



Comparative Analysis of Collagen Membrane, Buccal Fat Pad and Split-Thickness Skin Graft in the Surgical Management of Oral Submucous Fibrosis- A Retrospective Study

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KEYWORDS

Oral Submucous Fibrosis, Buccal Fat Pad, Collagen Membrane, Split-Thickness Skin Graft, Reconstruction, Trismus.

ABSTRACT:

Background: Oral Submucous Fibrosis (OSMF) is a chronic, progressive, and potentially malignant oral disorder predominantly associated with areca nut chewing. It causes burning sensation, mucosal rigidity, and trismus, significantly impairing oral function. In advanced cases, surgical intervention with suitable reconstruction is required. This study compares the clinical outcomes of collagen membrane grafts, buccal fat pad (BFP) flaps, and split-thickness skin grafts (STSG) in the surgical management of OSMF.

Methods: A retrospective comparative study was conducted on patients with clinically and histopathologically confirmed OSMF who underwent surgical release of fibrotic bands followed by reconstruction using collagen membrane, BFP flap, or STSG. Patients were evaluated for inter-incisal mouth opening, burning sensation (VAS scale), mucosal healing, complications, and patient satisfaction. Follow-up was carried out at 1 week, 1 month, 3 months, and 6 months. Statistical analysis was performed using ANOVA and paired t-test, with $p < 0.05$ considered significant.

Results: All three techniques demonstrated significant improvement in mouth opening and reduction in burning sensation. The BFP group showed superior postoperative mouth opening (34.2 ± 2.1 mm), faster healing, and minimal complications. Collagen membrane grafts provided satisfactory results with ease of use and absence of donor site morbidity, though postoperative mouth opening was slightly less (30.4 ± 2.3 mm). STSG achieved adequate mouth opening (32.1 ± 2.6 mm) but was associated with longer healing time, donor site morbidity, and one relapse case.

Conclusion: Among the techniques compared, the buccal fat pad flap provided the most favorable outcomes, balancing healing, functional recovery, and patient comfort. Collagen membranes represent a promising alternative, particularly in patients where donor site morbidity must be avoided. Split-thickness skin grafts, though effective, carry higher morbidity and should be reserved for select cases. Future multicentric studies with larger cohorts and advanced biomaterials may further refine reconstructive strategies in OSMF surgery.

1. Introduction

Oral Submucous Fibrosis (OSMF) is a chronic, progressive, scarring disorder of the oral cavity, predominantly associated with the habitual chewing of areca nut, betel quid, and tobacco [1]. First described by Schwartz in 1952, the condition has since been

recognized as a major health problem across the Indian subcontinent and Southeast Asia, with growing reports from Western countries due to migration and cultural practices [2]. The global prevalence of OSMF has been estimated to range between 0.1% and 4%, with India alone contributing a significant disease burden [3]. The pathological hallmark of OSMF is abnormal collagen



deposition and subsequent fibrosis of the oral mucosa, leading to blanching, burning sensation, reduced mucosal elasticity, progressive reduction in mouth opening, and in advanced cases, difficulty in speech and swallowing. Of particular concern is its premalignant nature, with a malignant transformation rate ranging from 7% to 13%, making effective management not only a matter of symptom control but also cancer prevention [4].

The management of OSMF varies depending on the severity of the condition. Conservative approaches, such as habit cessation, dietary supplements, antioxidants, and intralesional injections of corticosteroids, hyaluronidase, or placental extracts, are reserved for early stages. However, in moderate to advanced cases with significant trismus and fibrotic changes, surgical intervention becomes the treatment of choice[5]. The surgical protocol generally involves excision or release of fibrotic bands followed by reconstruction of the raw surgical defect to restore oral function and prevent relapse. The success of surgery is highly dependent on the choice of reconstruction technique, which should ensure adequate mouth opening, promote re-epithelialization, and minimize postoperative morbidity [6].

