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Surgical management of oral submucous fibrosis with promising use of nasolabial flap

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Abstract
Purpose: To evaluate the efficacy of nasolabial (NL) flap as a grafting technique in the management of oral submucous fibrosis (OSMF).
Patients and Methods: A prospective randomized study was conducted including 10 patients who were treated surgically for OSMF. Patients with the chief complaint of long standing difficulty in mouth opening (less than 20mm), pain in relation with the third molars or any non-malignant growth associated with that region were included.
Results: This prospective study was carried out to evaluate the use of NL flap as a grafting technique in OSMF cases and observe the surgical outcome in terms of post-surgical mouth opening.1 week post-operative mouth opening ranged from 25mm to 45mm with a mean of 36 mm. However, 15 days, 1 month and 3 months post-operative mouth opening was 32, 34, and 36 mm respectively. Finally the 12 months follow up showed a range from 22 mm to 44 mm with a mean of 34 mm.
Conclusion: Cessation of habits, vigorous mouth opening exercises and improvement in nutritional statusis must for better results post-operatively. All the patients showed sustained mouth opening, satisfactory epithelialization, and minimum wound contracture. The NL flap has proven to be a useful and reliable treatment modality.

Keywords: Oral submucous fibrosis, nasolabial flap, grafting, coronoidotomy

Introduction
Oral submucous fibrosis (OSMF) has been well documented in Indian medical literature since the time of Sushruta. In the Sushruta Samhita it is described as: 'Swelling within the throat with burning, pricking pain, haemorrhage, putrid and necrosed muscle, caused by pitta known as Vidari, occurring in mouth particularly in the side by which the patient lies [1].
Pindborg *et al*. (1996) has defined the condition OSMF as- "An insidious chronic disease affecting any part of the oral cavity and sometimes even the pharynx. Although occasionally preceded by and/or associated with juxta epithelial inflammatory reaction followed by a fibroelastic change of the lamina propria with epithelial atrophy leading to stiffness of the oral mucosa which causes trismus and inability to eat." [2]
OSMF is characterized by blanching and stiffness of the oral mucosa, which causes progressive limitation of mouth opening and intolerance to hot and spicy food. It is more prevalent in Indian subcontinent and is identified as an important premalignant condition (Paissat 1981, Gupta and Sharma 1988). OSMF can occur in any age but the majority of patients range between 20 and 40 years of age. Most reports suggest that there is no sex predilection and this is supported by the apparently contradictory findings of Pindborg *et al*. with a female to male ratio 8:3 and those of Yuh-Yuan *et al*. with a female to male ratio of 1:34 [2].
Areca nut (the fruit of the areca catechu palm), commonly known as betel nut or supari, plays a crucial role in the etiology of OSMF.
Arecoline - an alkaloid component of areca nut, stimulates fibroblastic proliferation and collagen synthesis. The flavanoid +/- catechin and tannins are also components of the areca nut and stabilize the collagen fibrils, rendering them resistant to degradation by collagenase.

The stubborn trismus is a result of juxtaepithelial hyalinization and secondary muscle involvement (i.e., muscular degeneration and fibrosis) [3].

Medical treatment is indicated only in early stage but mostly patient consults when condition is moderate to severe (Lee *et al*., 2006). Surgical treatment is indicated in late and irreversible stage. The procedure consists of release of fibrous bands followed by covering the raw areas with graft like skin, fresh amnion, collagen, or local flaps (Canniff *et al*., 1986) [14].

The nasolabial flap promises good results. It is typically classified as an axial pattern flap based on angular artery. It can be based superiorly or inferiorly. Surgical descriptions about nasolabial flap began as early as 1830 when Dieffenbach used superiorly based nasolabial flaps to reconstruct nasal alae. In 1864, Von Langhenbeck used the nasolabial flap to reconstruct the nose (Schmidt and Dierks, 2003). Fifty-seven years later, Esser (1921) described the use of the inferiorly based nasolabial flap to close palatal fistulae [6].

Inferiorly based nasolabial flap is a reliable, economical option for the management of OSMF (Borle *et al*., 2009) [5, 7].

The cases included in this study were those having advanced disease with interincisal distance (IID) less than 20 mm. Majority of the patients also had chief complain of pain in relation with the third molars and adjoining retromolar trigone region. Severely compromised oral hygiene was also a common observation. Considering this deteriorated condition, surgical procedure with various modifications has been contemplated to relieve the patient's chief complaint.

