



## Anatomical Study Of Facial Artery Perforator And Its Clinical Application In Oral Submucosal Fibrosis

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

### Abstract

**Introduction** Oral submucosal fibrosis usually presents as fibrosis followed by stiffness in the buccal mucosa, soft palate, and faucial pillars. Fibrotic bands become palpable which run vertically in the cheek region and circumferentially in the lips. Gradually, these fibrotic bands lead to the inability in opening the mouth. This leads to hypersensitive mucosa to food. Oral submucosal fibrosis is precancerous and is more prevalent in India and one-third of patients progressed to squamous cell carcinoma. Surgical management is indicated in moderate to severe cases with trismus and have developed irreversible mucosal damage. Resection of tumors in the cheek areas will have functional as well as aesthetic problems which can cause a major challenge to reconstructive surgeons.

**Aims & Objectives:** To evaluate the applicability of nasolabial perforator flap in the surgical management of oral submucosal fibrosis. To define the anatomy of the facial artery and its perforators. To design various flaps based on perforators and the branches of the facial artery.

**Material And Methods** The study was conducted in the Department of Plastic & Reconstructive Surgery, Department of Surgery, at Government medical college, nagapattinam during the periods of 5 months from May 2021 to October 2021. 28 facial artery specimens in 14 preserved cadavers were studied. Dissection was performed with a degloving approach to face, facial artery identified and dissected in an antegrade manner, and perforators identified. Callipers and scales were only used. No injection study was done. Perforators about the facial artery in the segment between the upper and lower sulcus of the mouth were defined. Parameters assessed were: a. Number of perforators their size and location, b. Presence/absence of venae commitments. We observed the size of the perforator is inversely proportional to the number of perforators in the perforator triangle.

**Results:** This retrospective analysis study was conducted to analyze the results of Facial artery perforator-based nasolabial flap in the surgical management of oral submucosal fibrosis. The results were statistically analyzed. 14 cadaveric specimens were dissected to study the perforators from the facial artery seen in the perforator triangle. There is a negative correlation between the size of the perforator and the number of perforators and is statistically significant. As the number of perforators decreases the vessel caliber increases. Therefore the average size of perforators both right and left side together seen was 1.4 mm. The average number of perforators on both sides together was 2.2. There was no vein seen accompanying the perforators in this cadaveric study. The site of origin of perforators was analyzed. It is found to arise from the facial artery in 50 % of cases and the Superior labial artery in the other 50%.

**Conclusion:** The present study showed the easy way of flap harvest and is easily reproducible by all the surgeons. This technique of utilizing nasolabial flap as a perforator flap is a single staged procedure with no flap

complications, least donor site morbidity, and the good aesthetic and functional outcome can be considered for all patients with oral submucosal fibrosis.

**Keywords:** Facial artery perforator, Oral Submucosal Fibrosis, Perforator Triangle, Reconstruction With Regional Flap

## Introduction

Oral submucosal fibrosis usually presents as fibrosis followed by stiffness in the buccal mucosa, soft palate, and faucial pillars. Fibrotic bands become palpable which run vertically in the cheek region and circumferentially in the lips. Gradually, these fibrotic bands lead to the inability in opening the mouth. This leads to hypersensitive mucosa to food [1] Oral submucosal fibrosis is precancerous and is more prevalent in India and one-third of patients progressed to squamous cell carcinoma. Surgical management is indicated in moderate to severe cases with trismus and have developed irreversible mucosal damage. [2] Resection of tumors in the cheek areas will have functional as well as aesthetic problems which can cause a major challenge to the reconstructive surgeons [3] The best donor areas available for coverage of defects after oral submucosal fibrosis excision are the cheek and forehead areas. This is because of factors like proximity to the defect, excellent color match, and the easy way of transfer to the recipient site. The donor area for the nasolabial flaps parallels the nasolabial fold and spans between the inner canthus and lower border of the mandible since the skin is lax in this area [4]. Nasolabial flaps can be either superiorly based or inferiorly based. For the reconstruction of nasal defects lower eyelid defects as well as cheek defects excluding the area at the cephalad region of the nose, superiorly based nasolabial flaps give good coverage. For the reconstruction of the lip, commissural defects or anterior part of the oral cavity inferiorly based flaps are generally preferred. Yet the use of nasolabial flap is considered ideal for full-thickness defect of the nose with or without exposure of bone or cartilage [5]. Reconstruction of the ala of the nose by nasolabial flap utilizes the principle of the local turnover flap. Narrow flaps can be used to reconstruct small defects such as an alar rim deformity secondary to facial burn. Columella reconstruction is often

