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CASE SERIES

THE ROLE AND SIGNIFICANCE OF MYRIAD MATRIX SOFT TISSUE BIO-SCAFFOLD IN ORAL CAVITY TISSUE RECONSTRUCTION POST -CANCER SURGERY-CASE SERIES

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ABSTRACT

Reconstruction of the soft tissue defects post cancer surgery remains a significant clinical challenge due to the hostile environment of the oral cavity, characterised by polymicrobial colonization, constant movement and presence of high moisture levels persistently. Conventional techniques like the split-thickness grafts and pedicled grafts have been widely used. However, they entail donor site morbidity, prolonged surgical time and variable esthetic and functional outcomes. The Myriad matrix, a decellularized ovine forestomach matrix (OFM), represents a novel biologically active scaffold that supports rapid tissue integration, angiogenesis, and epithelialization. This case series presents two patients with histopathologically confirmed oral squamous cell carcinoma (OSCC) involving the right buccal mucosa and the lateral aspect of the tongue. Both the patients underwent oncologic resection, followed by soft tissue reconstruction using the Myriad matrix soft tissue bio-scaffold. In both the cases, the matrix contributed a stable scaffold for closure, eliminated the need for autologous tissue harvesting, and allowed for complete mucosalization of the defect site. Postoperative follow-up revealed excellent healing, with no evidence of graft-related complications. Functional recovery, including speech, deglutition, and tongue mobility, was well re-established. These findings emphasize the clinical advantages of OFM in oral tissue reconstruction, highlighting its reliability, ease of use, and regenerative potential. The Myriad matrix may thus serve as a valuable alternative in reconstructive strategies, particularly in resource-limited surgical settings.

Keywords*:* Oral squamous cell carcinoma, Soft tissue defect, Wound Healing, Myriad matrix, Ovine Forestomach Matrix, Biocompatible Materials

INTRODUCTION

Reconstruction of soft tissue defects, precipitated by the surgically excised tumorous lesions, present significant challenges to clinicians during management. The oral cavity, in particular, is considered a dynamic and an adversarial habitat owing to the colonization of microbial bioburden, exhibition of perpetual motion and persistently high moisture levels [1]. Oral cancer potentially originate from the squamous cells and later spreads to the other body parts if not intervened promptly. The oral squamous cell carcinoma (OSCC), being the most common malignancy occurring in the head and neck region exhibits an 80% 5-year survival rate at stage I, but drastically drops to merely 15% at stage IV. Management involves either unimodal or multimodal approach encompassing surgery, chemotherapy and radiotherapy. In addition, reconstruction of the post-surgical defect and further oral rehabilitation plays a key role in esthetics and functional outcomes of management strategies [2–4]. Reconstructive techniques traditionally encompasses, split thickness grafts, pedicle grafts or free soft- tissue grafts. However, they entail their own limitations, including extended surgical or operative time, high cost, donor site morbidity, and unpredictable functional and esthetic outcomes [5]. In this respect, several biological scaffolds have been explored for managing such clinical scenarios, and the Myriad matrix soft-tissue bio scaffold, which is the ovine forestomach matrix (OFM) has been widely investigated and has gained immense attention in soft tissue reconstruction [6].

OFM is an extra cellular matrix (ECM) which is the decellularized form, derived from the forestomach of sheep. It consists of matrisomal proteins, retaining its native ECM elements, along with other essential proteins and growth factors such as fibroblast growth factor (FGF), epidermal growth factor (EGF), and connective tissue growth factor (CTGF). These structural elements have been known to play crucial roles in stimulating angiogenesis, regulating inflammatory status, modulating cellular proliferation and differentiation, all of which embrace towards tissue regeneration [7]. The structural properties of OFM, including its high porous nature accelerate its action as a promising bioscaffold for new tissue growth in environments, where the conventional grafts may fail to accomplish adequately [8]. OFM has been successfully integrated in reconstruction of complex soft tissue defects, including those involved with bone exposure or neurovascular bundles [9]. Recent documentations have emphasized the successful utilisation of OFM in the reconstruction of oral cavity defects, especially those involving glossectomies, or excision of growths, involving the buccal mucosa and floor of the mouth. Su *et al.*, have reported successful glossectomy defect reconstruction using OFM grafts. It is considered to possess immense potential in tissue regeneration owing to its ability to rapidly integrate within the surrounding tissue architecture, complete epithelialisation, and minimal or no scarring [10]. In addition, graft related infections or complications have not been observed, even when they are used with chemotherapy. Owing to its superiority over other commercially available ECM products such as cost effectiveness, stability, adaptability to different defect geometries, and ease of handling, OFM has evolved as an invaluable gratuity in the reconstructive spectrum, particularly in the resource-constrained circumstances. The current case series describes the successful management of squamous cell carcinoma of the tongue and the buccal mucosa which were surgical excised and reconstructed with the Myriad soft tissue matrix.