Patients and Method

This is a prospective randomized study, including a series of 10 patients (6 Male 4 Female) and (7 Patients of age group 41-60 and 3 Patients of age group 21-40) treated surgically for OSMF in the Department of oral and maxillofacial surgery at the College of dental sciences and research centre, Ahmedabad. Ethical clearance was obtained from committee before starting the study.

Inclusion criteria

- Patients with the chief complaint of long standing difficulty in mouth opening, pain in relation with the 3rd molars or any non-malignant growth associated with that region.
- Patients with positive history of betel nut, supari, tobacco chewing (with or without lime), and had stopped the habit for at least 6 months.
- Unilateral or bilateral clinically and histo-pathologically proven cases of OSMF with reduced mouth opening.

Exclusion criteria

- Patients with malignancy.
- Medically compromised patients.
- Uncooperative patients, not willing to discontinue the habit and not willing to turn up for the long follow up.
- Patients who are not willing for being a part of study.

Methodology

Prior to surgery all the patients were motivated to strictly leave the habits (betel nut chewing, tobacco chewing. etc.). The patients were appraised of the final outcome of the surgery, since it was essential to avoid unrealistic expectations.

Pre-operative preparation and evaluation

Patients who fulfilled the above criteria were selected for the study. A detailed history was obtained from each patient with special reference to their habits. The patients were screened and their pre-operative IIO was recorded. (Fig.1) Radiographic investigation was carried out to rule out any pathology in the jaws, teeth, and TMJ region and also to determine the necessity of removal of teeth. (Fig.5a) Routine haematological investigations were carried out. All the patients were assessed by the Physician and Anesthesiologist for surgery under general anesthesia. Necessary prophylactic dental procedure wherever possible was carried out. Patients were kept on nil by mouth (NBM) overnight prior to surgery. Patients were advised to shave the face (male) and take a savlon head bath on the day of surgery. Pre-operative antibiotic and analgesic were administered parenterally.

Intra-operative procedure

Fig. 1: Pre-operatve. (IID = 2mm)

Step 1: Intubation

General anaesthesia was administered with blind awake nasal intubation technique. Fibre-optic intubation was kept ready for all the cases, but was not required. Tracheostomy was not performed in any of the cases.

Step 2: Patient preparation

Extraoral painting was done with 5% povidone iodine and 70% alcohol. Draping was done with sterile towels. Intraoral irrigation was done with 5% povidone iodine and normal saline.

Step 3: Local anaesthesia infiltration
With the consent of anaesthetist 2% lignocaine hydrochloride with adrenaline (1:80000) was infiltrated in the surgical site (bilateral buccal mucosa) to achieve hemostasis.

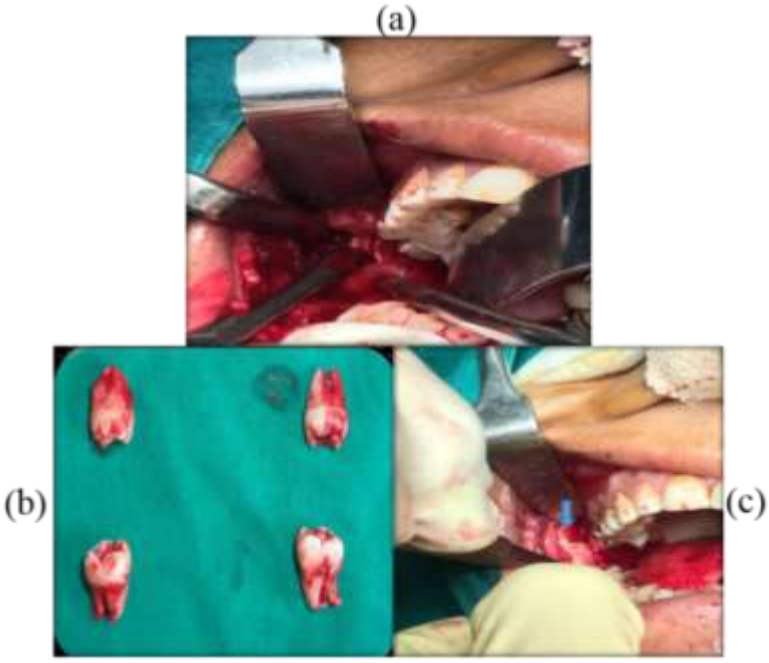

Fig 2: Intra-operative. (a) Intra-oral fibrotomy (b) Removal of 3rd molars (c) Intra-oral coronoidotomy – Cut from medial to lateral (see arrow)

