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Management Of Oral Sub-Mucous Fibrosis : A Review

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Abstract
Oral Submucous fibrosis is a crippling disease affecting the oral cavity and extending upto pharynx and esophagus. It is most common in the countries of south-east Asia and shows greater predisposition towards the Indian ethnic group. Despite its prevalence and association with a significantly increased risk of cancer, its etiology is still not clear. It could lead to a spectrum of oral deformities ranging from inability to open mouth, tongue depapillation, hoarseness of voice to malignancy, which is why it has been grouped as a pre-malignant condition. A number of grading systems and management protocols to deal with this progressive disease have been published in the literature. This paper presents a review of the prevalence, etio pathogenesis and management of this condition.

Key Words
Oral Submucous Fibrosis (OSMF), Medical Management, Surgical Management

Introduction:
Oral sub mucous fibrosis (OSMF) is an insidious, chronic, resistant disease which may involve the submucosa of any part of the oral cavity and may extend upto pharynx and esophagus. The disease which was considered primarily a disease prevailing in the southern Asia and southern Asian immigrants to other parts of the world [1,2] has now gained considerable attention world-wide.

The etiology of this crippling disease is complex even though the actual mechanism is obscure. The condition has a multifactorial origin but is commonly associated with chewing of areca nut (betel nut) habitually [3].

The disease has a spectrum of presentations ranging from, excessive salivation, burning sensation, absent gustatory sensation and limitation of mouth opening leading to difficulty in chewing, swallowing, articulation and poor oral hygiene and its complications. It has been associated with an increased risk of malignancy and hence is considered as a pre-malignant condition [4].

The main aim in the treatment of submucous fibrosis is to relieve the symptoms and improve the oral opening. The non surgical management of such a patient includes discontinuation of the habit, avoidance of spicy foods, medicinal measures like local steroids, placental extracts, hyaluronidase injections singly or in combination and oral anti-oxidant supplements along with jaw opening exercises. Surgical measures attempting at excision of fibrous bands, coverage of resultant defects with skin grafts, collagen or other dressing materials, buccal pad of fat, local flaps, vascularised flaps, with or without coronoidectomy and post-operative active jaw physiotherapy have been documented.

History:
0SMF has been well established in Indian medical literature since the time of Sushruta-- a renowned Indian physician who lived in the era 600 B.C and was termed as 'Vidari'. It was first described in the modern literature by Schwartz in 1952 who coined the term atrophica idiopathica mucosa oris to describe an oral fibrosing disease, he discovered in 5 Indian women from Kenya[5]. Joshi subsequently coined the termed oral submucous fibrosis (OSMF) for the condition in 1953[6].

This condition has been referred to under a number of names, diffuse oral submucous fibrosis[7], idiopathica scleroderma of the mouth[8], idiopathic palatal fibrosis[9]

Prevalence:
Global estimates from 1996 indicate that about 2.5 million people have OSMF [10]. However, results from studies conducted in 2002 [11] indicate that more than 5 million people in India have OSF (0.5 percent of the Indian population). In addition, it is estimated that up to 20 percent of the world's population consumes betel nut in some form,[12] so the prevalence of OSMF probably is higher than that noted in the published literature.

The rate varies from 0.2-2.3% in males and 1.2-4.57% in females in Indian communities.[13] Oral submucous fibrosis is widely prevalent in all age groups and across all socioeconomic strata in India. The occurrence of this condition in children is extremely rare. Youngest case

reported in the literature was a 4-year-old girl [14]. A case of OSMF in a 12 year old girl was reported in 1993 and the etiology was traced to be the habit of chewing roasted areca nuts [15]. Another case of a 11 year old girl was reported in 2001 highlighting the link between oral submucous fibrosis and the regular use of areca-nut (paan) and the newer trans-cultural oral tobacco products [16]

A sharp increase in the incidence of oral submucous fibrosis was noted after pan masala came into the market, and the incidence continues to increase. Migration of endemic betel quid chewers has also made oral submucous fibrosis a public health issue in many parts of the world, including the United Kingdom, South Africa, and many Southeast Asian countries.[17]

Etiopathogenesis:

Although various factors have been implicated in the development of oral submucous fibrosis, the exact role of any one of these in the development, severity and extent of the disease is not clear, as the disease may still occur if none of these is present.

