LifeLong Learning

CE Course: Miswak: An Alternative Approach to Oral Hygiene Practices

By: Onur Nacakgedigi, DDS

This 2 CEU self-study online course in cross-cultural dental hygiene care will provide evidence-based education and recommendations for the use of the naturally occurring toothbrush "miswak" (Salvadora Persica). The author has no commercial conflict of interest to disclose.

Figure 1: Brushing teeth with miswak

Learning Objectives

After completing this course, the participant should be able to:

1. Understand the magnitude of poor oral health as a global and domestic challenge, especially for poor, racially and ethnically diverse refugees and immigrants
2. Elaborate on the historical evolution of the human oral biome from Neolithic through the Agricultural and Industrial Revolutions to a status of quasi-permanent health challenge
3. Explain the use of the miswak stick as a natural cleaning brush across several continents and cultures
4. Discuss cross-cultural dental hygiene care within the context of the diversity of California's population
5. Identify the health, cost, and cultural benefits of using miswak
6. Explain how to use miswak

Poor Oral Health: A Global Challenge

The "miswak" is a teeth cleaning chewing twig harvested from the *Salvadora Persica* tree (*arak,* jhak, pīlu, Salvadora indica, toothbrush tree, mustard tree).[12] In many rural areas of the Middle East, Central Asia, and Southeast Asia, miswak has been used for centuries and is still widely used because of its' good taste, texture, availability, very low cost, and beneficial effect on teeth and supporting tissues (Figures 1 & 2). Endorsed by several world religions, this chewing stick is commonly used to clean the mouth before prayer.[13-14]

Tooth decay is the most common chronic health problem in the world. Globally, more than 3 billion people have tooth decay and periodontal problems rank 11th in disease prevalence.[1] Poor oral health has a significant impact on the quality of life including eating, speaking, everyday activities, school, or work, while also placing a high economic burden on health systems.[1,2] One in four adult Americans have untreated tooth decay, 20% of children aged 5 to 11 years and 13% of adolescents aged 12 to 19 years have at least one untreated decayed tooth.[3,4] In California, caries causes 2 million people to miss work and school each year and 55% of children aged 6 to 8 eight years have untreated dental caries.[5]

Even though tooth decay is one of the most preventable diseases[6], it disproportionately affects the poor, refugees, and immigrants.[7-11] The prevalence of tooth decay is nearly twice as high for children aged 5 to 19 years from low-income families compared with children from higher income households, and children residing in rural areas have less access to dental care compared to those residing in

urban areas.[4,7,8] Children of refugee families have the highest incidence of oral health problems as they face language, cultural, and financial barriers to accessing and using dental services.[8,10,11] We, as dental practitioners, know good oral health has a major influence on one's general quality of life and well-being and several chronic and systemic diseases have been attributed to poor oral health.

With the increasing incidence of oral diseases, the global need for alternative prevention and treatment methods and safe, effective, and economical products has expanded. From a public health perspective, it is surprising to see a disconnect between poor oral health in refugees, underserved and immigrant families, and a solution that is both inexpensive and readily available as part of the traditional culture of many of these populations - the *"miswak"*, a naturally occurring "toothbrush".

Figure. 2 Man with Miswak

More importantly, the miswak *"tooth cleaning stick"* has been documented as a potent suppressor of oral pathogens such as cariogenic, periodontal and endodontic bacteria.[15] Dental hygienists motivated to address disparities in home care and treatment options in refugee, underserved and immigrant populations, could provide oral health instruction and cross-cultural assessments that include the use of the miswak. Such a holistic approach to oral hygiene would be a modern revival of a wholesome practice that has been with humans since the late Stone Age.

Miswak: A Symbol of the Wisdom of Our Ancestors

Our Stone Age ancestors had healthier teeth than most people do today. The "Agricultural Revolution" that replaced hunting and gathering with farming appears to have initiated a decline in oral health which has continued for 8,000 years. Researchers from the University of Adelaide's Australian Centre for Ancient DNA, and the University of Sydney, conducted a genetic analysis of calcified dental plaque found in 34 prehistoric northern European human skeletons.[16] Dental calculus is ubiquitous in both present-day and ancient human populations, and microscopic analysis has shown that it accurately preserves bacterial morphology over millennia. The study used these calculus DNA samples to analyze how the composition of oral bacteria changed from the Stone Age through the era of the hunter-gathers and into the farming economy of the medieval era. A DNA analysis of a 150 year old sample from the Industrial Revolution, the era that ushered in the double-edged novelty of processed sugar and flour, showed farming populations displayed more periodontal disease than hunter-gatherers. Oral health worsened in the 1850s putting what we know as the 'modern mouth' in a quasi-permanent state of disease.