Step 4: Fibrotomy
The fibrous bands were palpated to assess the extent of the incision. Bilateral intraoral 'Y' incision (two wings of Y towards the corner of mouth) was given using no. 15 blade along buccal mucosa at the level of occlusal plane avoiding injury to the Stenson's duct orifice. (Fig. 2a) Initial fibrotomy with knife was enhanced further by manipulation with finger. The incision extended posteriorly to pterygomandibular raphe and anterior pillar of the fauces (to the extent of fibrosis) using a long and angulated BP handle. The incision was extended to the depth of the submucosal layer and the wound created was further freed by manipulating with fingers and/or curved Hemostat until no fibrotic band was appreciated. The mouth was then forced opened using Heister's jaw stretcher and IID was recorded. Fibrotomy done on both cheeks alternately. Attempt to detach the attachment of masseter and medial pterygoid muscle was made.

Step 5: Removal of maxillary 3rd molars
Since most patients in this study complained pain in partially and/or impacted 3rd molars, teeth no 18 and 28 were removed at this stage. (Fig. 2b)

Step 6: Intra-oral coronoidotomy
Fibrotomy incision was extended vertically along the anterior border of ramus upto the tip of coronoid process. Overlying tissue and temporal muscle fibres were detached with caution till the coronoid process bone was appreciated. Sigmoid notch was hooked with condylar retractor. Pronged L-retractor was used to keep the tip of coronoid process exposed for further manipulation. Using a micromotor bur no. 18, the coronoid process was cut at an angle of 45 degree, under copius saline irrigation, by oscillating the bur medio-laterally with controlled force. (Fig. 2c) Final splitting of the cut coronally was done with an upwards facing curved osteotome. No attempt was made to remove the cut portion of coronoid. Same procedure was carried out on contralateral side.

Step 7: Removal of mandibular 3rd molars
Teeth no. 38 and 48 were removed and mouth opening was again recorded. Sharp cusps of all other teeth were smoothened. Free condylar movements were checked. A deliberate attempt to dislocate the TM joint was elicited to confirm that no untoward injury (fracture) of the condyle during splitting of the coronoid bone.

Step 8: NL flap grafting
A flap was designed on the nasolabial fold and with calculated length and width to cover the intraoral fibrotomy defect with mouth open without tension. Ideal length:width ratio was 3:1. The tip of the outlined flap was extended approximately 15 mm inferior to the medial canthus of eye, while the width depending upon the fibrotomy defect in mouth open position. The modiolous area was outlined with a diameter of 1 cm and at the distance of 1 cm lateral to the angle of the mouth. (Fig. 3a) Local anaesthetic solution was infiltrated and a subdermal skin incision was made on the marked NL flap except the area of modiolous which was incised only at the supradermal depth. The NL flap was raised in one plane taking care not to disturb the underlying facial muscle. (Fig. 3b) Extraction of 2nd molar, if expected to cause trauma to the nasolabial flap, is recommended. In this study, this anticipation was not observed in any of the case. Sharp cusps of all the teeth were smoothened. The modiolous was de-epithialised and a small tunnel was made to push the nasolabial flap intraorally. The tip of the transposed nasolabial flap was sutured at the RMT area whereas the margins with upper and lower margins of the fibrotomy defect, with 4-0 vicryl suture. Mattress sutures were also taken for better adherence of the NL flap to the bed of fibrotomy defect. (Fig. 3c) The facial NL defect area was undermined laterally and wound closed in layers after achieving proper haemostasis. (Fig.3d) Similar procedure was carried on contralateral side. Ryle's tube was passed and secured in position.

Fig. 3: NL flap. (a) Flap design (b) Flap elevation (c) Intra-oral suturing (d) Extra-oral suturing

Post-operative management

Ryle's tube was removed after 48 hrs. All the patients were given antibiotic coverage and liquid diet for one week. Patients were discharged after 3 days. Mouth opening was measured and postoperative complications were assessed. Intensive physiotherapy was started using Heister's mouth gag after 1 week. Oral hygiene was maintained by regular intraoral flushing with povidine iodine solution. Patients were trained to continue the physiotherapy exercises daily and maintain the oral hygiene.

Follow up

Extra-oral suture were removed on 15th Day. With strict instructions regarding continuation of mouth opening exercises, discontinuation of habit, and maintaining oral hygiene, patients were recalled for follow-up and mouth opening was noted at 15 days, 1 month, 3 months, 6 months, and 12 months. Wound healing was observed. The results were then analysed.