When the disease was first described in 1952, it was classified as an idiopathic disorder [5].

Earlier workers correlated it with hypersensitivity to capsaicin (Capsicum annum and Capsicum fructescens-- an active ingredient in chilies -- secondary to chronic iron and/or vitamin B complex deficiencies; or exposure to cashew kernel oil[4,18]. Ramanathan summarized the evidence of OSMF being a mucosal change secondary to chronic iron and/or Vitamin B Complex deficiency. He suggested that the disease is an Asian analogue of sideropenic dysphagia[19].

Currently, the habit of chewing areca nuts (the fruit of Areca catechu plant) is recognized as the most important etiologic agent in the pathogenesis of this condition. A number of epidemiological surveys, case-series reports, large sized cross sectional surveys, case-control studies, cohort and intervention studies provide over whelming evidence that areca nut is the main aetiological factor for OSMF [7, 20-22]. Four alkaloids have been conclusively identified in biochemical studies, arecoline, arecaidine, guvacine, guvacoline, of which arecoline is the main agent. The alkaloid component of the betel nut stimulates the inflammatory process [20]. An initial epithelial inflammation is followed by fibro-elastic changes in the lamina propria [20,23]. Epithelial atrophy and collagen deposition result in the formation of dense fibrotic bands. Overactivity during chewing causes ischaemic changes. Subsequent fibrosis and scarring in the masticatory muscles contribute further to fibrotic band formation and trismus. These bands are visible in the palate, buccal and labial areas and, in later stages, in the pharyngeal and oesophageal areas. In vitro studies on human fibroblasts using areca extracts or chemically purified arecoline support the theory of fibroblastic proliferation and increased collagen formation that is also demonstrable histologically in human OSMF tissues [24]. The role of areca alkaloids, copper in fibroblast proliferation and increased collagen synthesis, stabilization of collagen structure by tannins and fibrogenic cytokines, genetic polymorphisms predisposing to OSMF, role of the collagen related genes CoL1A2, COL3A1, CoL6A1, COL6A3 and COL7A1 have been discussed by W.M. Tilakaratne et al[25].

A possible autoimmune basis to the disease with demonstration of various auto-antibodies and an association with specific HLA antigens A10, DR3, DR7, and probably B7, along with haplophytic pairs A10/DR3, B8/DR3, and A10/88, has been found [26]. These pairs, together with the presence of autoantibodies and chronic inflammation of the oral mucosa, have been suggested as an autoimmune basis of oral submucous fibrosis.

Clinical features

The most frequently affected locations in oral submucous fibrosis are the buccal mucosa and the retromolar areas. It also commonly involves the soft palate, palatal fauces, uvula, tongue, and labial mucosa. It is generally believed that oral submucous fibrosis originates from the posterior part of the oral cavity and subsequently involves the anterior locations[27]. A study on the regional variations of this condition pointed out that such an observation would depend on whether the areca nut juice and the quid are swallowed or spat out[28].

It manifests as a burning sensation in the mouth, intolerance to eating hot and spicy foods, blanching and stiffness of the oral mucosa, trismus, vesiculation, excessive salivation, ulceration, pigmentation change, recurrent stomatitis, defective gustatory sensation, dryness of the mouth , gradual stiffening and reduced mobility of the soft palate and tongue leading to difficulty in swallowing and hyper nasality of voice, hoarseness of voice (with laryngeal involvement) and occasionally, mild hearing loss due to blockage of Eustachian tube [29].

The precancerous nature of oral submucous fibrosis has been observed with development of slowly growing squamous cell carcinoma in one-third of oral submucous fibrosis patients[30]. In southern India, 40% of oral cancer patients had oral submucous fibrosis[31]. A 7.6% incidence of oral cancer in oral submucous fibrosis patients has been reported in a median 10-year follow-up period [11]. Pindborg et al. summarized the criteria in support of the precancerous nature of the disease as higher prevalence of leukoplakia among oral submucous fibrosis patients, high frequency of epithelial dysplasia, concurrent finding of oral submucous fibrosis in oral cancer patients, and histologic diagnosis of carcinoma without the clinical suspicion of it[32].

