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The use of Mucograft™ for reconstructing small non-keratinised oral cavity defects

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Abstract

Reconstructing small non-keratinised oral cavity defects has long been a challenge for Head and Neck Surgeons. Traditional techniques including autologous split-thickness skin grafts have a long history of use but are associated with a number of drawbacks. Newer techniques including dermal matrix templates have shown some promising results. In this paper we describe the use of Mucograft™ (Geistlich Pharma AG, Wolhusen Switzerland) to reconstruct small non-keratinised oral cavity post ablative defects which has resulted in predictable soft tissue regeneration and promising outcomes compared to traditional reconstructive techniques.

Introduction

Reconstructing post excision oral cavity defects can be challenging with significant functional implications (Rigby and Taylor, 2013). Surgeons are required to restore and preserve key functions of the oral cavity rather than simple coverage or closure of a wound (Rigby and Taylor, 2013). Goals for reconstruction include anatomic, functional and cosmetic considerations. These include appropriate post-operative speech and swallow, tongue mobility, oral competence and mastication (Consorti *et al*., 2024).

Traditional techniques for managing small oral mucosal defects have involve primary closure, mucosal and skin grafts or the wound is left to heal by secondary intention (Rigby and Taylor, 2013). Where the defect crosses oral cavity subunits, primary closure can result in tethering resulting in impaired function (Rigby and Taylor, 2013). In an oncology setting, primary closure can potentially bury microscopic disease obscuring oncologic surveillance and early detection (Rigby and Taylor, 2013). Likewise in patients where wounds are left to granulate secondarily, significant post operative pain and risk of haemorrhage can occur (Rigby and Taylor, 2013). For larger defects, grafts are inadequate and pedicled and microvascular free tissue transfer are required (Consorti *et al*., 2024).

Techniques for reconstruction of small oral cavity defects include autografts, xenogeneic or allogeneic materials, all of which have their own advantages and disadvantages (Herford *et al*., 2010). Split thickness skin grafts have a long history of success in the oral cavity (Rigby and Taylor, 2013). They provide an abundant supply of donor tissue and result in predicatable and reliable healing (Rigby and Taylor, 2013). Unfortunately, they have a number of drawbacks including a lack of tissue bulk and risk of secondary scar contracture (Mangini *et al*., 2023). In addition they are required to be quilted or bolstered to the underlying tissue and may necessitate a tracheostomy to ensure adequate airway protection. Split thickness skin grafts also result in donor site morbidity including pain, risk of infection, and unsightly or hypertrophic scarring (Rigby and Taylor, 2013).

Newer techniques described in literature to reconstruct small and medium sized defects include the use of dermal matrix templates which have been widely used in reconstruction of cutaneous defects (Consorti *et al*., 2024). These have shown to result in rapid healing with minimal scar contracture, reduced surgical time and the need for more complex reconstruction techniques (Consorti *et al*., 2024; Mangini *et al*., 2023). One of the main disadvantages with the use of a dermal matrix is the need to remove the outer layer 3-4 weeks after application.

Likewise, collagen membranes have been used extensively in soft tissue coverage over extraction sites and bone grafts (Herford *et al*., 2010). A porcine collagen matrix, Mucograft™ (Geistlich Pharma AG, Wolhusen Switzerland) , has been used extensively in periodontal literature as an alternative to autologous grafts, including connective tissue grafts or free gingival grafts, to aid in recession coverage and in gain of keratinised tissue. We utilised Mucograft in reconstructing small non-keratinised post ablative oral cavity defects of the tongue, floor or mouth and buccal mucosa.