considered difficult since nasal flare duplication is highly difficult. This can be easily achieved by tunneling the superiorly based nasolabial flap onto the columella by an alar crease incision. [6] The nasolabial flap can be raised in many ways like superiorly based, inferiorly based, medially-based, or laterally based flaps because of the existence of the rich vascular network between the terminal branches of the facial artery. [7] These flaps also have a very rich subdermal vascular plexus making it possible to be raised both as a random pattern flap and an axial pattern flap or even as a subcutaneous pedicled flap. [8] Bio geometry of raising these flaps is dictated by the presence of redundant soft tissue availability in this region and in effect possibility to primarily close the secondary defect. The maximum length of the nasolabial flap that can be safely harvested is 10-12 cms. Width is limited especially for superior and medially-based flaps and the maximum dimension is 5 cms only. [9] Contrary to this, flaps based inferiorly have length limitations. Tunneling of flaps is generally easier for covering oral cavity defects without pedicle compromise. The greatest amount of restriction to tunneling will be experienced for covering nasal defects when tunneled between the inner canthus and nasolabial fold because of the least redundancy of tissue available in the region. [10]

## Material and methods

The study was conducted in the Department of Plastic & Reconstructive Surgery, Department of Surgery, at Government medical college, Nagapattinam during the period of 5 months from May 2021 to October 2021. 28 facial artery specimens in 14 preserved cadavers were studied. Dissection was performed with a degloving approach to face, facial artery identified and dissected in an antegrade manner, and perforators identified. Calipers and scales were only used. No injection study was done. Perforators about the facial artery in the segment between the upper and lower sulcus of the mouth were defined. Parameters assessed were: a. Number