Figure 3. Salvadora Persica

This study of the oral pathogen genomic evolution shows a dramatic decrease in the microbiota diversity of oral bacteria, a substantial reduction in saprophytes, and a domination by cariogenic strains of bacteria. These results are concerning when we consider the fact that oral bacteria are transferred vertically from the primary caregiver(s) in early childhood and horizontally between family members later in life.[17]

The design of the modern toothbrush may be traced to chewing sticks which were used by Babylonians as early as 3500 BC, and to toothpicks that were chewed on to help clean the teeth and mouth as discussed in ancient Greek and Roman literatures.[19-20] The miswak teeth cleaning twig, prepared from various parts of the *Salvadora Persica* tree, has been in use for over seven thousand years in the Middle East, Asia, Africa, and the Americas.[18]

The miswak can be prepared from 182 species of plants, the most popular being *Salvadora Persica,* belonging to

Continued on Page 18

the family *Salvadoraceae*.[21-22] *Salvadora Persica* has a wide geographic distribution ranging from India, Nepal, Malaysia, Iran, Iraq, Saudi Arabia, Egypt, and to several countries in Africa. The miswak is one of the oldest known oral hygiene tools, and it is still being used by millions of people. Miswak (*miswaak*, *siwak*, *sewak*, Arabic: كاوس) means, in Arabic, 'tooth-cleaning stick' or "stick used on teeth and gums to clean them". Miswak is called 'koyoji' in Japanese, 'qesam' in Hebrew, 'qisa' in Aramaic, and 'mastic' in Latin.

Cultural Competence and Complementary Alternative Medicine

Figure 4. Miswak Holder

Oral health programs should be customized to better meet the needs of a target population by understanding cultural behaviors and characteristics, such as belief systems, religious and cultural values, explanatory models for health and illness, help-seeking behaviors, and everyday life experiences and oral health practices.[23] Consideration of those factors is important for dental professionals when developing appropriate oral health campaigns because cultural characteristics may be directly linked to the acceptance and adoption of health education programs and messages.[24]

The practice of using the miswak as a toothbrush is not only culturally relevant, it is also a legitimate complementary and alternative medicine (CAM) therapy. The National Center for Complementary and Alternative Medicine defines CAM as "the medical and health care practices, systems, and products that are not included yet in the conventional medicine delivery system and are now in the process of being studied under rigorous scientific inquiry."[25] Driven by an ethnically diverse population not only eager to embrace natural remedies for self-care as well as underinsured and underserved individuals, CAM practices are gaining in popularity in the United States. The 2007 National Health Interview Survey Report, conducted by the United States Centers for Disease Control and Prevention and the National Center for Health Statistics, examined 8.5 million Americans and showed that 38.8% of adults (age 18 years and older) and 11.8% of children reported using CAM within 12 months of the survey.[26] The 2015 *Trends in the Use of Complementary Health Approaches Among Adults: United States, 2002–2012*, shows a continued linear increase across three time points in the use of yoga, tai-chi, qigong, and natural health products.[27] A review of global CAM and traditional medicine prevalence conducted by the World Health Organization's (WHO) points out that while only 12% of the population of United Kingdom use CAM, more than 70% of Canadians report using one or more natural health products.[28] In Africa, 80% of Ethiopians use traditional medicine, while 70% of rural populations of Pakistan and Indonesia use CAM and traditional medicine.

With increased globalization, the number of immigrants in the U.S. has increased by 60%, from 20 million in 1990 to over 32 million in 2019. Currently, over 11% of the U.S. population is foreign-born (over 52% of them are from Latin America and over 26% from Asia). Immigrants represent an even greater proportion (20%) of California's population. The growth of the foreign-born population segment is expected to accelerate in the future decade, pressing dental professionals to meet the health needs of an increasingly diverse society. Successfully meeting these challenges will depend on culturally competent dental services able to strengthen doctor-patient communications and to respect patients' health beliefs and socially normed attitudes. For many immigrants from the Middle East, Asia, Africa, and Latin America, the use of the miswak is a common practice. In multicultural California a dentist or a dental hygienist may likely have patients who come from the millenary miswak culture.