Case description 1.

A 55-year-old male patient reported to the Oral and Maxillofacial Surgery outpatient department at Sri Ramachandra Dental College, Chennai, India, with a primary complaint of an ulcer on the right side of his cheek, which was non healing and was persistent for the past three months. The patient presented that he was in normal health until three months ago when he noticed a sharp tooth in the upper right posterior region. The impingement and irritation from this tooth led to recurrent trauma against the inner aspect of his cheek, resulting in the development of an ulcerative lesion. Over time, this ulcer gradually increased in size, and the patient commenced to experience a burning sensation and continuous, gnawing pain. On general extraoral examination, the patient was conscious, co-operative and oriented. Intraoral examination revealed an ulceroproliferative lesion approximately 4 × 3 cm in size, located on the right buccal mucosa. Anteroposteriorly, the lesion extended about 3 cm from the right oral commissure to the right retromolar trigone. Superoinferiorly, it spanned from 1 cm above the occlusal plane of the right posterior teeth down to the lower mucovestibular region, involving the gingivobuccal sulcus. The lesion appeared erythematous with irregular margins. No bleeding or discharge was observed. On palpation, the ulcer was indurated and mildly tender. There was no clinical evidence of palpable lymphadenopathy. The patient's past medical history revealed a recent diagnosis of hypertension, for which he has not yet commenced any medication. There was no other contributory medical history. There was no relevant past surgical history, or known drug allergies.

Figure 1. 1a. Preoperative profile picture, 1b. Incisional biopsy suture wound of suspected oral squamous cell carcinoma of the right buccal mucosa

An incisional biopsy of the lesion was performed. He was subsequently advised to undergo a contrast-enhanced computed tomography (CECT) scan which identified a subcentimetric right submandibular lymph node, suggesting possible early nodal involvement. The histopathological examination of the biopsy confirmed the presence of a well-differentiated squamous cell carcinoma (SCC) involving the right buccal mucosa. The CECT findings corroborated with this diagnosis and also revealed a right submandibular lymph node measuring less than 1 cm in diameter. The patient has since been admitted for further evaluation and management. Based on clinical, histological, and radiological findings, a final diagnosis of a well-differentiated squamous cell carcinoma of the right buccal mucosa was made.

Surgical management

The patient was brought to the operating room and placed in a supine position. After administration of intravenous general anesthesia, left nasal intubation was performed. The patient was catheterized, and both intraoral and extraoral regions were prepared with 10% povidone-iodine solution. Sterile draping was completed, and markings for a transverse skin crease incision were made.

A skin incision was placed, and subplatysmal dissection was carried out. The sternocleidomastoid (SCM) muscle was exposed and retracted laterally. Dissection was performed along the anterior border of the SCM, allowing identification of the internal jugular vein (IJV). Lymph node dissection was carried out at Levels IIA and III. The spinal accessory nerve (SAN) was traced, identified, and preserved during the procedure. Level IIB lymph nodes were then carefully resected. Dissection continued anteriorly, exposing the anterior and posterior bellies of the digastric muscle. The marginal mandibular nerve was identified and secured. The submandibular gland, along with Level IB lymph nodes, was excised, and the facial artery and vein were ligated. Dissection proceeded into the submental triangle, and Level IA lymph nodes were removed. The surgical area was irrigated thoroughly with saline and betadine, and a Romovac drain was placed.

Teeth, 42, 44, 14, 15, 17, and 18 were extracted. A wide local excision of the lesion involving the right buccal mucosa was performed in conjunction with a marginal mandibulectomy extending from tooth region 42 to 48. A frozen section from the posterior margin was sent for histopathological analysis, which confirmed the absence of malignant cells. Following copious irrigation, intraoral closure was done using the myriad matrix and 3-0 Vicryl sutures. Extraoral closure was completed with 2-0 Vicryl, and skin staples were applied. Final dressing was performed, and the throat pack was removed.

Post-operative care and follow up

Following the procedure, the patient was extubated in a stable condition before being transferred to the Post-Anesthesia Care Unit (PACU). Postoperative care involved effective pain control, strict oral hygiene maintenance,

and scheduled follow-up visits to assess healing progress and minimize potential complications. At the 13-month postoperative followup, the defect site exhibited complete mucosal coverage and excellent healing, with well-integrated buccal tissue and no signs of ulceration, necrosis, or infection. The absence of fibrosis or scarring indicated optimal tissue regeneration, confirming the successful epithelialization and integration of the Ovine Forestomach Matrix (Myriad matrix).