The malignant transformation rate for OSF is 7 to 30 percent.[1,2,33]

The characteristic histologic features of OSMF consist of, atrophic epithelium often keratinized, generally without rete ridges, and in advanced cases it may be ribbon-like with juxtaepithelial hyalinization and collagen of varying density[31].

Staging:

Pindborg et al described 4 consecutive stages of oral submucous fibrosis based on histologic findings: very early stage, early stage, moderately advanced stage, and advanced stage[34].

Khanna and Andrade in 1995 developed a classification system for the surgical management of trismus[35].

- Group I: Very early stage without mouth opening limitations with an inter-incisal distance of greater than 35 mm.

- Group II: Early stage with an inter-incisal distance of 26-35 mm.
- Group III: Moderately advanced cases with an inter-incisal distance of 15-25 mm. Fibrotic bands are visible at the soft palate, and pterygomandibular raphe and anterior pillars of fauces.
- Group IVA: Advanced stage: Trismus is severe, with an inter-incisal distance of less than 15 mm and extensive fibrosis of the oral mucosa.
- Group IVB: Disease is most advanced, with premalignant and malignant changes throughout the mucosa

Divya Mehrotra et al suggested a clinical grading of the disease and treatment methods as [27]:

- Grade I: stomatitis and burning sensation in the buccal mucosa with no detection of fibres. Suggested treatment for this group is abstinence from habit and medicinal management.
- Grade II: symptoms of grade I, palpable fibrous bands, involvement of soft palate, and maximum mouth opening 26-35 mm. Suggested treatment: abstinence from habit and medicinal management.
- Grade III: symptoms of grade II, blanched oral mucosa, involvement of tongue, and maximal mouth opening 6-25 mm. Suggested treatment: abstinence from habit and surgical management.
- Grade IV: symptoms of grade III, fibrosis of lips, and mouth opening ?5 mm. Suggested treatment: abstinence from habit and surgical management.

S. M. Haider et al gave the following staging system[36]:

Clinical and Functional Staging

Clinical Stage
1. Faucial bands only
2. Faucial and buccal bands
3. Faucial, buccal, and labial bands

Functional Stage
A Mouth opening ? 20 mm
B Mouth opening 11-19 mm
C Mouth opening ?10 mm

Management
The management of an OSMF patient depends on the degree of clinical involvement. It comprises of: discontinuation of areca-nut related habit, nutritional support and anti-oxidants, physiotherapy, immunomodulatory drugs(steroids) for local/systemic application, intra-lesional injections of steroids, hyaluronidase, human placental extracts etc, either singly or in combination for early/milder form of disease and surgical measures for advanced cases with post-operative nutritional support and anti-oxidants alongwith active physiotherapy to prevent contracture at the surgical site and recurrence. It is very essential to follow these patients closely in order to prevent recurrence and to detect any developing malignancy at its earliest so as to manage this untoward and most common eventuality.

Medical Care
Medical treatment is symptomatic and predominantly aimed at improving mouth movements. The medical management has been summarized in the following table given by Auluck et al[37]

Surgical Care
Surgical treatment is indicated in patients with severe trismus and/or biopsy results revealing dysplastic or neoplastic changes. Surgical modalities that have been used include the following:

Simple excision of the fibrous bands, excision of bands with myotomy with or without coronoidectomy, coverage of the raw area with skin grafts, fresh amnion, collagen membrane, buccal pad of fat, local flaps or vascularised free flaps, followed by active post-operative jaw physiotherapy with anti-oxidants and proper nutrition and regular follow-ups to ensure maintenance of oral opening and early detection of malignant changes if any.

Use of lasers for band excision also has been documented.

Coverage of the area with fibrin glue or Absorbable Atelocollagen also is being tried at various institutes.