While one should keep in mind that each cross-cultural dental hygiene encounter will present individuals with unique values and beliefs, these patients may or may not adhere to their cultural groups' traditional oral health

practices. Therefore, a cultural assessment will be needed to determine whether a patient is using a miswak or whether he/she will be open to using the chewing stick versus a traditional toothbrush. The assessment should integrate culturally competent interviewing styles about health beliefs, practices, and culture that would elicit the patient's genuine perspective. As mentioned in previous articles in the CDHA Journal by author/educator Toni Adams, incorporating a patient's cultural values and beliefs into a dental hygiene assessment and treatment plan is known to correlate directly with satisfaction with dental hygiene care and with a better compliance.[29] Lastly, dental health professionals are expected to be aware of their own cultural identifications in order to control personal biases that interfere with the therapeutic relationship. This involves not only examining one's culture but also examining perceptions and assumptions about the patient's culture. Developing self-awareness can better prevent the dental practitioners unwarranted biases or culturally imposed distortions about "non-American" practices such as the miswak.

Preparation and Usage of *Miswak*

Miswak is harvested from plant parts of the *Salvadora Persica* or *arak* tree. The common method of preparation for chewing sticks includes 15-20 cm long pencil-sized sticks, with diameter ranging from 1 to 1.5 cm, prepared from the root, stem, twigs or bark of the trees. The stick is chewed or trimmed at one end until it becomes frayed into a brush. A pen-like grip can be used to hold the stick in one hand as it becomes a "brush" (Figure 5).

Figure 5. Preparing miswak

Hirschfeld proposed the following procedures: "the miswak should be held between the little finger, the index, middle, and ring fingers and point downward with the thumb extended along the handle toward the bristles (Figure 6). The anterior teeth are to be brushed first, then the labial and lingual surfaces of the posterior teeth, and, lastly, the occlusal surfaces" (Figure 7).[30-31]

The mouth cleaning procedure includes brushing of teeth, gums and tongue. When brushing has been completed, the stick can be left in the mouth for some additional time to stimulate salivation and further release beneficial chemical components. After use of the miswak for several days, the bristles become worn out and should be cut off to expose a fresh end. New bristles will be prepared by chewing or tapering every few days till the miswak stick is depleted.

Figure 6 Holding a miswak

Figure 7 Brushing with miswak

The Benefits of Miswak

Miswak is effective as a toothbrush and a great alternative in the prevention of dental caries because of its unique chemical composition:

- Miswak has fibrils like a toothbrush and is thus an effective mechanical tool for reducing the level of daily plaque accumulation,
- The silica present in miswak acts as a mild abrasive aiding in stain removal,
- The vitamins and minerals found in *Salvadora Persica*, including vitamin C, calcium, and chloride - inhibit

Continued on Page 20

calculus formation, hasten healing and soft tissue repair, and prompt the remineralization of hard dental tissues,

- Several studies have shown that miswak has significant antimicrobial activity against common oral microorganisms associated with periodontitis and caries such as *Streptococcus mutans, Streptococcus sanguinis, Streptococcus salivarius, Streprococus faecalis, Lactobacillus acidophilus, Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Enterococcus faecalis* and *Candida albicans*,[32,33,34]
- Essential oils contained in miswak (e.g. benzyl nitrite, eugenol, thymol, isotheymol, eucalyptol, isoterpinolene, and g-caryophyllene) have antibacterial effects and a bitter taste which stimulates salivary flow,
- The miswak contains nearly 1.0 *lg/g* of total fluoride.[32,33] Other substances include benzyl isothiocyanate (BITC), saponin, salvadorine, chlorides, sulphur, terpenes, glycosides, large amounts of silica, small amounts of tannins, saponins and flavonoid and sterol (Table 1),[32,33,37-38]
- As a chemo-preventive agent, BITC has broad-spectrum bactericidal activity and inhibits the growth and acid production of *Streptococcus mutans*.[24,35]

