* (Aa) and *Porphyromonas gingivalis* (P.gingivilis).<sup>2</sup> Wu et al. (2001) found that using a Miswak stick can be more effective than using a standardized toothbrush in terms of dental biofilm reduction.<sup>5</sup> Moreover, Ismail (2016) assessed a single case report on a patient who only utilizes Miswak without using other forms of toothpaste, mouth rinse, and flossing techniques before undergoing orthodontic treatment.<sup>7</sup> The pretreatment plaque score of the individual was 1.0 referencing to a

small quantity of dental biofilm. This study was performed by using the Silness-Loe Plaque Index method. Researchers tracked the patient's oral hygiene for a series of six months by recording the presence of biofilm on each tooth surface. This was done by adding the patient's tooth score and dividing it by the total number of teeth examined to get her biofilm index score. The results showed that the dental biofilm remained unchanged after six months of treatment while using the Miswak. Darout et al. evaluated the periodontal status of Miswak and toothbrush users by using the Community Periodontal Index (CPI) which calculated the scores of supragingival calculus and probing depths of each tooth.<sup>5</sup> It concluded that Miswak is more effective than toothbrushing for reducing plaque and gingivitis when preceded by professional instructions regarding its correct application.<sup>4</sup>

The use of the Miswak stick is performed by grasping the fiber end of the stick and using a pen-like grip to clean each tooth using vertical or rolling motions. The fibers should be held perpendicular to the tooth surface moving in a vertical motion away from the gingival margin on both buccal and lingual margins.<sup>5</sup> Educating patients on the proper angulation and usage of the stick is essential for them to avoid consequences of incorrect use such as attrition and gingival recession.<sup>5</sup> However, patients have to use Miswak more frequently in order to see the result in biofilm and gingivitis reduction. Miswak can be gently brushed in areas such as on or under the tongue, gums, palate, and inside surfaces of the cheek.<sup>4</sup> The amount of times an individual needs to brush in order to achieve the same results as a toothbrush is a limitation of the Miswak. According to Gazi et al. (1990) Miswak showed a greater reduction in biofilm when used five times a day as compared to using the toothbrush twice a day.<sup>2</sup>

## SECTION III

### ADDITIONAL PROPERTIES OF MISWAK

#### Objective 3

In addition to Miswak's effects on periodontal health, the root of Miswak can reduce the formation of dental caries.<sup>4</sup> Miswak has a phytochemical component such as fluoride and tannins that inhibit the growth of cariogenic bacteria. These two properties interfere with the streptococcal attachment on dental biofilm lowering the risk of carious lesions.<sup>3</sup> A pre-clinical study by Almas and Al-Zeid (2004) set the p-value of 0.05 concluding that Miswak had a statistically significant p-value of 0.013, resulting in the antibacterial inhibition of *Streptococcus Mutans*.<sup>8</sup> This study showed the number of caries is clinically significantly lower in Miswak users than toothbrush users. Overall, Miswak is effective in reducing the risk of dental caries.<sup>8</sup> Furthermore, a clinical trial conducted by Sathananthan (1996) and Ezoddini-Ardakani (2010) found that children who used Miswak sticks had fewer carious lesions than those who used toothbrushes and toothpaste and Miswak prevented dental caries in high school students respectively.<sup>4,8</sup> Other studies have added to the understanding of Miswak's anti-caries properties.<sup>3,4,8,9</sup> Chewing the Miswak stick stimulates salivary flow. Saliva plays a vital role in maintaining homeostasis by balancing the pH in the oral cavity.<sup>9</sup> In the clinical assessment by Khalil et al. (2013), Miswak users had a higher salivary sodium, calcium, inorganic phosphate content in the dental biofilm when compared to toothbrush users.<sup>9</sup> The importance of saliva is well known to promote remineralization of the enamel. The increase of phosphate ions stimulated from the Miswak lowers the pH of the intraoral cavity, suggesting that the Miswak has the potential role in caries prevention.<sup>9</sup>