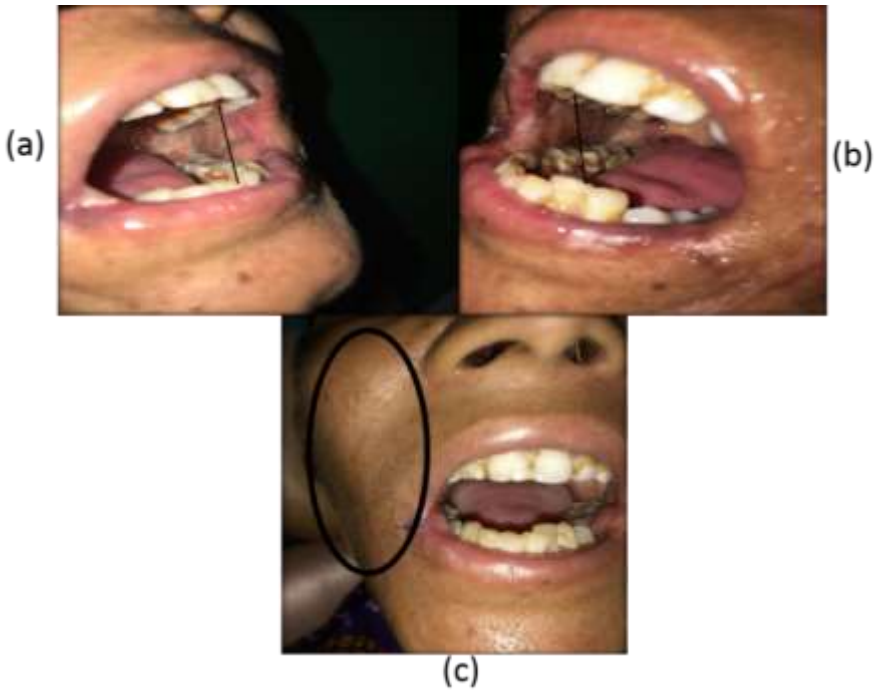

Fig. 4: (a, b) 3 months follow up showing flap adaptation & IID – 30mm (c) Extra-oral healing – absence of scar.

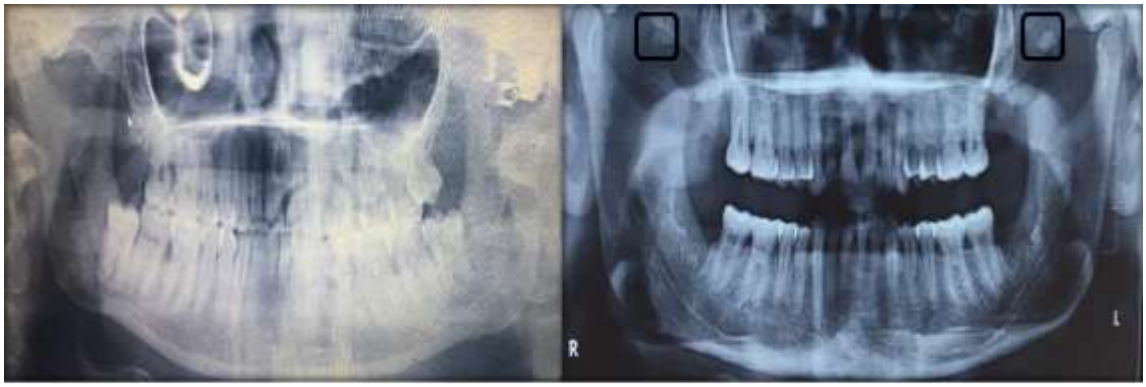

Fig. 5: OPG. (a) Pre-operative (b) Post-operative showing coronoiodotomy

Results

Age and Sex

10 patients were included in the study, with the age group of between 20 years and 60 years. 6 patients were male, and remaining 4 females. Hence with the sex predilection seemed to favour males with Male:Female ratio of 3:2. (Table 1)

