



# Insight into history of Areca nut and oral submucous fibrosis: a narrative review

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## Abstract

Oral Submucous Fibrosis (OSF) is an age old disease. It is even mentioned by Suśruta, one of the earliest surgeons of the recorded history (600 BCE) in his book in *Suśrutasaṃhitā*. OSF is Areca nut (*Areca Catechu Linn.*) habit associated disease and more prevalent in countries where the use of this nut is high. In Southeast Asian countries it is widely used due to their high cultural beliefs. The pathogenesis of this age old irreversible disease is very complex, that none of the treatment modalities till date has provided satisfactory results. In this article, insight to Areca nut native, cultivation and cultural aspects, the psychology behind its use in various cultures and review of current medical literature is attempted to trace back the history of OSF.

**Keywords** Areca nut · Habit · History · Oral Submucous Fibrosis (OSF)

## 1 Introduction

One of the major aims of medical science is to reduce the cancer burden on society. Though there is significant progress in the fight against cancer, the developing countries face lack of access to information about prevention, early detection, and its treatment due to inadequate medical and public health infrastructure. Oral cancer has become a big burden in developing countries especially in Southeast Asia. The two third of the annual incidence rates (275,000) for oral cancer and oropharyngeal cancers (130,000) occur in developing countries (Warnakulasuriya & Tilakaratna, 2013). Oral Squamous Cell Carcinoma (OSCC) is the most common type of oral cancer which accounts for 90% (Lingen et al., 2008). OSCC occurs in individuals with tobacco and/or areca nut habit and usually arises from pre-existing Oral Potentially Malignant Disorders (OPMDs) like oral Leukoplakia, oral Erythroplakia and Oral Submucous Fibrosis (OSF). Amongst all OPMDs, Oral Submucous Fibrosis is the most disabling disease (Warnakulasuriya & Tilakaratna, 2013). The use of Areca nut with or without combination of

tobacco is a primary etiology for OSF. The longer follow-up study has reported that 7.6% OSF transforms into OSCC (Murti et al., 1985). Though Areca nut consumption is a major public health issue all over the world, the prevalence of its consumption is primarily focused in Southeast Asian countries due to deeply rooted age old traditions and its addictive behavior (Strickland, 2002; Nelson & Heischouer, 1999; Winstock, 2002). Among commonly used psychoactive substances worldwide, Areca nut takes fourth place after tobacco, alcohol and caffeine (Nelson & Heischouer, 1999). In this paper we have tried to uncover the facts about the origin of Areca nut, its components, cultural significance, global scenario, its relation with OSF and steps to be taken to prevent OSF.

## 2 Areca nut (*Areca catechu Linn.*)

*Areca catechu* tree is a tall tropical palm of family *Palmaceae* which can reach up to 30 m tall (Benegal et al., 2008). The endosperm of *Areca catechu* (an orange to yellow color fruit) is Areca nut. Its processing is done either by sun drying the ripped fruit or by boiling the nuts. The processed nut is consumed with or without tobacco in various forms like scented *supārī*, *māvā*, *gutkā*, betal-quid etc. (More et al., 2012). Areca nut contains various alkaloids, flavonoids and trace elements like copper. The alkaloids

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comprise of arecoline, arecaidine, guvacine, guvacoline (Harvey et al., 1986).

### 3 Areca nut native, cultivation and cultural aspects

The native range is unknown in the wild and Areca nut exists only where humans grow it. Though in recent literature the origin of Areca nut has been postulated as Philippines (Strickland, 2002), its origin could be traced to India in Āyurvedic literature like *Purāṇa*, *Lalitāsahasranāma* and *Āyurvedic saṃhitās*. Areca is called *pūga* in Sanskrit (Puga, 2014; Joshi, 1998). The use of *pūga* as an ingredient in *tāmbūla* (*pān*) and its use in some Hindu rituals is a centuries old tradition in India. Today Areca nut is grown in East Africa, Madagascar, Arabian Peninsula, India, Sri Lanka, Bangladesh, Myanmar, Thailand, Cambodia, Laos, Vietnam, southern China, Malaysia, Indonesia and Taiwan (Gupta & Ray, 2004; Gupta & Warnakulasuriya, 2002). In terms of Areca nut production, India and other Southeast Asian countries are leading globally (Gupta et al., 2018). The use of areca nut has continued from ancient times to the present. The historical trends show the regional variation and the use is mostly in religious ritualistic gatherings and even for its medicinal benefits. This is supported by discovery of artifacts throughout many ancient civilizations. Areca nut use can be traced back to 3600 years ago to prehistoric Pacific Ocean people among Lapita culture. In the northern part of the Areca zone, the earliest evidence of Areca use is based on the findings in the Spirit cave in North Western Thailand (Strickland, 2002; Winstock, 2013). Kunya or Areca juice play is an important part of celebration in Myanmar, the Solomon Islands and Vietnam (Strickland, 2002; Benegal et al., 2008). In Indian subcontinent during the Gupta period (320±499 CE), there is persuasive evidence for its presence and use. Mostly in India, the use of Areca nut is usually wrapped in a betel leaf or *pān*. *Pān* culture is apparent in India from prehistoric era but usage of *pān* with Areca nut and slaked lime was popularized during Mughal dynasty (Verma, 2011). Tun-huang manuscripts describe use of Areca nut in China around 750 CE. Later in Southeast Asia and in the Middle East through the major ports of the Coromandel coast, Sri Lanka and the Malabar coast, the Areca nut use can be outlined (Strickland, 2002). In present times, due to immigrants and mixture of cultures there is widespread use of areca nut usage globally (Auluck et al., 2009). There are many customized areca nut preparations like *māvā* and also commercially available products like *gutkā*. Both customized preparations and commercially available products are mixed with tobacco products. *Māvā* is a preparation containing thin shavings of areca nut, tobacco