Technique description

Ten patients were managed in the maxillofacial surgery department for mucosal lesions, either dysplastic or early oral cavity cancers, resulting in small post excisional defects. These included 7 lateral tongue (figure 1), 1 buccal mucosa (figure 2), and 2 floor of mouth post excisional defects. Prior to placement of Mucograft, meticulous haemostasis of the surgical bed was performed. The graft was then measured and trimmed to the defect size to avoid excessive tension. In some cases a template was used to achieve the desired graft shape and size. It was then placed on the defect in a dry state with the spongy surface placed face down on the tissue bed. There was no requirement to pre-hydrate or wash the graft. The graft was then wetted to improve the adherence to the underlying soft tissue and resorbable sutures were placed circumferentially around graft to secure it in its position. At least one quilting suture was placed in the centre to anchor the graft to immobilise and prevent lifting from the

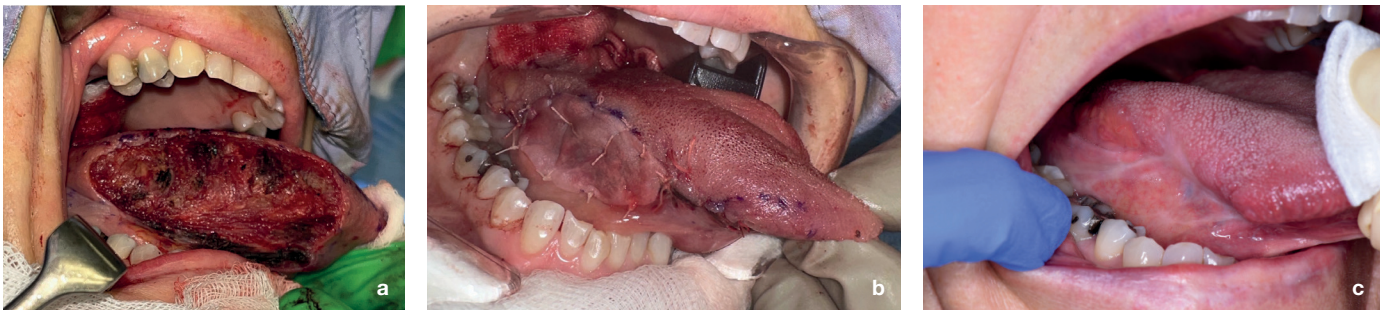

Figure 1. Lateral tongue excision and placement of Mucograft (a-b) and healing 6 months post-operatively (c).

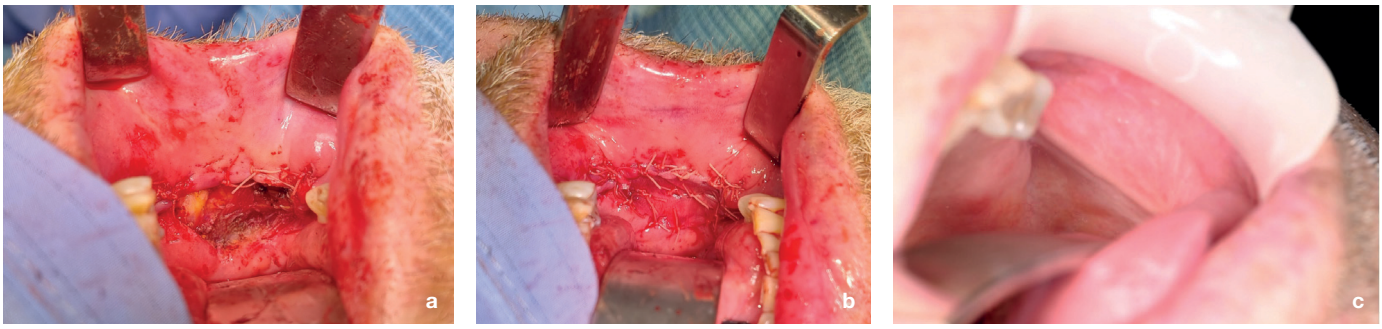

Figure 2. Buccal mucosa defect reconstructed with Mucograft (a-b) and healing 1 year post-operatively (c).

underling tissues. No bolstering of the graft was required. All patients were managed on a liquid or soft diet initially along with a course of oral antibiotics. No patients were managed with an enteral feeding tube in the post operative period. The patients were followed up from 7-24 months. In the acute setting it was successful in all cases with no signs of dehiscence, post operative bleeds, infection or loss of graft post operatively. Long term one patient complained of a lisp, likely secondary to contracture, and was referred to speech and language therapy for review. All patients had good swallow and cosmetic appearance. Written consent was obtained for the use of clinical photography and the study was registered with the Waikato Hospital Clinical Audit Support Unit. Ethics approval was obtained through Health and Disability Ethics Committee (Reference number 2022 AM 6134).