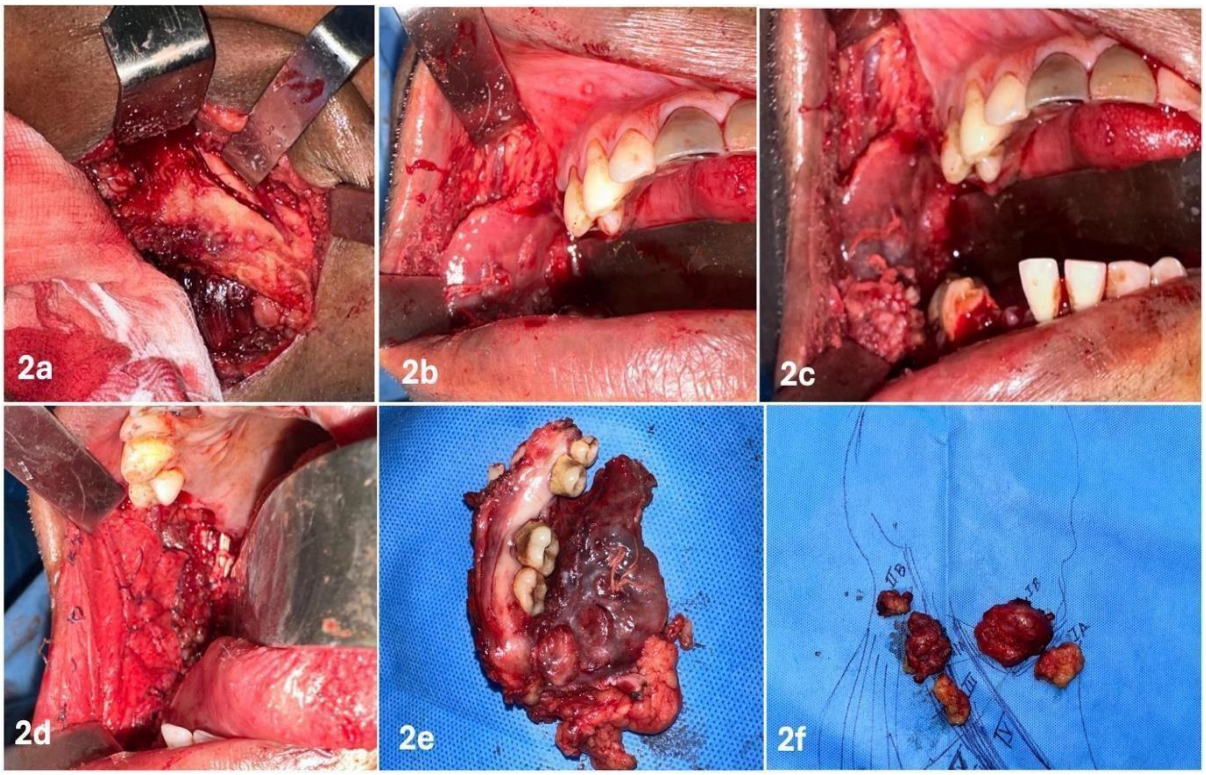

Figure 2. Intraoperative pictures showing 2a. Osteotomy cut for marginal mandibulectomy, 2b and 2c. Wide local incision of the lesion in the right buccal mucosa, 2d. Lesion excised and reconstructed with Myriad matrix, 2e. Excised specimen- buccal mucosal lesion along with marginal mandibulectomy, 2f. Excised specimen showing selective lymph node dissection (level I to III)

Figure 3. 3a. Postoperative image showing no gross deformity at the 13th month follow-up visit, 3b. Intra oral complete mucosalization following myriad application

Case description 2.

A 56-year-old female presented to the outpatient department at a private hospital at Chennai, India, with a primary complaint of irritation caused by a sharp lower right third molar (tooth 48), which was reportedly impinging on the adjacent right lateral border of her tongue. The patient gave a history of a non-healing ulcer over the right side of the tongue which had persisted for several weeks. She had undergone an incisional biopsy 15 days prior, which showed inflammatory cells but was negative for malignancy.