and slaked lime which makes it even more addictive product (Gupta & Ray, 2004).

### 4 The psychology behind using Areca nut in various cultures

Strickland (2002) in his article “Anthropological perspectives on use of the Areca nut” has specified three main reasons behind the use of Areca nut by humans which includes cultural beliefs, to get medicinal benefits and to achieve desirable effects from the fruit. As a part of cultural practice, sharing Areca nut preparations is thought to facilitate relaxed behavior. In many cultures, sharing pan leaves and Areca nut symbolizes the ethnic identity and also thought to be a good premonition. The method of preparation and sharing varies from culture to culture and even from ritual to ritual. The second reason of Areca nut use is its Āyurvedic medicinal properties. The Āyurvedic literature *Bhāvaprakāśanighaṇṭu* states the medicinal properties of *tāmbūla* (*pān*) (Chunekar, 2009). Areca nut is used as an astringent, dentifrice and aphrodisiac. In Ayurveda, it is believed to mitigate humours *kapha* and *pitta*. It is slightly sweet and creates dryness of oral cavity hence removes moisture and dirt from the mouth and also gets rid of bad taste. It stimulates digestion and used as purgative, anti-helmenthic and also has intoxicant effect (Strickland, 2002; Benegal et al., 2008; Gupta et al., 2018). The third reason of Areca nut use is to achieve desirable effects from the fruit. As it aids in cognitive performance and simulates euphoria by acting as antidepressant, it has been observed that individuals will become addictive and there will be increase in amount and frequency of intake (Benegal et al., 2008). This can be attributed to presence of psychoactive alkaloids like Arecoline. The dependence is seen in Areca nut users with/without addition of tobacco (Lee et al., 2016). The intake of Areca nut is through various preparations like plain Areca nut, betel-quit, lao-hwa-quit, stem-quit, Manipuri, *supārī*, *māvā*, *gutkā* and *pān masālā*. These types of preparations are used in India, Taiwan and other Southeast Asian countries. The use of *gutkā* is even seen among immigrant populations in USA, UK and Canada (Winstock, 2013).

### 5 OSF etiology, clinical features and current medical literature

The etiology of OSF was hypothesized to be multifactorial. Many etiologic factors are suggested like consumption of chillies, nutritional deficiency, genetic susceptibility, Areca nut consumption and immunologic factors. But through various evidences, Areca nut was concluded to be main causative agent for development of OSF (Kerr et al.,