Discussion:
Oral sub mucous fibrosis is a chronic, progressive, debilitating disease, which most commonly presents with burning sensation, intolerance to hot and spicy foods, difficulty in mouth opening with poor oral hygiene and its complications. OSMF most commonly affects the buccal mucosa In addition, there may be involvement of the retromolar areas, fauces, palate, tongue, pharynx and esophagus. The condition is sometimes preceded by and/or associated with vesicle formation, but always associated with a juxtaepithelial inflammatory reaction followed by a fibroelastic change of the lamina propria with epithelial atrophy, leading to stiffness of

Table 1: Treatment modality for OSF (Auluck et al., 2008).

Treatment	Treatment Details
Micronutrients and minerals	Vitamin A, B complex, C, D and E, iron, copper, calcium, zinc, magnesium, selenium and others
Milk from immunized cows	45 g milk powder twice a day for 3 months
Lycopene	8 mg twice a day for 2 months
Pentoxyfilline	400 mg 3 times a day for 7 months
Interferon gamma	Intralesional injection of interferon gamma (0.01- 10.0 U/mL) 3 times a day for 6 months
Steroids	Submucosal injections twice a week in multiple sites for 3 months/ Topical for 3 months
Placental extracts	
Turmeric	Alcoholic extracts of turmeric (3 g), turmeric oil (600 mg), turmeric oleoresin (600 mg) daily for 3 months
Chymotrypsin, hyaluronidase and dexamethasone	Chymotrypsin (5000 IU), hyaluronidase (1500 IU) and dexamethasone (4mg), twice weekly submucosal injections for 10 weeks

the oral mucosa and causing trismus and inability to eat [33]. The underlying muscles and the muscles of mastication can also be affected. However, a more serious complication of this disease is the risk of the development of oral carcinoma [20]. The precancerous nature of oral submucous fibrosis has been observed with development of slowly growing squamous cell carcinoma in one-third of oral submucous fibrosis patients [27]. Oral leukoplakia occurs with a high incidence among patients with submucous fibrosis. According to Pindborg's report on OSMF in India, leukoplakia occurred in 55% cases [32].

The aim of treatment for this condition is to provide good release of fibrosis and provide long term results in terms of maintainence of mouth opening and to detect any developing malignant change at its earliest.

Different treatment methods for oral submucous fibrosis have been discussed.

Administration of vitamin B-complex may relieve glossitis and cheilosis in OSMF patients [38]. A peripheral vasodilator, such as buflomedial hydrochloride, affects the tissues in diffuse fibrosis to a noticeable degree by relief of the local ischemic effect [39].

Pentoxifylline is a tri-substituted methylxanthine derivative, which increases red cell deformability, leukocyte chemotaxis, antithrombin and anti- plasmin activities, and more importantly to the present context, its fibrinolytic activity. Pentoxifylline decreases red cell and platelet aggregation, granulocyte adhesion, fibrinogen levels, and whole blood viscosity [40]. Recent work has delineated pentoxifylline's ability to decrease production of tumor necrosis factor alpha and reduce some of the systemic toxicities mediated by interleukin-2 [41]. The anti inflammatory and immunomodulatory actions led to subjective improvement in clinical outcome recorded in a study by R Rajendran et al [42].

Lycopene: A number of studies have proven that the management of premalignant lesions should include antioxidants along with the cessation of the habit. Lycopene is a powerful antioxidant obtained from tomatoes. It has been shown to have several potent anti-carcinogenic and antioxidant properties and has demonstrated profound benefits in precancerous lesions such as leukoplakia [43] It has been found to inhibit hepatic fibrosis in rats as well as human fibroblast activity in vitro suggesting its possible role in the management of oral submucous fibrosis[44]. Newer studies highlight the benefit of this oral nutritional supplement at a daily dose of 16 mg. Mouth opening in 2 treatment arms (40 patients total) was statistically improved in patients with oral submucous fibrosis. This effect was slightly enhanced with the injection of intralesional betamethasone (two 1-mL ampoules of 4 mg each) twice weekly, but the onset of effect was slightly delayed.[45]