Clinical examination of the oral cavity revealed a non-healing ulcer measuring approximately 0.5 cm × 0.5 cm on the right lateral aspect of the tongue. The ulcer had raised and indurated margins and was supposedly in continuous contact with tooth 48 during speech and mastication. No cervical lymphadenopathy was detected on palpation. Due to the suspicious nature of the lesion, an excision biopsy was performed for a revision surgery to obtain free margin, along with extraction of tooth 48. Histopathological examination of the excised specimen suggested squamous epithelium with underlying neoplasm arranged in sheets and nests composed of large polygonal cells with nuclear pleomorphism, hyperchromasia, increased mitosis and moderate amount of eosinophilic cytoplasm. These features confirmed the diagnosis of moderately differentiated keratinizing squamous cell carcinoma of the tongue.

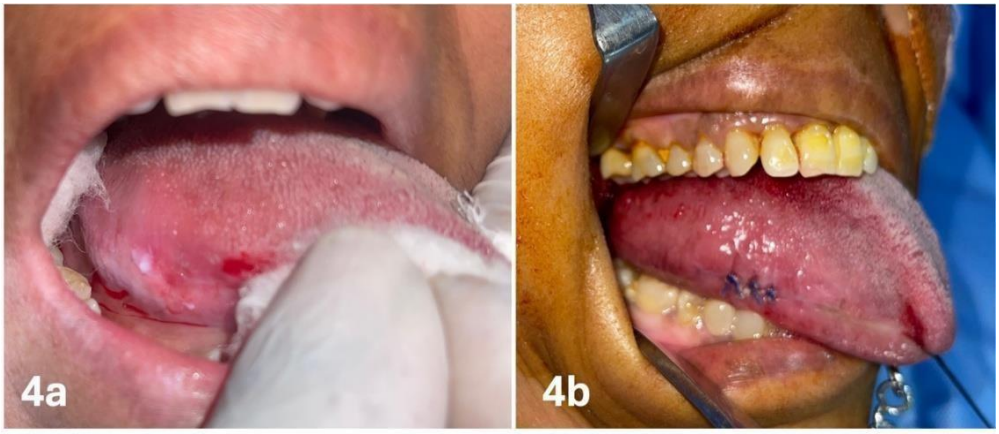

Figure 4. 4a. Intraoral image showing suspicious tender and indurated ulcerative lesion (0.5 cm x 0.5 cm) over the right tongue, 4b. Post-operative sutured wound following the excisional biopsy

Surgical management and post-operative follow-up

Intraoperatively, the lesion was excised with a 1 cm oncological margin, followed by selective neck dissection involving levels I to III. The tongue defect resulted in a partial glossectomy with minimal muscle involvement. Reconstruction of the defect was performed using a myriad (extracellular matrix) graft. Postoperative healing was satisfactory, with the patient exhibiting good tongue movements, speech and deglutition.

Figure 5. 5a. Surgical excision of the lesion, 5b. Excised tongue tissue along with evidence of clear margins, 5c. Myriad matrix soaked in saline before application, 5d. Myriad placed in situ & adapted well by quilting technique

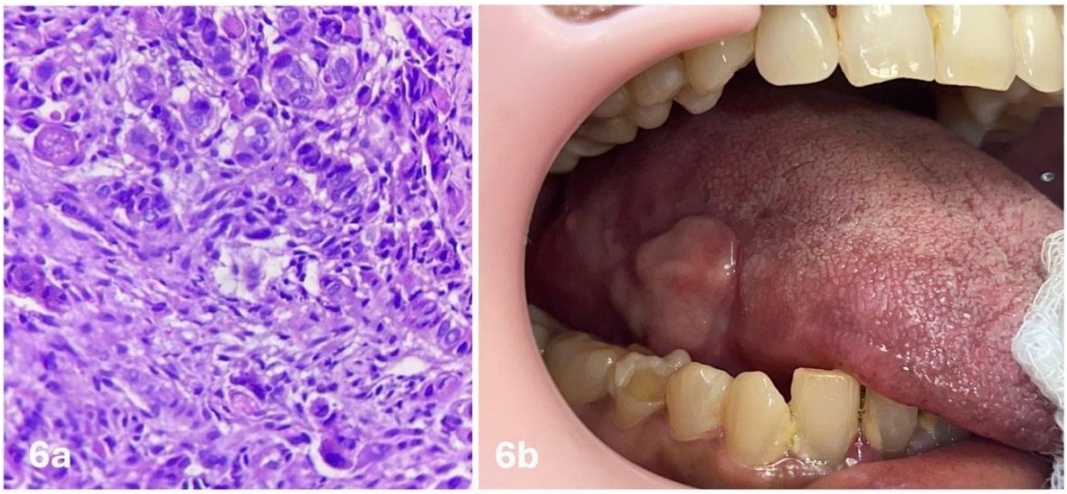

Figure 6. 6a. Histopathological image of the excised specimen suggestive of moderately differentiated keratinizing squamous cell carcinoma, 6b. 2 month post-operative image showing mucosalization of grafted tongue site

DISCUSSION

The management of oral squamous cell carcinoma pose significant challenge to clinicians as it not only involves oncologic resection, but also functional reconstruction of the resultant defect site [11]. In particular, the oral cavity being considered a sensitive site due to its constant mobility and microbial exposure, may not be amenable for an unhindered healing process, thus making the reconstruction of such sites quite demanding to garner long-term function outcomes.

