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Botanicals Promoting Oral and Dental Hygiene: A Review

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ABSTRACT

There is a long history of the use of plants to improve dental health and promote oral hygiene. In various parts of the world where tooth brushing by modern method is uncommon, the practice of tooth cleaning by chewing sticks is very commonly observed. A rise in the use of sugary diet, especially bakery products and carbonated drinks increase prevalence of dental caries. This unhealthy diet pattern is more common in children and adolescents that is why dental caries is considered a disease of childhood. Lack of oral hygiene from early to adult age results in accumulation of plaque and calculus, which is the major etiological factors for gingivitis (Inflammation of gums) and periodontitis (inflammation of supporting tissues of teeth). There is overwhelming evidence that periodontal disease and dental caries affect the majority of the populations, their prevalence and severity vary according to age, sex, race, geographic areas, socioeconomic factors, local and systemic factors and methods of oral cleaning. Undoubtedly, the plant kingdom is the source for almost most of the pharmaceuticals. Natural toothbrush sticks can be used by the vast majority of people who cannot afford to buy the commercial western toothbrush and toothpaste. The toothbrush sticks have proved to be important for the oral and dental hygiene and hence are useful in decreasing dental caries. The present review is an attempt to generate interest among the people regarding the potential of the natural tooth brushing in preventing and treating the common diseases of oral cavity and teeth such as bad odors, tooth decay, plaque etc.

Keywords: Miswak, Neem, oral and dental hygiene, tooth brushing

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INTRODUCTION

Oral diseases are closely linked to life style. Dental health encompasses the likelihood of making healthy choices in relation to diet, smoking, tobacco, oral hygiene and utilization of dental health services. A rise in the use of sugary diet, especially bakery products and carbonated drinks increase prevalence of dental caries. This unhealthy diet pattern is more common in children and adolescents that is why dental caries is considered a disease of childhood. Lack of oral hygiene from early to adult age results in accumulation of plaque and calculus, which is the major etiological factors for gingivitis (inflammation of gums) and periodontitis (inflammation of supporting tissues of teeth). There is overwhelming evidence that periodontal disease and dental caries affect the majority of the populations, their prevalence and severity vary according to age, sex, race, geographic areas, socioeconomic factors, local and systemic factors and methods of oral cleansing. A healthy mouth is a premise of overall health. The oral cavity can be a mirror image of other areas of the body and many systemic illnesses are manifested in the soft tissues of oral mucosa of the mouth. When oral health is compromised, overall health can be affected [1].

There is a long history of the use of plants to improve dental health and promote oral hygiene. In various parts of the world where tooth brushing by modern method is uncommon, the practice of tooth cleaning by chewing sticks is very commonly observed. This practice was recorded by the Babylonians in 5000 BC. This natural tooth brushing is very common today among many African and Southern Asian communities as well as in isolated areas of tropical America and the southern United States. In many African homes teeth are cleaned in the morning by chewing the root or slim stem of certain plants until they acquire brush like ends. The fibrous end is then used to brush the teeth thoroughly [2,3].

Lewis and Elvin-Lewis noted the effect of the Islamic culture in the wide spreading of tooth-brushing by Miswak (*Salvadora persica*) throughout many countries in Asia and Africa. In fact it is so popular that the generic term Miswak is often applied exclusively to this species by some writers. They also noted a quotation attributed to the Prophet Mohammad:" the Siwak (Chewing stick) is an implement for the cleaning of mouth, teeth and pleases God. '' [4].

The above literature proves that plants as intact crude organs and their products (e.g., powdered plants, extracts, etc) have been widely used by different cultures to promote oral hygiene since ancient times. Examples of the most popular plants are *Salvadora persica*, *Azadirachta indica* and *Eugenia caryophyllus.* The present review is an attempt to generate interest among the people regarding the potential of the natural tooth brushing in preventing and treating the common diseases of oral cavity and dentals such as bad odors, tooth decay, plaque etc.

Natural Chewing Sticks

The most popular chewing sticks are those having a good flavor, texture and a recognized effect on the teeth and supporting tissue. Freshly cut specimens are always desirable because they are more easily chewed into a brush. Some of them, however, possess such tough fibers that they penetrate the gums during use thus causing some discomfort [3].

The plants used are very carefully selected for such properties as foaminess, hardness or bitterness and certain species are more popular than others. A great number of these plant species have related medicinal properties that may be antibacterial. Plants have also been incorporated into dentifrices and there are several modern examples of this practice. They were also used to provide natural chewing gums for oral hygiene, to treat toothache, gingivitis and periodontal diseases. Buffered extracts of some common chewing sticks show antimicrobial activity against oral microbial flora but to varying degrees. Some African chewing sticks are also reported to contain fluoride ions, silicon, tannic acid, sodium bicarbonate and other natural plaque inhibiting substances that can reduce bacterial colonization and plaque formation [3].