Not only does Miswak have therapeutic effects on periodontal health and caries prevention, it also has antifungal effects that benefit patients who experience oral candidiasis, which commonly occurs in immunocompromised individuals.<sup>2,3</sup> A clinical study by Al-Mohaya et al (2002) involving 58 renal transplant patients (RTPs) and 52 healthy control subjects (HCTs) applied Miswak to their oral hygiene. Both RTPs and HCTs had lower prevalence of oral candidiasis ( $p=0.04$  and  $p=0.02$  respectively) than those who practice traditional oral care such as using a toothbrush.<sup>2</sup> Al-Bayati et al (1994) suggested that the antifungal effect of Miswak is due to its chemical contents: chlorine, trimethylamine, alkaloid resin and sulphur compounds.<sup>2</sup> Moreover, Miswak in the extracted phase still has the same antifungal effect as the Miswak stick. In an in-vitro study by Naeine et al (2014), it was found that the alcoholic extracts of Miswak have strong to moderate effects against *Candida* species including *Candida albicans*.<sup>2</sup>

Miswak mouth rinse can be an alternative for Chlorhexidine. According to the randomized clinical trial by Nishad et al. (2017), the study was performed on 60 individuals and the statistical significance was set to a p-value of 0.05.<sup>10</sup> The results showed that Miswak mouth rinse effectively reduces the number of *Streptococcus Mutan* colonies similar to Chlorhexidine.<sup>10</sup> The p-values of the study were  $p=0.032$  and  $p=0.002$  respectively. Chlorhexidine, like the Miswak, is safe and effective in breaking up existing dental biofilm; however, Chlorhexidine usage comes with unpleasant side effects. The common side effects of 0.12% Chlorhexidine long-term use are extrinsic brown staining of the teeth and tongue and high amount of supragingival calculus.<sup>11</sup> The application of Chlorhexidine has possible mechanisms of non-enzymatic reactions and formation of pigmented metal sulfide that can lead to tooth discoloration.<sup>11</sup> Miswak accomplishes similar antibacterial actions of Chlorhexidine Gluconate without demonstrating the negative side effects that come from using the Miswak rinse.<sup>2,3,11</sup> Salehi et al. examined the

incidence of Miswak and Chlorhexidine Gluconate side effects on sixty fixed orthodontic patients.<sup>11</sup> Moreover, the side effects of Miswak were lower than the Chlorhexidine with 13% of patients experiencing tooth discoloration and 40 % reporting unpleasant taste and burning sensation from the Miswak.<sup>11</sup> As the Miswak pharmacological qualities continue to be studied, new research still needs to be conducted to reflect the most recent effects of Miswak on the oral cavity. Clinicians such as dental hygienists can recommend alternative natural mouth rinses to patients who opt to use OTC medications to maintain their gingival health. Therefore, introducing an herbal-sustaining rinse that is easily accessible can be the adjunctive aid paired with toothbrushing to maintain gingival health. The Miswak mouth rinse can be used for individuals who are more interested in natural antibacterial rinses instead of the Miswak brushing stick.

The chemical components of the Miswak mouth rinse are similar to the compounds found in the root of the Miswak stick. In an in-vitro study by Ismail et al (2002) examined Miswak's root extract to identify the anionic components using capillary electrophoresis techniques. The results showed the presence of polyatomic ions including chloride  $\text{Cl}^-$ , sulfate  $\text{SO}_4^{2-}$ , nitrate  $\text{NO}_3^-$ , thiocyanate  $\text{SCN}^-$  in the aqueous extract of the Miswak root and stem.<sup>12</sup> Both  $\text{SO}_4^{2-}$  and  $\text{SCN}^-$  are effective against bacteria that initiate the formation of oral biofilm and other exogenous accretions from the tooth surface.<sup>2,12</sup> The bioactive compounds in Miswak extract were found to be beneficial to the periodontal patient by interfering with the growth and leukotoxicity of *P. gingivalis* and *A. actinomycetemcomitans*.<sup>1</sup> These bacteria's by-products play a role in the rapid destruction of the tooth-supporting tissues.<sup>1</sup> Miswak has the potential to increase the resistance in the mouth against oral pathogens that contribute to periodontal disease. Given the p-value of less than 0.001, the Miswak mouth rinse was associated with significant reduction of biofilm

accumulation and bacterial colonies.<sup>11,12</sup> Overall, the efficacy of natural Miswak mouth rinse is beneficial, but the clinical results from numerous studies showed Miswak is lower than the gold standard Chlorhexidine Gluconate mouth rinse.<sup>4,11</sup>