2011). The alkaloids present in Areca nut are responsible for proliferation of fibroblasts and increased collagen synthesis (Harvey et al., 1986). Addition of slaked lime calcium hydroxide to Areca nut causes greater stimulation of fibroblast by facilitating hydrolysis of arecoline and arecaidine (Singh et al., 2017). Increase in the cross linking of collagen fibers is mainly facilitated by flavonoids (Rajalalitha & Vali, 2005). The prevalence of habit is seen mainly in adult population, but the children are now a days getting addicted in to this deadly habit (Gupta et al., 2018). OSF presents with significant clinical signs and symptoms like blanching of oral mucosa with palpable fibrous bands, burning sensation, restricted mouth opening, oral ulcerations and depapillation of tongue. Advanced stages show hearing disabilities and OSF can be associated with other OPMDs like oral leukoplakia (More et al., 2012). The malignant transformation rate is reported as 7.6% in long term follow-up studies (Murti et al., 1985). As it is irreversible disabling disease which leads to nutritional deficiency, the overall quality of life is severely affected (Tadakamadla et al., 2018). Oral Submucous Fibrosis is mentioned as ‘*vidāri*’ in Indian literature in the time of Suśruta (600 BCE) in his *Suśruta Saṃhitā*. In current medical literature, it was first mentioned in 1952 by Schwartz (1952). He reported this disease in Indian women residing in Kenya. The term he coined was ‘idiopathic tropica mucosae oris’. In the very next year Joshi gave the present term ‘Oral Submucous Fibrosis’ (Ali et al., 2014). Paymaster (1956) expressed the malignant potential of this disabling disease. Pindborg and Sirsat studied Oral Submucous Fibrosis cases with about 0.5% incidence of Submucous Fibrosis in 1000 South African Indians, and in the next year he gave the definition of OSF which is followed till date (Pindborg, & Sirsat, 1966). Rao (1962) discounted the importance of chronic irritants as significant etiological factors. Lemmer and Shear (1967) expressed that the addiction of chewing *supārī* could be an etiological agent. Ramanathan (1981) proposed that the prolonged chronic iron and/or vitamin B complex deficiency particularly folic acid possibly change the state of oral mucosa which becomes hypersensitive to oral irritants. The tannins from chewed Areca nuts reduces the susceptibility of collagen to degradation by collagenase (Khan et al., 2012). Pillai et al. (1992) proposed the possibilities of genetic, immunologic, viral, nutritional and autoimmune as possible etiological factors to explain the multifactorial model in the disease process. The term, potentially malignant disorders was presented at a workshop coordinated by the WHO Collaborating Centre for Oral Cancer and Precancer in the UK and OSF was one of the oral potentially malignant disorder (Warnakulasuriya et al., 2007). From 1957 to till date various OSF classifications have been proposed and till date various treatment modalities have been tested to treat this disease (More et al., 2012). Treating this age old irreversible disease is still challenging

because pathogenesis of the disease is so complex, that none of the treatment modalities are providing satisfactory results. Major etiology of OSF is Areca nut, cessation of Areca nut use remains key in the management of this disability (Warnakulasuriya & Kerr, 2016).

## 6 Need for the guidelines/policies

As expressed in the symposium report of ‘Perspectives on Areca nut with some global implications’, legislation is required to regulate and control the use of Areca nut products within countries (Gupta et al., 2018). Policy level restrictions may help to some extent only, it’s something like substance abuse. If we convince the people about its place as an ingredient in *tāmbūla* (pan), then its isolated use could be reduced drastically to save its users from effects of OSF.

## 7 Conclusion

History might reveal that the use of Areca nut has an ethnic identity, but the after effects of this is a health condition known as OSF, which has high mortality and morbidity. The main goal of any government should focus on preventing this condition. Hence, the propaganda on ill effects of Areca nut products should be included as health advisories.

## References

- Ali, F. M., Patil, A., Patil, K., & Prasant, M. C. (2014). Oral Submucous fibrosis and its dermatological relation. *Indian Dermatology Online Journal*, 5(3), 260–265.
- Auluck, A., Hislop, G., Poh, C., Zhang, L., & Rosin, M. P. (2009). Areca nut and betel quid chewing among South Asian immigrants to Western countries and its implications for oral cancer screening. *Rural and Remote Health*, 9(2), 1118.
- Benegal, V., Rajkumar, R. P., & Muralidharan, K. (2008). Does areca nut use lead to dependence? *Drug and Alcohol Dependence*, 97(1–2), 114–121.
- Chunekar, C. (2009). *Bhavaprakasha Nighantu*. Chaukhambha Bharati Academy.
- Gupta, P. C., & Ray, C. S. (2004). Epidemiology of betel quid usage. *Annals of the Academy of Medicine, Singapore*, 33(4), 31–36.
- Gupta, P. C., & Warnakulasuriya, S. (2002). Global epidemiology of areca nut usage. *Addiction Biology*, 7(1), 77–83.
- Gupta, P. C., Ray, C. S., Papke, R. L., Stepanov, I., Khariwala, S. S., Chaturvedi, P., Pednekar, M. S. (2018). Perspectives on areca nut with some global implications: Symposium report. *Translational Research in Oral Oncology*, 3, 2057178X1881406.
- Harvey, W., Scutt, A., Meghji, S., & Canniff, J. P. (1986). Stimulation of human buccal mucosa fibroblasts in vitro by betel-nut alkaloids. *Archives of Oral Biology*, 31(1), 45–49.
- Joshi, L. M. (1998). *Lalitā-sahasranāma: a comprehensive study of one thousand names of Lalitā-Mahā-tripurasundari: with original text in Sanskrit, roman transliteration and critical explanation of each name*. D.K. Printworld.