In recent years, emphasis of research has been on utilizing the traditional medicines that have a long and proven history of treating various ailments. Popular plants which are fascinated into chewing and/or tooth brushing sticks include *Salvadora persica* (Miswak from Arak tree) and Azadirachta *indica* (Neem) and others are described below.

Salvadora Persica (Miswak)

The Miswak (*miswaak*, *siwak*) is a natural toothbrush made from the twigs of the *Salvadora persica* tree (Arak). Miswak was 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 in the Islamic empires. It is believed that this precursor to the modern day toothbrush was used in Europe until about 300 years ago. Today, Miswak is being used in Africa, South America, Asia, the Middle East including Saudi Arabia, and throughout the Islamic countries. It has different names in different societies, for instance, miswaak, siwak, or arak are used in the Middle East; miswak in Tanzania; datun and miswak in India and Pakistan. The toothbrush tree, *Salvadora persica* is a small tree or shrub with a crooked trunk, seldom more than one foot in diameter, bark scabrous and cracked, whitish with pendulous extremities. The root bark of the tree is light brown and the inner surfaces are white, odour is like cress and taste is warm and pungent [5-7]. The use of the chewing stick is deeply rooted in many cultures. In the Middle East, the most common source of chewing sticks is the Arak (Salvadora persica) tree [8]. Chemically, the air dried stem bark of *S. Persica* through chemical studies showed that it is composed of trimethyl amine, salvadorine, chlorides, high amounts of fluoride and silica, sulphur, vitamin C, small amounts of tannins, saponins, flavonoids and sterols [9,10]. Its fibrous branches and roots have been used as toothbrushes by many Islamic communities. The use of Miswak is well spread in the Muslim population of the world and is a common entity in Muslim countries. The reason for common use of Miswak by Muslims can be attributed to religious beliefs. The last messenger of Islam, Prophet Mohammad used it frequently and also instructed his followers to do the same and hence the practice continues widely in Muslim countries. Hadhrat Abu Hurairah narrated that Prophet Mohammad said: '' Was it not for my fear of imposing a difficulty on my followers, I would have ordered that the Miswak be used before every Salaat (prayer).'' There are 70 benefits of Miswak as suggested by Islamic literature and many of these have been scientifically proven and the rest are being studied [11,12].

It has been scientifically proved to be very useful in the prevention of tooth decay even when used without any other tooth cleaning means. The users of Miswak have shown a remarkable lack of tooth decay as compared to other chewing sticks and to those with no tooth cleaning at all [13-15].

Azadirachta indica (Neem)

This tree, in Sanskrit, Nimba and Arishta, is a native of India, and is cultivated in all parts of the subcontinent on account of its medicinal properties. The leaves, bark and other products of Neem have been articles of the Indian materia medica since antiquity and are mentioned in the Ayurveda of Sushruta. This useful tree naturally attracted the attention of the Arabs upon arrival in the subcontinent and the tree was named as Azad-daracht in Hindi from its resemblance to *Melia azedarach* (or the Persian lilac-Bakayan) [5,16,17].

The active principles of the plant were brought to the attention of natural products scientists in 1942 when Salimuzzaman Siddiqui, while working at the Scientific and Industrial Research Laboratory at Delhi University, for the first time extracted three bitter compounds from neem oil, which he provisionally named as nimbin, nimbinin, and nimbidin respectively. Azadirachtin is a chemical compound belonging to the limonoids. It is a secondary metabolite present in the Neem tree seeds. This compound is found in the seeds of the Neem tree (0.2 to 0.8 percent by weight). Many more compounds, related to Azadirachtin, are present in the seeds as well as in the leaves and the bark of the Neem tree which also show strong biological activities [3].

Apart from many other uses of Neem, Neem mouth rinse is very effective in the treatment of infections, tooth decay, bleeding and sore gums. A mouthwash, using Neem oil, has been manufactured and used for the treatment of mouth ulcers [18].

Chewing of Cloves (*Eugenia caryophyllus*)

The clove is native to the North Moluccas, the Spice Islands of Indonesia. It is cultivated in Brazil, the West Indies, Mauritius, Madagascar, India, Sri Lanka, Zanzibar and Pemba. The Chinese wrote about cloves as early as 400 BC. Arab traders delivered cloves to the Romans [3]. Eugenol, a chief constituent of clove, has been used for analgesic, local anesthetic, anti-inflammatory, and antibacterial effects. It is used in the form of a paste or mixture as dental cement, filler, and restorative material [3].

As per the research studies done, clove buds suppressed the oral microorganisms to 70% and it is evident from the fact that many toothpastes contain clove oil as their major constituent. Essential oil of clove, dispersed in concentrated sugar solution had marked germicidal effect against various bacteria [19].