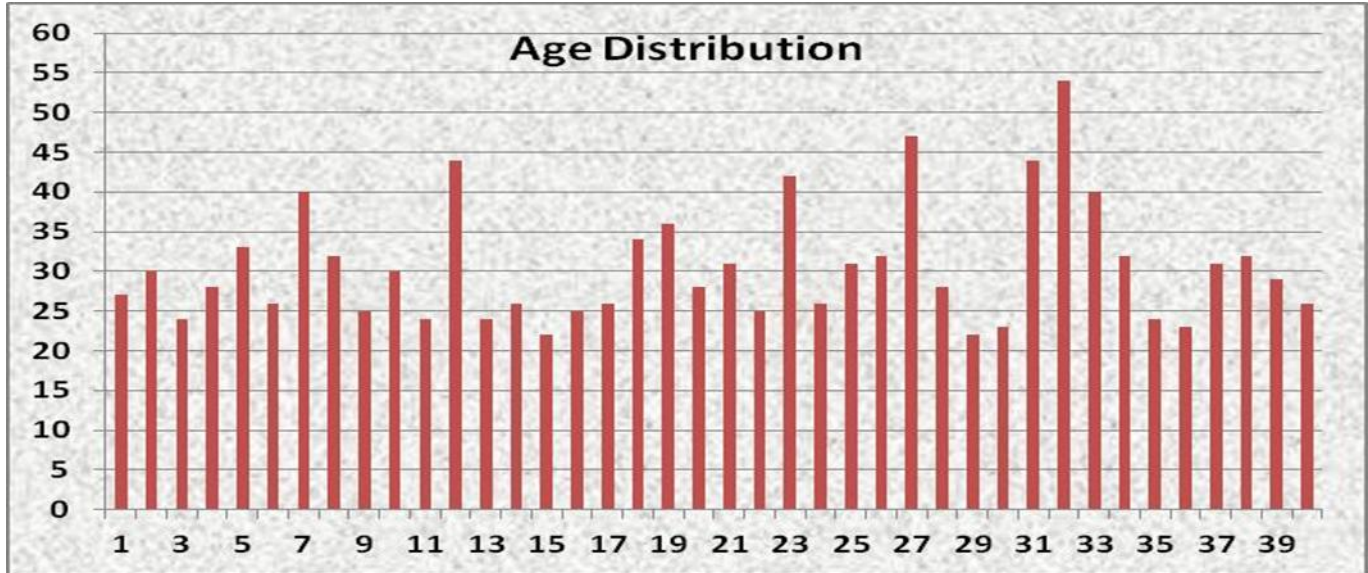
of perforators their size and location, b. Presence/absence of venae commitments. We observed the size of the perforator is inversely proportional to the number of perforators in the perforator triangle. All cases of oral submucosal fibrosis with trismus that required surgical intervention were included in the study. The proforma for the collection of data is presented. All the relevant details of the patient during preoperative, surgical, and postoperative follow-up periods were collected and analyzed. Appropriate photographs were taken for documentation. The patients were explained about the nature of the procedure and the various flap options available. Inclusion Criteria: Patients with oral submucosal fibrosis leading to restricted mouth opening and intolerance to heat and spicy food. Patients who failed conservative management with inter incisor distance less than 2 cms Exclusion Criteria: Submucosal fibrosis patients with adequate mouth opening. Patients whose histopathological examination revealed malignancy need more radical treatment. Patients are not willing to quit areca nut chewing. All comorbidities (including Type 2 DM) were attended to and appropriate consultations were obtained to optimize the patient before surgery. Smokers were taken up for surgery after two weeks of complete cessation of smoking is ensured. All patients were subjected to routine investigations for anesthetic fitness. The pre-operative biopsy is done to rule out malignancy Preoperatively OPG was done to rule out TMJ pathology and held Doppler examination to identify & locate the perforators from facial artery before surgery or Angiogram or other invasive studies were not done in any of the patients since this is an Adhoc perforator. Using Fergusson's mouth gag, the mouth was forcefully opened to an acceptable range of 40-45 mm. Out of these 40 patients, 22 patients in whom inter-incisor mouth opening of less than 30 mm was achieved by incising the fibrous bands, Coronoidectomy through the same incision in the vestibule to release the adoptive contracture of temporalis was done. Inter-incisor mouth opening of 40-45 mm was achieved for these patients. In other patients release of the fibrous band alone resulted in inadequate mouth opening. Hemostasis was achieved in all patients. Upper and lower third molars were extracted to facilitate access for Coronoidectomy and prevent entrapment of flap. In these patients, after