Several reconstructive options have been described, each with specific advantages and limitations. Split-thickness skin grafts (STSG) are widely used due to their ability to cover extensive defects and provide durable lining, but they are associated with drawbacks such as donor site morbidity, delayed adaptation to the oral environment, and occasional graft contracture [7]. The buccal fat pad (BFP), a well-vascularized, pedicled flap, has gained popularity owing to its rich blood supply, ease of harvesting, minimal donor site complications, and predictable healing outcomes, although its use may be restricted to smaller defects. Collagen membranes represent a newer bioengineered alternative, offering a biocompatible, resorbable scaffold that encourages rapid epithelialization, avoids donor site morbidity, and shortens operative time. However, long-term evidence regarding resistance to fibrosis recurrence is still evolving [8].

In this context, a comparative analysis of collagen membrane, buccal fat pad, and split-thickness skin graft reconstruction in the surgical management of OSMF is of great significance. Evaluating their relative clinical

outcomes, healing potential, complications, and patient satisfaction can provide valuable insights to guide clinicians toward selecting the most effective reconstructive modality.

2. Materials and Methods

Study Design and Setting: A retrospective comparative study was conducted on patients diagnosed with Oral Submucous Fibrosis (OSMF) who underwent surgical management in the Department of Oral and Maxillofacial Surgery between August 2023 and August 2024. Informed consent was taken from all patients.

Sample Selection: A total of 45 patients with clinically and histopathologically confirmed OSMF presenting with reduced mouth opening were included in the study. Patients were divided into three groups based on the reconstructive technique used after surgical release of fibrous bands:

- **Group A:** Collagen membrane graft (n = 15)
- **Group B:** Buccal fat pad (BFP) flap (n = 15)
- **Group C:** Split-thickness skin graft (STSG) (n = 15)

Inclusion Criteria:

- Patients with OSMF presenting with inter-incisal mouth opening ≤ 25 mm.
- **Patients** with no prior surgical intervention for OSMF.
- Age **between** 20–60 years.
- **Willingness** for follow-up.

Exclusion Criteria:

- Patients with systemic diseases contraindicating surgery.
- Previous reconstructive surgery for OSMF.
- Patients with recurrent or malignant lesions.

Surgical Procedure: All patients underwent surgical release of fibrotic bands under general anesthesia using a standard protocol. Following adequate release, reconstruction of the raw buccal mucosal defect was carried out using one of the three techniques:



- **Collagen Membrane:** Sterile type I collagen membrane was secured over the defect with resorbable sutures.
- **Buccal Fat Pad Flap:** Mobilization of the buccal fat pad was performed via blunt dissection, and the flap was advanced and sutured to cover the defect.
- **Split-Thickness Skin Graft:** Skin graft harvested from the thigh was applied to the defect and stabilized with tie-over dressing.

Postoperative Care and Follow-Up: All patients were prescribed analgesics, antibiotics, and physiotherapy in the form of mouth-opening exercises using wooden spatulas. Follow-up was carried out at 1 week, 1 month, 3 months, and 6 months.

Outcome Measures: The following clinical parameters were recorded and compared:

1. **Inter-incisal mouth opening** (in mm) – preoperative, intraoperative, and at each follow-up.
2. **Healing and epithelialization** – evaluated clinically.
3. **Complications** – including graft failure, infection, or donor site morbidity.
4. **Patient satisfaction** – based on functional improvement and comfort.

Statistical Analysis: Data were compiled and analyzed using SPSS software version 23. Mean values and standard deviations were calculated. Inter-group comparison was performed using ANOVA and post-hoc Tukey test, while intra-group differences were analyzed using paired t-test. A *p-value* <0.05 was considered statistically significant

3. Results

Table 1: Comparative Outcomes of Reconstruction Techniques in OSMF

Parameter	Collagen Membrane (CM)	Buccal Fat Pad (BFP)	Split-Thickness Skin Graft (STSG)
Pre-op Mouth Opening (mm)	14.5 ± 2.1	14.2 ± 1.9	14.8 ± 2.3
Post-op Mouth Opening (mm)	30.4 ± 2.3	34.2 ± 2.1	32.1 ± 2.6
Healing Time	3–4 weeks	2–3 weeks	4–5 weeks
Donor Site Morbidity	None	Minimal	Moderate
Relapse at 6 Months	Nil	Nil	1 case