Discussion

An ideal soft tissue graft should promote haemostasis, resist infection and excess granulation tissue accumulation, relieve pain, and promote rapid epithelialization of tissues (Herford *et al*., 2010). It should also ideally prevent contracture and eliminate the need for a secondary autogenous donor site with its associated morbidity (Herford *et al*., 2010). In the oral cavity this is particularly important to avoid functional implications resulting in speech and swallow changes (Consorti *et al*., 2024). Although traditional techniques, particularly split thickness skin grafts, have a long history of use in oral cavity reconstruction, the morbidity associated with their use has made them less desirable. Split thickness skin grafts also result in cosmetic changes to the lining of the oral mucosa which can make clinical surveillance for recurrence of malignancy more challenging.

Mucograft has been used as a biological dressing to aid in soft-tissue regeneration and reduce complications associated with primary closure, healing by secondary intention or autologous soft-tissue grafts including full or partial thickness skin or mucosal grafts. Similar to Gide® (Geistlich Pharma AG, Wolhusen Switzerland), it is a non-crosslinked bilayer porcine matrix composed of pure type I and type III collagen allowing for faster degradation rate compared to crosslinked membranes. It is of approximately 3.0 mm thickness, significantly thicker to traditional membranes. The increased thickness results in better handling characteristics and improved resistance to masticatory forces, likely improving healing. It is extracted from veterinary-certified pigs and is carefully purified to avoid antigenic reactions and sterilized in by gamma irradiation (Herford *et al*., 2010). The outer layer consists of smooth and compact collagen to accommodate suturing to the host mucosal margins. The inner layer consists of porous collagen with a spongy structure to allow tissue integration (Ghanaati *et al*., 2011; Rocchietta *et al*., 2012). This surface is placed adjacent to the host tissue to allow organisation of a blood clot promoting early vacularisation (Ghanaati *et al*., 2011; Rocchietta *et al*., 2012). It differs from Bio-Guide in that it does not act as a barrier to invading soft tissues. The non cross linked structure resulting in more rapid degradation which may promote better tissue integration and neovascularization. Immobilisation of the graft is important to allow for stabilisation of the blood clot and appropriate wound healing. Soft tissue at the periphery of the graft grows through the graft, as opposed to under the matrix, as it is replaces it (Ghanaati *et al*., 2011).

Periodontal literature has shown the use of Mucograft for keratinised defects has resulted in shortened surgical time (Del Pizzo *et al*., 2002; Sanz *et al*., 2009), reduced complication rate (Griffin *et al*., 2006) and pain secondary to the absence of a donor site (Sanz *et al*., 2009).

Other benefits associated with its use include a natural colour match (McGuire and Scheyer, 2010), a lack of donor site morbidity, reduced secondary scar contracture, good handling characteristics and faster soft tissue healing (Thoma *et al*., 2012). One of the main limitations with the use of Mucograft is its limited size, with the largest matrix being 30 x 40mm, necessitating the need for partial primary closure of the wound or the use of an alternative graft. When the defect is significantly larger than this, free tissue transfer is often the preferred approach. In addition, the use of a bioengineered graft results in additional costs over traditional autologous grafts. Although Mucograft was the only product used in this study alternative bioengineered matrices may be as useful in similar clinical scenarios.

These cases show Mucograft, in addition to keratinised defects, can be used successfully to reconstruct small oral cavity post excisional non-keratinised mucosal defects. The authors have been impressed by the outcomes of the use of Mucograft including rapid epithelialisation, perceived reduction in post operative pain, the lack of donor site morbidity, reduced secondary scar contracture, good handling characteristics and reduced operative time compared to traditional techniques. We feel the key techniques for a successful outcome include careful adaption to the defect size, immobilisation to the underlying tissues and careful post operative care. Clinicians should consider bioengineered grafts as part of their armamentarium when considering options for closure of oral cavity defects.

Author contributions

Both authors contributed to patient care, writing of the report, and final approval of the manuscript to be published.

Declaration of patient consent

Patients provided written consent for clinical procedures and for the use of clinical photographs.

Conflict of interest

The authors declare no conflicts of interest.

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