Table 1: Details of the patients

Patients	Age/Sex	Chief complaints			Habits				Pre-operative mouth opening (In mm)	Sites involved							Operative procedure (B/L)		Post-operative mouth opening (In mm)						
		Trismus	Burning	Pain	Type	Duration (In years)	Frequency (Packets/day)	Associated habit		Buccal mucosa	Palatal mucosa	Labial mucosa	Retromolar region	Anterior facial pillar	Tongue	Uvula	Fibrotomy + 3rdmolars removal	Coronoidotomy	NL flap grafting	Immediate post-operative mouth opening	1st week	15 days	1 month	3 months	6 months	12 months	18 months
1	21/M	Yes	Yes	Yes	Gutkha	6-7	2-4	-	8	P	P	P	P	P	P		P	P	P	**45**	**27**	**31**	**28**	**27**	**28**	**27**	**30**
2	25/F	Yes	No	Yes	Betel nut	8-10	5-6	Alcohol	5	P	P		P	P			P	P	P	**40**	**24**	**30**	**28**	**28**	**32**	**30**	**34**
3	42/M	Yes	No	Yes	Betel nut	5-6	10	Smoking	3	P	P	P	P		P		P	P	P	**45**	**26**	**28**	**30**	**32**	**34**	**36**	**38**
4	56/F	Yes	Yes	No	Gutkha	3	10-20	-	5	P			P	P		P	P	P	P	**42**	**30**	**32**	**29**	**30**	**34**	**36**	**36**
5	60/M	Yes	No	Yes	Gutkha	8-10	12	Smoking + + Alcohol	10	P	P	P	P		P		P	P	P	**50**	**28**	**30**	**32**	**34**	**35**	**38**	**39**
6	58/M	Yes	Yes	No	Gutkha	10	8	-	12	P			P	P		P	P	P	P	**45**	**28**	**30**	**32**	**34**	**35**	**36**	**38**
7	55/F	Yes	Yes	Yes	Betel nut	12	8-10	Alcohol	14	P	P	P	P	P	P		P	P	P	**40**	**28**	**30**	**32**	**34**	**36**	**38**	**39**
8	26/F	Yes	No	Yes	Gutkha	2	12-15	Smoking	2	P	P		P	P		P	P	P	P	**45**	**26**	**28**	**29**	**30**	**33**	**34**	**39**
9	50/M	Yes	Yes	Yes	Gutkha	15	10	Smoking + + Alcohol	5	P		P	P	P		P	P	P	P	**45**	**24**	**26**	**28**	**29**	**32**	**34**	**35**
10	45/M	Yes	No	Yes	Betel nut	20	5-10	Alcohol	6	P	P		P		P		P	P	P	**46**	**28**	**32**	**33**	**34**	**36**	**37**	**39**

Habits and Duration

All the patients in the study had habits which had abused the oral mucosa and had given a history of restricted mouth opening. 6 patients had gutkha (betel nut, tobacco and katha) chewing, and 4 patients had habit of chewing pure betel nut. Duration of habit ranged from minimum 2 years to maximum of 20 years. The frequency varied from minimum 2-4 packets/day to maximum of 10-20 packets/day. (Table 1)

Symptoms

Most of the patients in our study presented with complain of trismus (33.4%), burning sensation with trismus (26.6%) and burning sensation, trismus along with pain in third molars (40%). (Table 1)

Signs

Blanching was evident in different areas in the oral cavity depending on the habit. The most commonly and severely affected were the buccal mucosa, followed by the palatal and labial mucosa, retromolar area, and faucial pillars. (Table 1)

Clinical and functional staging

Clinical and functional staging were done based on classification given by S. M. Haider [13]. Accordingly 20% of the subject belonged to B' group i.e. with functional IID ranging from 11 mm to 19 mm and 80% belonged to 'C' group i.e. IID ≤ 10 mm. None of the patient came under group A (i.e. with IID ≥ 20 mm). (Table 1)

Pre-operative: Pre-operative IID ranged from 2 mm to 14 mm (mean 7 mm). (Table 1)

Intra-operative: In all the patients an IID of about 40 mm to 50 mm was achieved (mean 44.3 mm). (Table 1)

Post-operative: 1 week post-operative mouth opening ranged from 24 mm to 30 mm (mean 26.9 mm). However 15 days post-operative mouth opening ranged from 26 mm to 32 mm (mean 29.7 mm) and the 1 month follow-up showed the mouth opening ranging from 28 mm to 33 mm (mean 30.1 mm). Again the 3 months follow-up showed the IID ranging from as low as 27 mm to as high as 34 mm (mean 31.2 mm). (Fig. 4a) Finally the 6 months follow up showed a range from 28 mm to 36 mm (mean 33.5 mm), 12 months follow up showed a range from 27 mm to 38 mm (mean 34.5 mm), and 18 months follow up showed a range from 30 mm to 39 mm (mean 36.7 mm). (Table 1)

Complications: Intra-oral + Extra-oral.