Steroids: In patients with moderate oral submucous fibrosis, weekly submucosal intralesional injections or topical application of steroids may help to prevent further damage. Steroid ointment applied topically helps in cases with ulcers and painful oral mucosa. Its therapeutic effects were mainly anti-inflammatory and appeared to have a direct healing action [46] Steroids are well known to act as immunosuppressive agents for prevention or suppression of the fibroproductive inflammation found in OSMF lesions, thus ameliorating this fibro-collagenous condition [47] Placental extracts: The rationale for using placental extract in patients with oral submucous fibrosis derives from its proposed anti-inflammatory effect[48], hence, preventing or inhibiting mucosal damage. Cessation of areca nut chewing and submucosal administration of aqueous extract of healthy human placental extract (Placentrex) has shown marked improvement of the condition.[15]

Hyaluronidase: The use of topical hyaluronidase has been shown to improve symptoms more quickly than steroids alone. Hyaluronidase can also be added to intralesional steroid preparations. The combination of steroids and topical hyaluronidase shows better long-term results than either agent used alone.[49] Hyaluronidase degrades the hyaluronic acid matrix, actively promoting lysis of the fibrinous coagulum as well as activating specific plasmatic mechanisms [49,44]. Therefore, relief of trismus may be expected through softening and diminishing of fibrous tissue.

IFN-gamma: This plays a role in the treatment of patients with oral submucous fibrosis because of its immunoregulatory effect. IFN-gamma is a known antifibrotic cytokine. IFN-gamma, through its effect of altering collagen synthesis, appears to be a key factor to the treatment of patients with oral submucous fibrosis, and intralesional injections of the cytokine may have a significant therapeutic effect on oral submucous fibrosis[50].

The surgical treatment involves excision of fibrous bands and forceful mouth opening resulting in a raw wound surface. Relapse is common complication that occurs after surgical release of the oral trismus caused by OSMF. Initially surgeons aimed at surgical elimination of the fibrotic bands which showed further scar formation and recurrence of trismus, to prevent which, they started using various inter positional graft materials [51,52].

Yeh carried out a surgical procedure of incising the mucosa down to the muscles from the angle of mouth to the anterior tonsillar pillar, taking care to prevent damage to the stoma of the parotid duct, followed by split skin grafting into the defect, with acceptable results [53].

Canniff et al. described the procedure of split thickness skin grafting after bilateral temporalis myotomy or coronoidectomy along with daily opening exercise and nocturnal props for a further 4 weeks [26]. But the results with skin grafting have a high reoccurrence rate due to graft shrinkage[35,38,54]. The other limitation of the split thickness skin graft is the morbidity associated with the donor site along with maintenance of mouth opening post operatively for 7 to 10 days which is the most unpleasant and uncomfortable experience for the patient[55].

Collagen membrane is used as a biological dressing. Shobha Nataraj et al used collagen membrane composed of type I and type III bovine collagen (that is similar to human collagen), following excision of fibrotic bands to cover the raw areas during initial phase of healing and observed that collagen membrane had good adaptability to the surgical defect. Collagen when used to cover raw areas provides coverage for sensitive nerve endings thereby diminishing

degree of pain. The adherence of collagen membrane is initially due to fibrin-collagen interaction & later due to fibro vascular in-growth into the collagen. With time, it slowly undergoes collagenolysis and is eventually sloughed off. However, it resists masticatory forces for sufficient time, to allow granulation tissue to form. None of the cases in their study showed any adverse reaction to the collagen proving its safety as a biological dressing [55,56,57].

The value of amniotic membranes as dressings for partial-thickness burns has been demonstrated by Dino et al. and Colocho et al. There was no acute rejection and its application over partial-thickness defects provides for pain relief and re-epithelialization. In patients for whom deep defects were covered by fresh amnion grafts, the inter-incisal distance two years after surgical treatment decreased by 5-10 mm. Therefore, fresh amnion grafts would not appear to be effective in a single layer over deep buccal defects according to Lai DR et al[38]

Borle and Borle reported disappointing results with skin grafting to cover the raw area and used tongue flap to cover the defect [46] However, tongue flaps were found to be bulky and required additional surgery for detachment. Bilateral tongue flaps caused severe dysphagia and disarticulation along with the risk of postoperative aspiration[55]. Restricted mobility of tongue was observed in the immediate postoperative phase, causing discomfort to the patient and difficulty in speech, which made it a less ideal choice[27]