Effects of miswak on gingival and periodontal health have been reported in many clinical studies and show using a miswak five times a day reduced gingivitis both buccally and lingually. Most studies found that miswak has a comparable or superior effect to tooth brushing for reducing plaque and gingivitis with correct application.[23,35,41,42] Cleaning the tongue helps in fighting halitosis and effectively removing the white coating.[43,44]

The benefits of miswak are not limited to oral health effects; the chewing stick also has important general health benefits such as antiulcerogenic, anti-inflammatory, antihyperglycemic, antihyperlipidemic, antioxidant, analgesic and anticancer effects.[23,24,35,40,45]

Importance of *Salvadora Persica* in Public Health Programs

Cultural competence plays an important role in improving provider-patient communications as well as the oral health literacy of target populations. As such, they require a good understanding of a wide spectrum of sociocultural beliefs, norms, and help-seeking behaviors. Dental professionals serving multi-racial and multiethnic patients should practice cultural proficiency and humility and offer appropriate recommendations that can easily motivate their patients.[46]

Miswak has religious, social and cultural origins. Many refugees and immigrants prefer using miswak as part of their daily oral hygiene method rather than adopting the use of a toothbrush and toothpaste and encourage their children to use miswak prior to migration.[8.10,20] Because of low cost, availability, religious and cultural reasons, the use of the miswak is a traditional oral health practice and is being used as an alternative oral health aid for public health projects.[20] It is very cost-effective (one stick is approximately $0.50 and can be easily found at online markets such as Amazon.com, eBay.com and in local Middle-Eastern markets in the USA). The World Health Organization has recommended, given its' widespread usage, that *Salvadora Persica* be used globally as an oral hygiene tool[23] in preventive dentistry. Dental professionals should explain the proper usage of miswak because optimum results depend on its regular use with effective techniques. Hence, developing training courses to discuss miswak and other traditional oral health aids are very important.

EFFORTS Concept: From Miswak to Teledentistry

EFFORTS, an acronym for Education, Fluoride gel, Fluoride varnish, Oral examination, Restorative Treatment, and Salvadora Persica (SP) is a novel oral health intervention program developed in 2015 by Onur Nacakgedigi, DDS to address vulnerable populations not able to access dental care. EFFORTS encourages people to use the traditional miswak chewing stick because of its benefits, as previously stated.

EFFORTS can:

- raise awareness of importance of oral health among populations with oral health training and oral screening,
- protect against dental caries with fluoride applications and the effects of *Salvadora Persica,*
- treat dental caries (*only small, accessible painless cavities)* with Atraumatic Restorative Treatment
- eliminate dental plague, achieving healthier, gingiva, and curing gingivitis with *Salvadora Persica*.

EFFORTS also utilizes technology such as teledentistry, which is defined as "*the use of electronic information and telecommunications technologies to support long-distance clinical oral health care, patient and professional health-related education, public health, and health administration*".[47] Teledentistry is an effective screening tool and can be used to educate the population about oral disease.

Use of teledentistry, among the targeted vulnerable populations by the EFFORTS program, has the potential to reduce costs and break down barriers to dental care. It offers acceptable reliability for the initial diagnosis of caries[48] and can facilitate remote follow up care. We have developed a novel and low-cost intra-oral digital camera, MoonHealth®, that allows high-quality remote diagnosis and consultations via online platforms. Telecommunication provides a non-intrusive way to keep visual track of a patient's dental status. Remote screening is a cost-effective method that can reduce transportation and treatment costs due to the early detection of dental problems. It also has excellent potential for improving patient satisfaction and engagement by minimizing dental phobia.[47-48]

With MoonHealth®, people can longitudinally monitor their oral health status with dental reports, and receive "real-time" consultations with a dentist if they need further information about treatment and cost estimates. Schools, nursing homes, senior centers, refugee health centers, retail centers, and other community centers could easily obtain an inexpensive MoonHealth Kit, which includes one MoonHealth® intra-oral digital camera with sleeves, and instructions. Any minimally trained person (whether dental professional or not) can use this user-friendly camera to take intra-oral pictures. Dentists or dental hygienists do not need to travel for oral screening; MoonHealth provides online platforms to share those images. By using its mobile applications, people can register and log into

Continued on Page 22

Table: Beneficial role of various chemicals present in miswak (*Salvadora persica*)[12]