incising the fibrous bands and achieving an acceptable range of mouth opening, bilateral elliptical-shaped nasolabial flaps were marked with methylene blue ink. Flaps extended from the inner canthal region to the anteroinferior border of the masseter along the mandible. First the anterior incision is made, the dissection is performed towards the perforator triangle, perforators are identified which in 2 cases single perforator, and in the remaining cases where multiple perforators are seen, single best perforator is identified by trial clamping of the perforators. Lignocaine is sprayed topically over the perforator to relieve vessel spasms and good perfusion is seen at the extremes of the nasolabial flap. After identifying the single best perforator the other perforators are divided and coagulated with bipolar cautery. In all clinical cases, no obvious veins were seen, but studies have shown minuscule presence within the periperforator fatty cuff. The medial incision line followed the nasolabial folds till the inferior third and the width of the flap was kept 1.5-2 cm with medial and lateral limbs of the incision tapering at the ends. Bilaterally, flaps were raised in the plane of the superficial musculoaponeurotic system from both ends to the region of the perforator triangle. The diameter of the pedicle was roughly 1.5-2 cm. A transbuccal tunnel was created near the region of modiolus caudal to the sensory branch of the Trigeminal nerve. The flap was then transposed intraorally in a tension-free manner. The superior wing of the flap was sutured to the posterior edge of the defect while the inferior wing was sutured to the anterior edge of the defect<sup>21</sup> or sometimes even it is inserted into the sulcus using 3-0 poliglecaprone suture material. The generous undermining of the donor site was done in the subcutaneous plane and layer-wise closure was done with 3-0 polyglactin suture for the deeper layer and the secondary defect closed primarily with 5-0 polypropylene suture. The total operating time was approximately 3 hours. All the patients received prophylactic antibiotic coverage 3 doses and a liquid diet started on the evening of surgery. Extra-oral sutures were removed on the seventh postoperative day. Initial physiotherapy was started within 48 hours post-operatively with mouth opening exercises and placing mouth prop inter-molar. After the tenth postoperative day, intense physiotherapy was started using Heister's mouth gag during the daytime and at bedtime, a plastic mouth

prop is used. Duration and frequency were increased later to achieve the intraoperative values of mouth opening. Patients were instructed and motivated to continue the physiotherapy themselves for 6 months

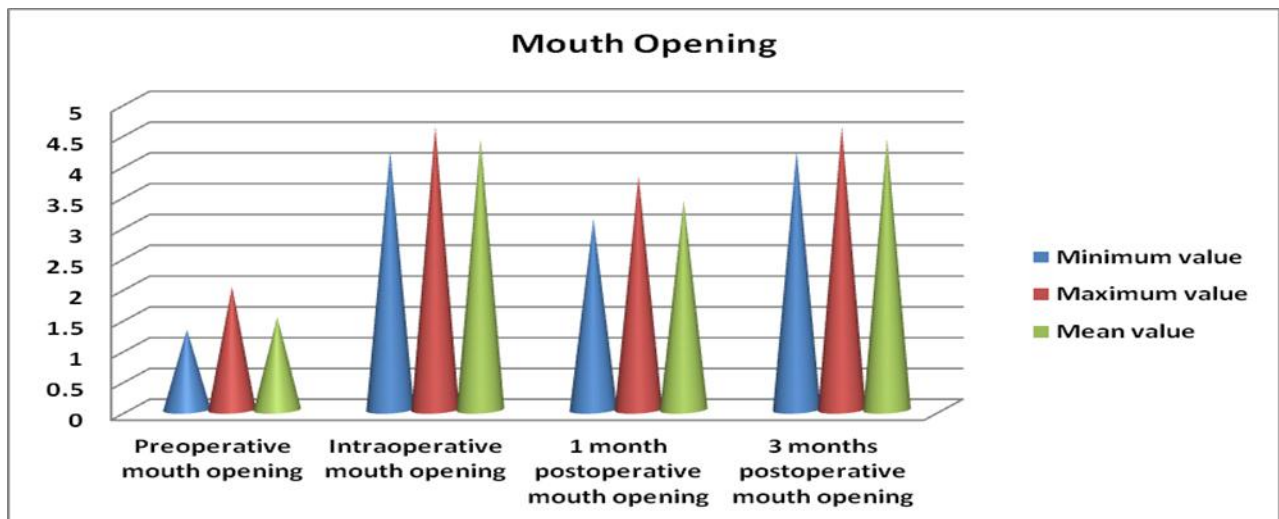
and followed up. The inter-incisal mouth opening was recorded postoperatively with a simple ruler and recorded in millimeters during the follow-up period.