Khanna and Andrade reported the incidence of shrinkage, contraction, and rejection of split skin graft as very high, owing to poor oral condition, with recurrence in 12 cases. Palatal island flap based on the greater palatine artery had been used to cover defect. This technique, accompanied with bilateral temporalis myotomy and coronoidectomy, was a highly effective surgical procedure [35] . However, use of island palatal flap has limitation such as its involvement with fibrosis and second molar tooth extraction required for flap to cover without tension [32,60]

Bilateral palatal flaps leave a large raw area on palatal bones in palate [61].

The nasolabial flap is typically classified as an axial pattern flap based on angular artery. It can be based superiorly or inferiorly. Kavarana and Bhatena filled the defect after sectioning of fibrous bands with 2 inferiorly based nasolabial flaps, with division of the pedicle after 3 weeks, and observed average mouth opening of 2.5 cm, with acceptable external scars [62]. Inferiorly based nasolabial flap is a reliable, economical option for the management of oral submucous fibrosis [63]. The advantages of nasolabial flap include its close proximity to defect, easy closure of donor site & a well camouflaged scar. The technique is easy to master and defects as large as 6 to 7 cm can be closed. The postoperative extra-oral scars are hidden in the nasolabial fold. Minor complications include loss of the nasomaxillary crease and the creation of an edematous and bulky flap. A periosteal suture can however be used to recreate the crease. By trimming all of the fat from the flap, the bulkiness can be reduced [64]. However, the nasolabial flaps cannot be extended adequately to cover the raw area, and they also cause facial scars and at times is hair bearing [27]

Yeh described the application of pedicled buccal fat pad after incision of fibrous bands and suggested that this was a very logical, convenient, and reliable technique for treatment of oral submucous fibrosis [53]. The surgical procedure is easy, less time-consuming since the donor site is in close proximity to the posterior third of the buccal defect and can be accessed and mobilized through the same buccal incision, which was used to release the fibrosis, without causing any noticeable defect in the cheek or mouth. Improvement in the suppleness and elasticity of the buccal mucosa on clinical examination were noted[53,55], The graft begins to show signs of epithelization from 2nd week with mean value of 14.73 days, so does not necessitate coverage with a skin graft [52,55,65], Should it fail, the consequences are not serious, as other options are open. Buccal fat pad serves as a good substitute, because it provides excellent function without deteriorating the esthetics and the results obtained were sustained long term [27]. Thus Lai DR et al considered this as the quickest and most efficient form of therapy for OSMF patients with severe trismus to ensure long-term improvement in mouth opening [38].

Mokal et al. advocated the use of vascularized temporal myofascial pedicled flap to bring in good blood supply to the area of affected muscle and mucosa to improve its function [61].

A total of five patients were treated with this technique and all of them showed good mouth opening in long term follow up. There was no donor site morbidity. The incision line is well hidden in the hair bearing area. Moreover, this technique releases strong muscles of mouth closure such as masseter from its origin and temporalis from its insertion. This procedure has its foundation on anatomical landmarks and physiological facts and is an effective method of treating oral sub mucous fibrosis [61]

Extraoral local flaps are limited by their extensibility to deeper parts of the defects. Free tissue transfer is hence the preferred choice. The radial forearm free flap has been widely accepted

because of its reliability, its thin, pliable and relatively hairless tissue characteristics and its long and sizable pedicle. It is one of the most popular flaps used in head and neck reconstruction. Wei FC et al have successfully applied this flap to reconstruct oral submucous fibrosis post-release defects [66]. Most donor sites were closed primarily in their series to leave only linear scars, thus the two most common donor-site problems encountered for radial forearm flaps, donor-site function and cosmetic appearance were avoided. A bi-paddled radial forearm flap from a single donor site has been also used for reconstruction of bilateral buccal defects[67]. However, the sacrifice of one of the two major vessels supplying to the hand on both sides is still a concern, with the potential risk of compromising the circulation to the digits, ranging from cold intolerance to gangrene change, especially in the smokers. Free flap reconstruction has proved effective for maintaining mouth opening after release of fibrosis. Two independent free flaps from separate donor sites, such as bilateral forearm flaps or bilateral anterolateral thigh (ALT) flaps, were traditionally required for reconstruction. The former option sacrifices one of the two major arteries in the forearm. Both the options are time consuming and required two donor sites. To eliminate these disadvantages, Jung-