Chemical substance	Mode of action	Benefical role
Fluoride	Antimicrobial	Prevent caries
Vitamin C	Healing/repair	Healing of oral tissues
Silica	Abrasive	Removes stains and plaque
Tannic acid	Antifungal	Reduces *Candida albican*
Sulphur	Bactericidal	Reducs bacterial count
Sodium bicarbonate	Abrasive	Used as dentifrice
Calcium	Inhibits demineralization and promotes remineralization	Buffering role in the oral cavity
Alkaloid (salvadorine)	Bactericidal	Stimulatory effect on gingiva
Essential oils	Antiseptic	Disinfects the oral cavity
Benzylisothiocynate	Preventive agent	Prevents against genotoxic and carcinogenic compounds
Resins	Forms a layer on enamel surface	Makes teeth resistant to caries attack
Chloride	Prevents calculus deposition on teeth surfaces; inhibits demineralization and promotes remineralization	Buffering role and maintains favorable pH of the oral cavity

the system and upload all images to their profile, promptly receive comprehensive dental reports, and keep their dental records safely stored in one place. Once reviewed by the dental professional, a dental report will include a dental exam, comments, images of teeth issues with explanations, solutions, education, and suggestions.

We envision use of the miswak as a physically and economically viable option in our outreach to homeless, indigent and other underserved populations as well as migrant populations arriving in the United States.

About the Instructor, Onur Nacakgedigi, DDS

A native of Turkey, Dr. Onur holds a DDS degree from Kirikkale University School of Dental Medicine, Turkey. After studying Atraumatic Restorative Treatment with Professor Fevzi Akinci in 2014 as a Visiting Scholar at King's College in Wilkes-Barre, Pennsylvania, Dr. Onur completed a two-year postdoctoral research training program with Dr. Koga at the Public Health Science Department in the Univeristy of California, Davis School of Medicine. Dr. Onur has been an Assistant Clinical Professor at UC Davis School of Medicine, Public Health Dept since 2017 teaching the course: Globalization and Health: Evidence and Policies. Dr. Onur is Principal Investigator on the *EFFORTS* Project for Syrian refugees at Qushtapa Refugee Camp in Northern Iraq. EFFORTS is a new comprehensive concept in dentistry designed to serve vulnerable populations in undersourced settings using the miswak ancient natural chewing stick. Dr. Onur has recently expanded his *EFFORTS* model to include his Teledentistry approach promoted by his company, *MoonHealth*. He was honored with the 2019 Ulysses Medal for Leadership in Refugee Health Award at UCD.

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2 CE Units (Category I)
CDHA Member $25,
Non-member $35

Home Study Correspondence Course

"Miswak: An Alternative Approach to Oral Hygiene Practices"

Circle the correct answer for questions 1-10

1. The miswak is a naturally occurring toothbrush that has been used for over seven thousand years in the Middle East, Africa, Asia and the Americas.
   a. True
   b. False

2. The miswak is a twig most commonly harvested from the Salvidora Persica or anorak tree and is still used by millions of people.
   a. True
   b. False

3. The design of the modern toothbrush can be traced to chewing sticks and toothpicks which were used by Babylonians as early as 3500 B.C.
   a. True
   b. False

4. The miswak is known to have some antimicrobial properties.
   a. True
   b. False

5. The practice of using a miswak is both culturally relevant and a legitimate complimentary and alternative medicine(CAM).
   a. True
   b. False

6. An advantage of using the miswak is that they do not wear out and do not require any maintenance.
   a. True
   b. False

7. Components of the miswak include:
   a. Essential oils which can benefit oral and general health
   b. Abrasive agents which reduce stain and plaque
   c. Halucinogenic agents
   d. Both a and b

8. In multicultural California a dentist or a dental hygienist may likely have patients who come from the miswak culture.
   a. True
   b. False

9. With correct application and use, studies have shown the miswak to have comparable or superior effects to tooth brushing for reduction of plaque and gingivitis.
   a. True
   b. False

10. Oral health programs should be customized to better meet the needs of a target population by understanding and assessing cultural behaviors, beliefs and practices.
    a. True
    b. False

The following information is needed to process your CE certificate. Please allow 4 - 6 weeks to receive your certificate. Please print clearly:

CDHA Membership ID#: _____ ❑ I am not a member

Name: _____ License #: _____

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Keep a copy of your test for your records.