**GRAPH:1 AGE**



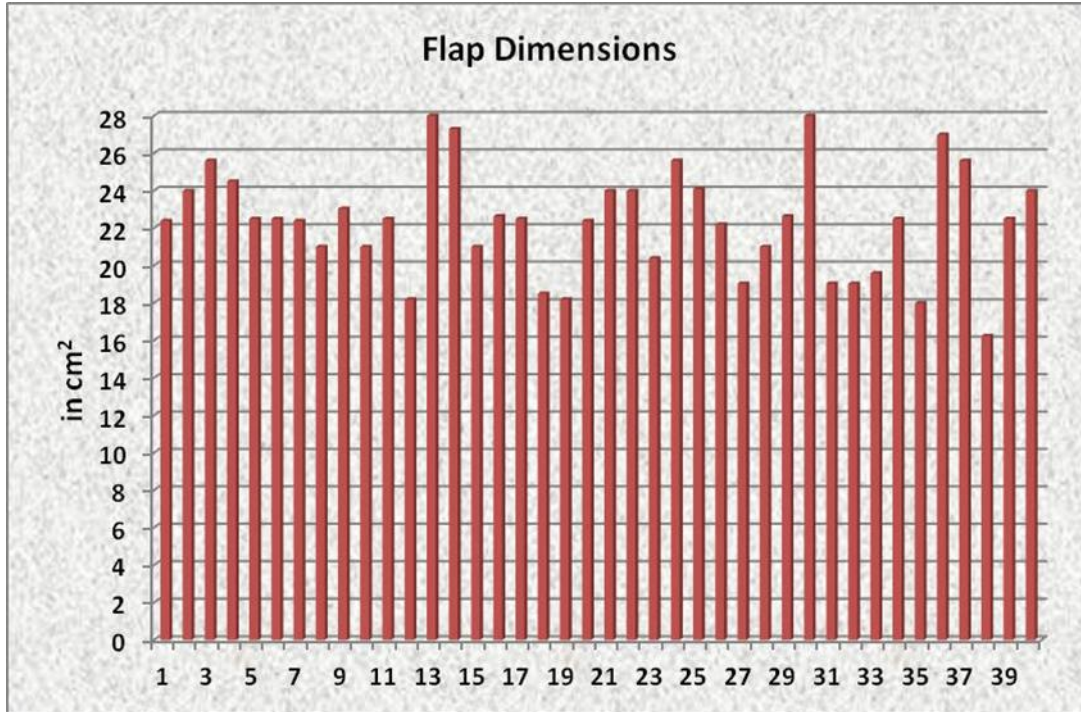
GRAPH :1 Minimum age was 22 and the maximum age was 54 in the study group with a mean age of 30.65. Of these 32 were males making up to 80% and 8 patients were females making up to 20% of the study population. 31 patients chewed areca nut, tobacco alone accounting for 77.5%. 9 patients chewed areca nut, tobacco along with smoking habit 22.5%.

**GRAPH:2 MOUTH OPENING**



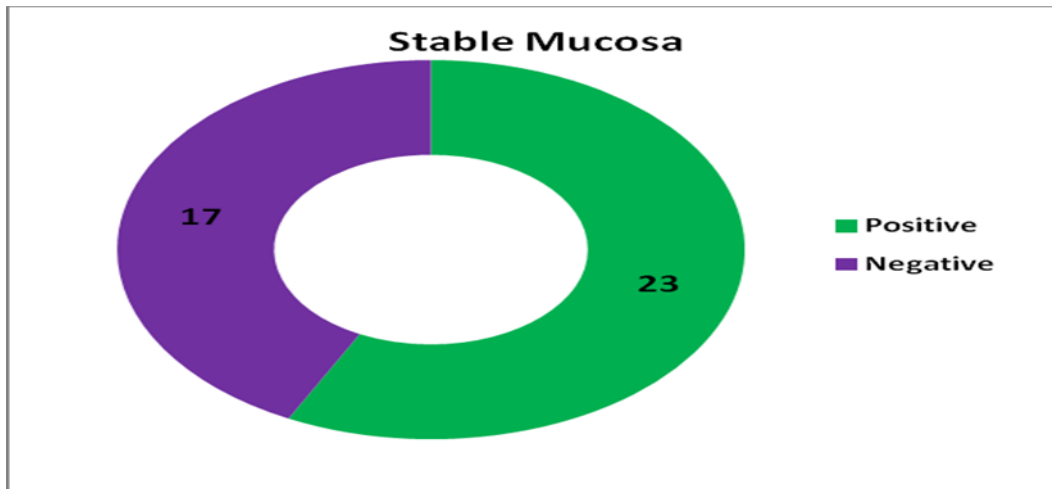
GRAPH:2 22 patients that are 55% of the patients underwent coronoideotomy as an adjunctive procedure to achieve adequate mouth opening