Mixtures of Leaves of Betel (*Piper betel* L.), Cardamom (*Elettaria cardamomum*) and Clove (*Eugenia caryophyllus*)

Role of *P. betel* in oral hygiene was indicated in several ancient texts and has also been shown in some recent studies. A recent investigation was carried out to test whether, owing to their medicinal properties, betel leaves, cardamom and clove, individually or in different combinations were able to inhibit the population of oral microorganisms. In addition, whole preparation of traditional Pan (betel leaf, lime, catechu, gulkand, cardamom and clove) was also tested for its effect against oral microbes. The results showed that all the experimental material was found to be effective against bacterial population of mouth cavity. The saliva obtained after mastication of entire betel leaf reduced the microflora, approximately 56% as compared to control. The chief constituent of the leaves is a volatile oil varying in the leaves from different countries and known as betel oil. It contains two phenols, betel-phenol (chavibetol) and chavicol. Cadinene has also been found. The best oil is a clear yellow colour obtained from the fresh leaves. The phytochemical investigations of betel leaves showed that it had high amount of tannins [19,20].

The cardamom also significantly inhibited the growth of oral microflora and the reduction was up to 77% as compared to control. The antimicrobial activity of cardamom is usually attributed to the volatile oils present in the seeds. Previous studies showed the effect of *Elettaria cardamomum* on oral microbial population in vitro and concluded that it was some constituents in the pericarp that might be largely responsible for antimicrobial activity of cardamom. Similarly, clove buds also suppressed the oral microorganisms to 70% and it is evident from the fact that toothpastes contain clove oil as their major constituent. Essential oil of clove, dispersed in concentrated sugar solution had marked germicidal effect against various bacteria [19].

The essential oils of spices and herbs were found to possess strongest antimicrobial properties. Different combinations were also applied on oral microbes and found to give good results. Both combinations, i.e. betel leaf and cardamom as well as betel leaf and clove buds inhibited the growth of oral microbe population by 65%, but the most marked effect on the oral bacterial population was observed in the saliva obtained after mastication of betel leaf along with cardamom and clove. The combined effect of all the three constituents reduced oral microbe population by 85% as compared to control. At last, the effect of whole traditional Pan comprising of betel leaf, lime, catechu, gulkand, cardamom and clove was also tested on oral microorganisms, reducing the growth to 30%. Based on these results it is concluded that most remarkable effect on oral microbial population is due to synergistic effect of the combination of betel leaf, cardamom and clove. Spices are known to affect biological functions and have been traditionally used for many disorders [19,20].

Other Plant Species Traditionally Used in Oral Hygiene [21]

Some of the popular Species used as natural toothbrush in Southern-Eastern Africa are *Albizia coriaria*, *Acacia nilotica, Balanites aegyptiaca*, *Berchemia discolor*, *Boscia coriacea*, *Cadaba farinose*, *Cordia sinensis, Cupressus lusitanica*, *Dobera glabra, Dodonia angustifolia, Euclea schimperi*, *Olea europea subsp. africana, Rhus abyssinica*, *Rhus natalensis, Rhus retinorrohoae, Rhamnus staddo* , *Sterospermum kunthianum*, *Salix subserrata, Vernonia amygdalina,* etc. In West Africa the lime tree (*citrus aurantafolia*) and the orange tree (*Citrus sinesis*) are used. The roots of Senna (*Cassia vinnea*) were used by black Americans and those of African laburnum (*Cassia sieberianba*) were used in Sierra Leone.

CONCLUSION

In terms of oral health, the major advantages of Miswak over that of western toothbrush are that it is cost effective for users, especially for those in developing countries. This is because firstly, the Miswak can be used for longer time duration - several weeks at a time. It is usually replaced when it gets too dry or rather more likely when lost. Another merit, unlike its common English name toothbrush stick, it is actually combined toothbrush and

tooth paste. This further cuts down the cost, e.g. 75 ml tooth paste costs about US $ 2 in Asmara, several fold of the price of one Miswak (US $ 0.10). Another advantage is the ready availability of Miswak in towns or villages. In addition, as it is dry and small size, it is easily carried around, hence enabling the user to prompt use after every meal.

Undoubtedly, the plant kingdom is the source for almost most of the pharmaceuticals. Natural toothbrush sticks can be used by the vast majority of people who cannot afford to buy the commercial western toothbrush and toothpaste. The toothbrush sticks have proved to be important for the oral and dental hygiene and hence are useful in decreasing dental caries. A large number of studies have been carried out to assess the efficiency and potential use of the natural toothbrush sticks and proved that a Miswak, used five times a day, may offer a suitable alternative to a toothbrush for reducing plaque and gingivitis. The greatest loss of teeth in adults is caused by periodontal disease, which can be very difficult to treat. This suggests a potentially valuable role for phytotherapy in assisting with the management of this difficult and serious disease. Studies indicate that *Salvadora persica* extract is somewhat comparable to other oral disinfectants and anti-plaque agents, and that it contains substances that possess antibacterial properties. Studies have demonstrated the antibacterial, anti-caries, anti-periopathic, and anti-fungal properties of aqueous extracts of various chewing sticks. The relative accessibility and popularity of chewing sticks in the Middle East and Africa as an oral hygiene tool make it a cost effective agent for plaque control in such communities.

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