In both the cases described here, the resection of the oral SCC resulted in a sizeable soft tissue defect. While the first case involved a wide excision of the right buccal mucosa, extending to the mandible, the second one warranted a partial glossectomy of the right aspect of the tongue. Each of the case exhibited unique challenges with respect to preserving aesthetics, form and function while minimizing morbidity and achieving superior stability.

In both the patients, the Myriad matrix (OFM) was grafted to the defect site following resection, circumventing the donor site and thus, multiple-step surgical procedures. In the first case with the wide mucosal defect and marginal mandibulectomy, the placement of the Myriad matrix allowed for tension free closure and acted as an ideal scaffold for re-epithelization and tissue integration. The intraoral closure was carried out using the 3-0 vicryl over the matrix and the extra oral closure via staples. The healing was satisfactory and the immediate, post-operative functional outcomes, comprising of speech, mastication, deglutition, and mobility, were adequately re-established. Although marginal mandibular defects are customarily reconstructed using free flaps, in the present case, the Myriad matrix was effectively employed to graft both the marginal mandibular defect and the associated buccal mucosal defect. In the second case, the defect site after partial glossectomy was reconstructed using a single, fine, OFM layer, trimmed and immobilized over the excised area. Post-operative evaluation revealed unexceptional healing, good tongu

movement, phonation, adequate articulation, with no evidence of complication or graft failure.

These findings of the present case series are supported by Su *et al.*, who described similar effective use of the Myriad matrix in tongue defect sites reconstruction. The matrix integration with tissue architecture occurred within three weeks' time with complete mucosal resurfacing and negligible scarring [10]. No adverse events were observed and the patients maintained stable function even with chemotherapy.

In a report by Consorti *et al.*, dermal matrix reconstruction of intraoral SCC resective procedures in 47 patients demonstrated favorable outcomes in buccal mucosal and tongue defects. While two cases of membrane failure were observed, all other patients demonstrated excellent mucosal healing and re-establishment of function at six months follow-up [12]. In addition, these findings echo our own experience with OFM in minimizing morbidity and maximizing functional recovery. Moreover, Bohn and Chaffin in 2020 reported that OFM reconstructed in soft tissue defects on denuded vital structures, showed defect granulation within 1-2 weeks and complete granulation tissue formation with 1-6 weeks [9].

Thus, it is evident that the Myriad matrix renders key advantages in the reconstruction of oral cavity defects, making it a potent alternative to conventional reconstructive biomaterials. Unlike many other biomaterials, it demonstrates tremendous resistance to enzymatic degradation in a saliva-rich environment, ensuring durability amidst the vital phases of healing [13]. Moreover, the matrix also refrained from the necessity of microvascular anastomosis, thus making the overall procedure relatively less technique sensitive.

It has also been suggested that the mucosal lining that regenerates over the matrix highly mimics native oral mucosa. Unlike the split-thickness grafts, that frequently result in keratinized or fibrotic tissue, OFM bolsters the restoration of a soft and pliable, non-keratinized mucosal phenotype, and thus, considered ideal for re-establishing speech, mastication, and deglutition. By and large, these advantages translate to a cut-above in the management of oral SCC patients.

CONCLUSION

The use of the Myriad matrix soft tissue bioscaffold or the OFM in the reconstruction of oral post-cancer excision defects exhibits a viable, efficient, and biologically amenable substitute to conventional reconstructive biomaterials. In our present cases, oral SCC of buccal mucosa and tongue, the OFM grafts culminated in exceptional healing, tissue regeneration, and preservation of oral functions and esthetics with no untoward complications. Thus OFM may be considered a frontline reconstructive option, especially for intraoral defects. With more studies and refinement, it holds promise to become a principal component in oral and maxillofacial reconstructive surgeries.

DECLARATIONS

Ethical approval and consent to participate
Not Applicable
Availability of data and material
Conflict of interest
The authors declare that there are no competing interest. **Acknowledgements**
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