**GRAPH :3 FLAP DIMENSIONS**



GRAPH ;3 The minimum Flap dimension harvested was 6.5 cm x 2.5cm = 16.25 cm<sup>2</sup>[Average of rt & lt sides]The maximum flap dimension harvested was 8.3 cm x 3.3 cm = 27.3 cm<sup>2</sup>[Average of rt & lt sides] Mean flap dimension was 23.12 cms<sup>2</sup>

**GRAPH:4 STABLE MUCOSA**



Graph:4 After the procedure and abstinence from areca nut about 57.5% of patients had a stable mucosa with tolerance to food at the end of 6 months on follow up.

**Discussion**

In the Indian subcontinent, oral submucous fibrosis is a precancerous condition with a high prevalence rate. The soft palate, palatal fauces, uvula, tongue, labial mucosa are the common site of occurrence. [11]The

buccal mucosa and retromolar areas are the frequent sites. It usually begins from the posterior part of the oral cavity and progresses anteriorly. In our series also, buccal mucosa and retromolar areas were most commonly involved. The most common etiological factors are chewing betel nut and tobacco. In our study, all patients had a positive history of chewing some form of betel nut or tobacco or a combination of both for a variable duration.[12] Burning sensation of the mucosa, intolerance to hot and spicy food,

mucosal blanching, vesiculation, excessive salivation, pigmentation change, ulceration, altered taste sensation, dryness of mouth, and recurrent stomatitis are the common clinical features seen in the early stages of oral submucosal fibrosis. There is fibrosis followed by stiffness in the buccal mucosa, soft palate, and faucial pillars. [13,14] Fibrotic bands become palpable which run vertically in the cheek region and circumferentially in the lips. Gradually, these fibrotic bands lead to the inability in opening the mouth. All our patients exhibited this pattern in at least one stage of the disease.[15] All our patients had a history of treatment with one or more of the conservative modalities yet their symptoms were progressing. Surgical therapy is beneficial in cases presenting severe trismus and which are not responding to a conservative line of management. After surgical therapy, oral mucosa should regain and retain its normalcy and there should be a reduction in the risk of oral cancer. [16] Mere cutting of the fibrotic bands followed by forcible mouth opening and allowing secondary epithelization left an unsatisfactory rigid buccal mucosal surface even when attempts were made to reduce collagen formation by insertion of steroid impregnated packs.<sup>50</sup> It results in scar formation and recurrence of trismus.[17] Additional procedures like temporalis myotomy and bilateral Coronoideotomy can be performed to enhance mouth opening. and in our series few patients underwent Coronoideotomy to achieve adequate mouth opening.[18] Disappointing results were obtained while covering the raw area after excision of the fibrous band with split-thickness skin graft as graft take was poor initially, shrinkage and contracture were found to be very high because of the poor oral conditions and this leads to recurrence of symptoms.[19] Split thickness skin grafts along with bilateral temporalis muscle myotomy or Coronoideotomy were effective, but have the drawbacks of secondary contracture formation in temporalis tendon and muscle and pterygomandibular raphae, which appears to be the principal cause of restricted mouth opening.[20] Though the techniques of harvesting the palatal island flaps were found to be simple, it has their limitations. The palatal flap may be involved with fibrosis, second molar tooth extraction is required for flap cover without tension, and flap dimensions may be inadequate to cover the defect.[21] Tongue flaps