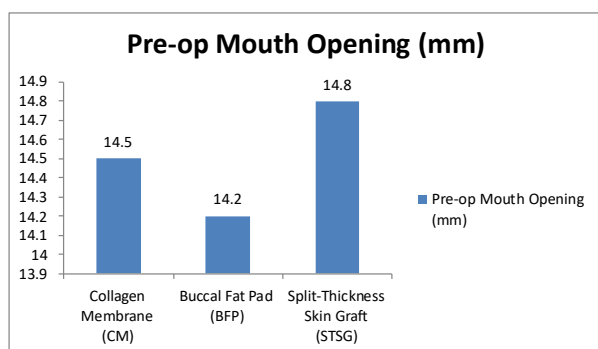


Figure 1. Pre- op mouth opening in Group collagen membrane, Buccal fat pad and Split-thickness skin graft

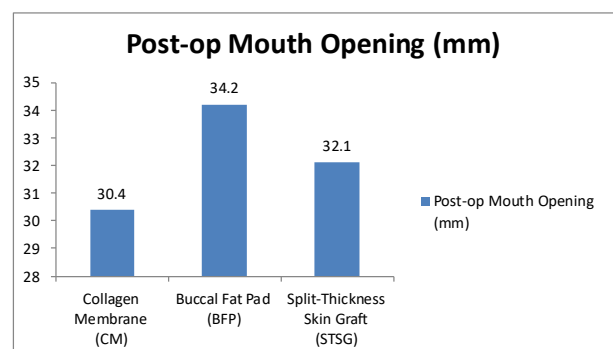


Figure 2. Post op mouth opening in Group Collagen membrane, Buccal fat pad and Split Thickness Skin Graft

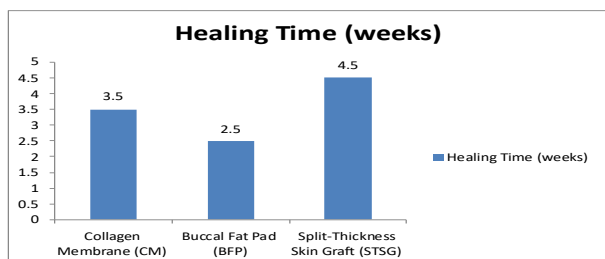


Figure 3. Healing time in weeks

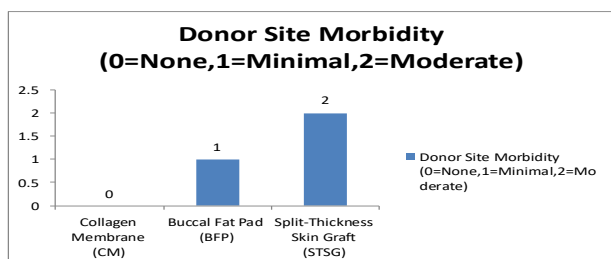


Figure 4. Graph showing donor site morbidity in groups

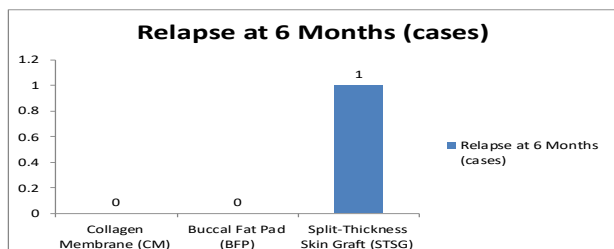


Figure 5. Graph showing relapse at 6 months in groups

4. Discussion

Oral Submucous Fibrosis (OSMF) represents a debilitating, premalignant disorder characterized by progressive fibrosis of the oral mucosa leading to stiffness, intolerance to spicy foods, burning sensation, and most importantly, limitation in mouth opening. The surgical management of OSMF involves excision or release of fibrotic bands followed by reconstruction of the raw area with a suitable graft or flap. The choice of reconstructive modality significantly influences postoperative outcomes, healing, and relapse rates. The present study compared three reconstructive techniques—collagen membrane (CM), buccal fat pad (BFP), and split-thickness skin graft (STSG)—to assess their effectiveness in improving functional and clinical outcomes.