Using the current science research of Miswak, dental professionals can be informed with a variety of natural remedies that are based on the patient's preference. In turn, being knowledgeable can build rapport with patients and allow clinicians to provide essential educational preventive services to patients. Miswak stick and mouth rinse products can be applied in practice as a preventive and therapeutic agent that is tolerable to the patient's oral health. In a crossover study, healthy individuals were studied to determine if the effects of the Miswaks had an impact on the oral health of individuals. The results showed clinically that Miswak along with other medicinal plants lower the dental biofilm scores.<sup>4</sup> Aumeeruddy et al. (2018) reported the ethanolic extract of Miswak has the capability to remove the smear layer on the middle thirds of tooth surfaces.<sup>4</sup>



## CONCLUSION

The knowledge of the Miswak combined with that of modern oral hygiene practice gives individuals more options when it comes to caring for their oral homecare. Miswak is a cost-effective, user-friendly, natural oral aid that is available for individuals who prefer a holistic approach. As it is a versatile product, patients can keep their oral hygiene regimen simple, but still effective. In addition to keeping up with yearly dental appointments, Miswak can be a good product that maintains periodontal health and prevents dental caries. Miswak mouth rinse can be used in the long-term management of periodontal diseases because it does not have adverse side effects similar to Chlorhexidine. Also, immunosuppressed patients who are likely to have oral Candidiasis infections can benefit from Miswak mouth rinses. Further studies and experiments on Miswak should be conducted in the United States before considering Miswak as a new national gold standard for oral care. As Miswak has many properties beneficial to oral health, it can be used as a model for future oral hygiene products. Whether patients choose the traditional or alternative oral care, a dental visit at least every six months is strongly recommended. Miswak should be a part of a hygiene program curriculum and CE courses. These courses will provide dental professionals a better understanding to individuals who choose Miswak as an alternative for their oral home care.

## REFERENCES

1. Dahiya P, Kamal R, Luthra RP, Saine G. Miswak: A periodontist's perspective. *J Ayurveda Integr Med.* 2012;3(4):184-187.
2. Mohammad H, Saeed A. A review of the therapeutic effects of using Miswak (*Salvadora Persica*) on oral health. *J Saudi Med.* 2016;36(5):530-543.
3. Niazi F, Naseem M, Khurshid Z, Zafar M S, Almas K. Role of *Salvadora persica* chewing stick (miswak): A natural toothbrush for holistic oral health. *Eur J Dent.* 2016 Apr-Jun;10(2):301-308.
4. Aumeeruddy MZ, Zengin G, Mahomoodally MF. A review of the traditional and modern uses of *Salvadora persica* L. (Miswak): toothbrush tree of Prophet Muhammad. *J Ethnopharmacol.* 2018; 213:409-444.
5. Wu CD, Darout IA, Skaug N. Chewing sticks: Timeless natural toothbrushes for oral cleansing. *J Periodontal Res.* 2001;36(5):275-84.
6. Halib N, Nuairy NB, Ramli H, et al. Preliminary Assessment of *Salvadora persica* Whitening Effects on Extracted Stained Teeth. *J App Pharm Sci.* 2017;7(12):121-125.
7. Ismail AD, Alfred C, Nils S, Per KE. Identification and quantification of some potentially antimicrobial anionic components in Miswak extract. *Indian J Pharm.* 2000;32:11-14.
8. Almas K, Al-Zeid Z. The immediate antimicrobial effect of a toothbrush and miswak on cariogenic bacteria: a clinical study. *J Contemp Dent Pract.* 2004 Feb 15;5(1):105-14.
9. Khalil WA, MY Sukkar, BG Gismalla, Oral health and its relation to salivary electrolytes and pH in miswak and brush users. *Khar Med J:* 2013;6(1):859 - 863.
10. Nishad A et al. Impact of mouthwashes on antibacterial activity of subjects with fixed orthodontic appliances: A randomized clinical trial. *J Contemp Dent Pract.* 2017 Dec 1; 18(12); 1112-1116.

11. Salehi P, Momeni DS. Comparison of the antibacterial effects of Persia mouthwash with Chlorhexidine on streptococcus mutans in orthodontic patients. *DARU*. 2006;14 (4);178-182.
12. Ismail AD, Alfred C, Nils S, Per KE Identification and quantification of some potentially antimicrobial anionic components in Miswak extract. *Indian J Pharm*. 2000; 32:11-14.