have also been used for treating oral submucous fibrosis. The disadvantages are postoperative dysphagia, disarticulation, the risk of postoperative aspiration. Second stage procedure needed for detachment of the pedicle<sup>12</sup>. The tongue may also be involved in oral submucous fibrosis.[22] Application of amniotic membrane is of little benefit when used in a single layer over deep buccal defects.<sup>44</sup> Human placental grafts can also be applied to cover the defects. It has shown few beneficial results when combined with submucosal injection of Dexamethasone.[23] Microvascular work for free tissue transfer in the form of Bilateral radial artery forearm free flaps<sup>15</sup>, the paddled radial forearm flap<sup>16</sup>, the anterolateral thigh<sup>18</sup> may be needed when the flap defect size is large and the local/regional flaps are violated. Donor site morbidity, as well as unsightly scar formation, is a major disadvantage. The flaps are hairy and 40% of the patients require secondary de-bulking procedures.[24] The present study was conducted to achieve results in terms of mouth opening and reduction of symptoms by transecting the fibrous bands and reconstruction using nasolabial perforator/propeller flap. This retrospective study included 40 patients with clinically and histopathologically confirmed diagnoses of oral submucous fibrosis. The anatomical studies lead to the novel way of perforator dissection that is constantly seen in the perforator triangle. Nasolabial flap with robust vascularity can be harvested as an Adhoc perforator/propeller flap. Sizeable Nasolabial flap can be harvested on a single best perforator after trial clamping resulted in the hyperperfused nasolabial flap. The nasolabial flaps have advantages such as the donor site being in the same operating field, reliable and rich vascularity, provides versatility in design, proximity to the defect, ease of flap elevation, supple skin, thus aiding in increasing mouth opening and causing minimal aesthetic deformity.[25] This Adhoc nasolabial perforator/propeller flap provides a stable and supple tissue that gets mucosalised within six weeks gets elastic elongation during mouth opening and recoils back to a good contour on closing the mouth without forming any fold of flap which get caught in the molars. These methods of reconstruction pave the way for good masticatory efficiency [100%], maintain oral hygiene by good mouth opening [100%], and eschew hypersensitivity to hot and spicy

food in 60% of cases within 3 months in our clinical study.[26] Though pedicled nasolabial flap can be used in a staged manner for intraoral reconstruction with intermediary oral cutaneous fistula, this method of reconstruction is single staged. This stable and supple tissue inhibits recurrence.[27] The anatomical study defined the safest passage of nasolabial flap for an intraoral lining that is caudal to a sensory buccal branch of trigeminal nerve wherein the orbicularis oris muscle fibers are split. Then the flap is tunneled intraorally without undue tension and kinking of the pedicle. As noted in other studies the most commonest occurrence of carcinoma is from the cheek segment 70%. This method of reconstruction completely brings in a new stable monopolized epithelium which is free from any unstable epithelium for malignant transformation.[28] What we found in our cases after reconstruction with counseling to the patient with complete abstinence from tobacco exposure no cancer found and precancerous unstable epithelium in the palate, the floor of mouth healed well in 1-year follow-up.[29,30]

### Conclusion

Oral submucosal fibrosis is a progressive disease leading to trismus. Surgical release of fibrous bands and reconstruction with regional flaps is a very good option. Facial artery perforator-based nasolabial flap offers excellent results in the form of supple cover to the defect and least donor site morbidity. The presence of constant perforators in the perforator triangle as evidenced in the anatomical study paved way for this novel technique of flap harvest. Adequate mouth opening which is the prime goal is achieved with good stable cover and is maintained with good physiotherapy, abstinence from areca nut, and tobacco chewing. The present study showed the easy way of flap harvest and is easily reproducible by all the surgeons. This technique of utilizing nasolabial flap as a perforator flap is a single staged procedure with no flap complications, least donor site morbidity, and the good aesthetic and functional outcome can be considered for all patients with oral submucosal fibrosis.

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