All the patients, treated with NL Graft, showed good result in taking up of the graft. Intra-oral hair growth over the transported flap was a significant feature observed in males. Extra-oral scar started fading after 2-3 months and almost complete scar disappearance was seen after 6 months. (Fig. 4c)

Discussion

Patients having pre-operative IID between 2 mm to 14 mm were planned for surgical excision of fibrous bands, intraoral coronoidotomy, and removal of all 3rd Molars. Like any other wound, raw areas in the oral cavity are prone to infection, contraction, and scarring. Hence, there is a need to cover the defect with graft after the fibrotic bands are released. Coverage of the raw area using NL flap as a grafting technique, was employed.

The versatility and usefulness of the NL flap is well known. The flap has a good vascular supply; hence survival rate is high. The blood supply of the NL flap is attributed mainly to the facial artery.

After release of fibrotic bands a mean forced intra-operative IID of 44.3 mm was achieved. On the first post-operative day a mean unforced mouth opening of 21.7 mm was achieved. Mean mouth opening of 33.5 mm was achieved at 6 months, 34.5 mm at 12 months, and 36.7 mm at 18 months.

All patients were prescribed nutritional supplements and antioxidants. Vigorous mouth opening exercise was advised to all patients.

In this study, using the NL flap, IID of over 35 mm was achieved at the end of follow up period which ranged from 1 to 12 months.

Important considerations for NL flap are:-

- Length to width ratio = 3:1.
- Tip of the flap = 1.5 cm below the medial canthus of eye.
- Mesial margin of NL flap: 2-3mm distal to the NL fold.
- Modulous: 1 cm away from the corner of mouth.
- Diameter of the modulus: 1 cm.
- Thickness of flap: Subdermal (leaving facial muscles intact).
- De-epithelization of modiolus: must.
- Securing the flap with mattress suture.
- Closure of donor site by undermining and advancing (outer) lateral margin.

The NL flap has advantages such as, the donor site is 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 [6].

The disadvantage of this technique of grafting is the need for a second stage procedure. In some of the cases where fistula results following tunnelling for inserting the flap or/and commissural correction. Both these mishaps have been avoided by de-epithelising the modiolus in the buccal tunnel portion. There may be other problems, such as cheek biting or dental trauma to the flap or a bulky base of the flap passing over the alveolus. Possible post-reconstruction outcomes are flap necrosis due to hematoma, infection, or tension on the suture line, where further surgery may be required [12]. Although most complications are of inconsequential nature and the surgeon must observe due diligence when using this flap.

Other common post-operative complications following NL flap have been the scar in the facial region, obliteration of the natural depth of the NL fold and growth of unwanted hair intraorally in males. This can be prevented by properly outlining the flap. There may also be a pin cushioning effect around the NL fold, which could be avoided by using a rhomboid design. Restricted width of the flap preclude its usage in wide and excision in extensive OSMF.

Flap survival depends on the early recognition of flap compromise, such as ischemia and necrosis. Smoking is also associated with an increased risk of flap failure because of its deleterious effects by aggravating hypoxia and vasoconstriction. Hematoma may result from inadequate hemostasis and drug induced coagulopathy, hence medications inducing coagulopathy, for example, acetylsalicylic acid and nonsteroidal anti-inflammatory drugs and vitamin E, should be avoided for at least 2 weeks prior and 1 week after surgery [11].

Hematoma formation may reduce tissue perfusion and can lead to ischemia and necrosis. Keloid at donor site has also been reported.

Management of OSMF by NL flap techniques with good

postoperative exercises enables gaining disease free functional mouth opening with minimal cosmetic deformity at the donor site. Adequate surgical correction both active and passive physiotherapy are crucial in the post-operative period to overcome secondary contractures and to maintain a good opening of mouth.

Patient's regular follow-up was done for 18 months. Post-operatively, we noted progressive increase in the IID enabling the patient to chew even semi-solid to solid food. Extra-oral scar was minimal and was well accepted by all the patients. There was no morbidity of the donor site. Facial nerve weakness was not observed in any of the cases. The only drawback was intraoral hair growth in few male patients which in few months eventually subsided with mucosalization of the graft tissue.

Conclusion

OSMF is one of the most poorly understood and unsatisfactorily treated diseases. Younger the age, the more rapid the progression of the disease. 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. It may be concluded from this study that the NL flap is a simple and viable option for the reconstruction of oral defects in a low resource setting where microvascular expertise is not available. Random pattern NL flap is a very good option for intraoral reconstruction of fibrotomy defect in surgical management of OSMF with excellent functional and cosmetic results and with minimal complications.

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