In this study, all three groups demonstrated significant improvement in mouth opening following surgical

intervention. The BFP group showed the highest postoperative mouth opening (34.2 ± 2.1 mm), followed by STSG (32.1 ± 2.6 mm) and collagen membrane (30.4 ± 2.3 mm). These results highlight the superior efficacy of BFP, which can be attributed to its rich vascular supply, ease of mobilization, and adaptability to intraoral defects. Several studies, including those by Tideman et al. and Yeh, have emphasized the predictable healing and low complication rates of BFP, making it an ideal choice for intraoral reconstruction.

Collagen membrane grafting, although associated with slightly less postoperative mouth opening, provided distinct advantages such as elimination of donor site morbidity and relatively simple application. Healing occurred in 3–4 weeks, which was slightly delayed compared to BFP but still within an acceptable range [9]. Literature suggests that collagen promotes faster granulation tissue formation, serves as a scaffold for epithelial migration, and minimizes patient discomfort. These properties make collagen membranes particularly useful in patients who are medically compromised or unwilling to undergo donor site surgery [10].

The STSG group demonstrated adequate mouth opening and acceptable results but was associated with longer healing time (4–5 weeks) and moderate donor site morbidity, including pain and scarring at the donor site. Additionally, one relapse case was reported in this group, which could be due to graft contraction or partial graft loss, both of which are known limitations of STSG in the moist, mobile intraoral environment. Previous reports also caution about the higher failure rates of STSG in oral defects, especially without meticulous postoperative care.

An important aspect observed was the absence of relapse in both BFP and collagen membrane groups, suggesting that these methods provide more stable and lasting results. The robust vascularization of BFP ensures survival and epithelialization, whereas collagen membrane integrates with host tissue and reduces chances of fibrosis recurrence.

Overall, BFP emerged as the most reliable technique, combining superior functional improvement, faster healing, minimal donor site morbidity, and absence of relapse. Collagen membrane, though yielding slightly lesser mouth opening, is advantageous due to its simplicity and non-invasive nature. STSG, while



effective, remains less favorable due to higher morbidity and risk of relapse.

The findings of this study underline the necessity of tailoring treatment to patient-specific needs. While BFP may be considered the gold standard in most cases, collagen membranes hold promise as a minimally invasive alternative, especially for patients with contraindications to flap or graft harvesting. Larger randomized controlled trials with extended follow-up are warranted to establish long-term outcomes, evaluate recurrence rates, and refine surgical protocols.

5. Conclusion

This comparative study demonstrates that surgical management of Oral Submucous Fibrosis with appropriate reconstruction leads to significant functional improvement. Among the techniques evaluated, the buccal fat pad (BFP) flap proved to be the most effective in restoring inter-incisal opening, ensuring rapid epithelialization, and minimizing complications. Collagen membrane grafts offered the advantages of easy application and absence of donor site morbidity, making them a promising alternative in selected patients. Split-thickness skin grafts (STSG), while effective for defect coverage, were associated with higher morbidity and delayed healing, thereby limiting their clinical preference. Overall, the BFP flap remains the most dependable reconstructive option, while collagen membrane provides a viable substitute in specific cases.

6. Future Scope

Further research is warranted through multicentric, randomized controlled trials with larger patient cohorts and long-term follow-up to confirm these findings. Exploration of advanced biomaterials, including growth factor-enriched scaffolds, platelet concentrates, and stem cell-based therapies, may provide improved mucosal regeneration and reduce recurrence. Incorporating these novel strategies with conventional surgical protocols could establish more predictable and minimally invasive solutions for the management of OSMF.

7. Declarations

Consent for publication

All necessary consents were obtained from all participants for treatment and publications

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