Ju Huang et al developed a technical modification that allows harvesting of two independent flaps from one ALT thigh based on one descending branch of the lateral circumflex femoral artery (d-LCFA). With the described technique, two teams can work simultaneously, the total operation time can be reduced and one donor site can be left un-operated, one donor thigh scar can be concealed more easily than bilateral donor sites scarring both forearms, the sacrifice of the d-LCFA is less critical than the sacrifice of the radial artery. However, since ALT flaps may be too bulky for oral mucosa reconstruction, flap-thinning procedures, either intra-operatively during flap transfer reconstruction or secondarily after surgery may be undertaken[68].

Omura and Mizoki used a newly developed collagen/silicone bi-layer membrane as a mucosal substitute and reported that postoperative course was unremarkable and that repair was effective. The membrane comprised an outer layer of silicone and inner layer of hydrothermal cross-linked composites of fibrillar and denatured collagen sponge. The membrane was placed on oral mucosal defects after removal of the outer silicone layer after 10-14 days[69].

Use of a KTP-532 laser release procedure was found to increase mouth opening range in 9 patients over a 12-month follow-up period in one study[70].

Fibrous bands encircle the lips, buccal mucosa, and faucial pillars. The constriction of the oral aperture is not only disfiguring but also limits access needed for surgery. FRAME et al used CO2 laser, rather than a scalpel or a technique involving multiple tiny incisions for surgical relief of the limited oral aperture, because the laser beam spontaneously sealed all blood vessels, allowing the surgeon perfect visibility and accuracy in excising the fibrous tissues time[55]. Furthermore, the laser excised wound heals with less contraction and scarring than wounds left by surgical excisions[71]. However, Lai DR et al[38] considered it be practically impossible to excise all fibrous tissues in the oral cavity at one time.

Fibrin glue is a biological tissue adhesive based on the final stage of coagulation wherein. Thrombin acting on fibrinogen converts it into fibrin. Thus, it has two components, fibrinogen and thrombin obtained from patient's own blood. Use of the fibrin glue is simple, safe, cost effective, and rapid technique. Its use to cover the raw areas after excision of fibrous bands is being tried at various institutes.

Absorbable Atelocollagen Membrane is available as a sterile, pliable surgical porous scaffold agent made of highly purified type I atelocollagen derived from porcine skin. It is being used for coverage of the raw areas in non-healing and burn wounds. It shows minimal antigen reaction due to the elimination of telopeptides, is completely absorbable, highly bio-compatible and suitable for reconstruction of soft tissue. Its advantages include, bleeding control and stabilization of the blood clot, acceleration of the wound healing process, provides matrix for tissue ingrowths, can be cut to fit any size wound, soft and conformable to wound site, maintains integrity in moist state, leaves wound free of fiber. Its use in OSMF is being tried in many institutes and long term results are awaited.

Patients suffering from this incurable, chronic fibro-elastic scarring disease need to be fully informed. It is essential at the onset of treatment to avoid raising expectations. Treatment needs to be coupled with cessation of betel/tobacco quid chewing and active jaw physiotherapy in order to manage properly both early and advanced stages of OSMF[38]. Patients should be closely followed up to monitor the inter-incisal distance and any developing suspicious lesion so that appropriate and timely treatment for the same may be initiated.

Conclusion:

Oral submucous fibrosis is one of the most poorly understood and unsatisfactorily treated diseases. The younger the age, the more rapid the progression of the disease. Because of the significant cancer risk among these patients, periodic biopsies of suspicious regions of the oral mucosa are essential for early detection and management of high-risk oral premalignant lesions and prevention of cancer. Dentists can play an important role in both the education of patients about the perils of chewing betel quid and in the early diagnosis of such high-risk premalignant lesions and cancer.

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