- Kerr, A. R., Warnakulasuriya, S., Mighell, A. J., Dietrich, T., Nasser, M., Rimal, J., ... Johnson, N. W. (2011). A systematic review of medical interventions for oral submucous fibrosis and future research opportunities: Oral submucous fibrosis, medical management. *Oral Diseases*, 17(1), 42–57.
- Khan, S., Chatra, L., Prashanth, S. K., Veena, K. M., & Rao, P. K. (2012). Pathogenesis of oral submucous fibrosis. *Journal of Cancer Research and Therapeutics*, 8(2), 199–203.
- Lee, C.-Y., Herzog, T. A., Murphy, K. L., & Chang, Y.-Y. (2016). Betel quid dependence scale. In *Neuropathology of drug addictions and substance misuse* (pp. 827–835). Elsevier.
- Lemmer, J., & Shear, M. (1967). Oral submucous fibrosis. A possible case in a person of Caucasian descent. *British Dental Journal*, 122(8), 343–346.
- Lingen, M. W., Kalmár, J. R., Karrison, T., & Speight, P. M. (2008). Critical evaluation of diagnostic aids for the detection of oral cancer. *Oral Oncology*, 44(1), 10–22.
- More, C. B., Das, S., Patel, H., Adalja, C., Kamatchi, V., & Venkatesh, R. (2012). Proposed clinical classification for oral submucous fibrosis. *Oral Oncology*, 48(3), 200–202.
- More, C. B., Gupta, S., Joshi, J., & Verma, N. S. (2012). Classification system for oral submucous fibrosis. *Journal of Indian Academy of Oral Medicine and Radiology*, 24, 24–29.
- Murti, P. R., Bhonsle, R. B., Pindborg, J. J., Daftary, D. K., Gupta, P. C., & Mehta, F. S. (1985). Malignant transformation rate in oral submucous fibrosis over a 17-year period. *Community Dentistry and Oral Epidemiology*, 13(6), 340–341.
- Nelson, B. S., & Heischouer, B. (1999). Betel nut: A common drug used by naturalized citizens from India, Far East Asia, and the South Pacific Islands. *Annals of Emergency Medicine*, 34(2), 238–243.
- Paymaster, J. C. (1956). Cancer of the buccal mucosa; a clinical study of 650 cases in Indian patients. *Cancer*, 9(3), 431–435.
- Pillai, R., Balaram, P., & Reddiar, K. S. (1992). Pathogenesis of oral submucous fibrosis: Relationship to risk factors associated with oral cancer. *Cancer*, 69(8), 2011–2020.
- Pindborg, J. J., & Sirsat, S. M. (1966). Oral submucous fibrosis. *Oral Surgery, Oral Medicine, and Oral Pathology*, 22(6), 764–779.
- Puga, P. 18 Definitions. (2014). *Wisdomlib.Org*. August 3, 2014. <https://www.wisdomlib.org/definition/puga>.
- Rajalalitha, P., & Vali, S. (2005). Molecular pathogenesis of oral submucous fibrosis—a collagen metabolic disorder. *Journal of Oral Pathology & Medicine*, 34(6), 321–328.
- Ramanathan, K. (1981). Oral submucous fibrosis—an alternative hypothesis as to its causes. *The Medical Journal of Malaysia*, 36(4), 243–245.
- Rao, A. B. (1962). Idiopathic palatal fibrosis. *The British Journal of Surgery*, 50(219), 23–25.
- Schwartz, J. (1952). *Atrophia Idopathica mucosa oris*.
- Singh, D. V., Srivastava, D. M., Roshan, D. R., Dhingra, D. H., Goel, D. T., & Mishra, D. R. (2017). A review article on Etiopathogenesis of Osmf. *IOSR Journal of Dental and Medical Sciences*, 16(04), 58–60.
- Strickland, S. S. (2002). Anthropological perspectives on use of the areca nut. *Addiction Biology*, 7(1), 85–97.
- Tadakamadla, J., Kumar, S., Laloo, R., Gandhi Babu, D. B., & Johnson, N. W. (2018). Impact of oral potentially malignant disorders on quality of life. *Journal of Oral Pathology & Medicine*, 47(1), 60–65.
- Verma, S. (2011). Areca nut (betel nut) chewing: A popular Indian cultural practice and its mucosal implications. *International Journal of Dermatology*, 50(2), 229–232.
- Warnakulasuriya, S., Johnson, N. W., & van der Waal, I. (2007). Nomenclature and classification of potentially malignant disorders of the oral mucosa: Potentially malignant disorders. *Journal of Oral Pathology & Medicine*, 36(10), 575–580.
- Warnakulasuriya, S., & Kerr, A. R. (2016). Oral submucous fibrosis: A review of the current management and possible directions for novel therapies. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, 122(2), 232–241.
- Warnakulasuriya, S., & Tilakaratna, W. M. (2013). *Oral medicine & pathology: A guide to diagnosis and management*. Jaypee Brothers Medical.
- Winstock, A. (2002). Areca nut-abuse liability, dependence and public health. *Addiction Biology*, 7(1), 133–138.
- Winstock, A. R. (2013). Areca nut, betel quids, and associated products. In *Principles of addiction* (pp. 863–872). Elsevier.

