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Palatal Mucoperiosteal Free Graft: Another Reconstruction Option for Oral Defects

Key Words
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Mouth
Reconstruction
Palate mucosa
Graft

Abstract
Traditional methods of repair for medium-size (3–5 cm) oral defects include allowing granulation, primary closure, skin grafts, and buccal mucosal grafts. Each of these methods has several disadvantages, and all tend to result in significant scar contracture and often lack sufficient bulk. In 10 patients, the defect left by resection of cancer lesions was reconstructed with a free palatal mucoperiosteal graft. In all patients, the grafts survived with little contracture, allowing for adequate tongue mobility. Because of the thickness of the palatal mucoperiosteum, local depressions typically associated with floor of the mouth defects could be avoided. The palatal donor site was left to granulate and recovered in 2–3 weeks with little residual deformity. In 4 patients a through-and-through resection of a floor of the mouth cancer was performed in continuity with a neck dissection. A palatal mucoperiosteal free graft was utilized exclusively in the reconstruction, without the development of salivary fistula.

Introduction

Significant oral soft tissue defects generally result from the extirpation of malignant tumors, the main exceptions being ranulas [1] and floor of the mouth cysts [2]. In terms of reconstruction oral defects can be divided into two groups: a small defect group where the main goal is to reconstruct the missing mucosal surface, and a large defect group where soft tissue bulk is necessary to fill the defect. The large defect group can be further subdivided depending on the necessity to repair a bony defect. Satisfactory one-stage reconstruction of large defects is frequently accomplished with regional pedicled flaps or free vascularized flaps [3, 4].

The repair of small (2–5 cm) floor of the mouth, alveolar ridge and anterior tongue defects can be accomplished by allowing wounds to heal by granulation alone, direct edge-to-edge reapproximation, skin grafts [5–7], mucosal grafts [8, 9], or local pedicled flaps [9, 10]. The split-thickness skin graft (STSG) has been the most frequently used repair method in these reconstructions [5]. STSGs are readily available in large surfaces, they allow for satisfactory tongue motion after healing [5, 11] and drape easily in order to recreate a lingual vestibule necessary for dental

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Table 1. Staging and treatment characteristics of the patient population

Patient	Location	Staging	Primary treatment	Neck treatment	Continuity	Radiation therapy
1	Floor of the mouth	T_1 N_0	intraoral excision	MRND (XI)	no	no
2	Anterior tongue	T_1 N_0	partial glossectomy	MRND (XI)	no	no
3[a]	Floor of the mouth	T_2 N_1	intraoral excision and marginal mandibulectomy	RND	no	yes
4[a]	Alveolar ridge	T_1 N_0	intraoral excision and marginal mandibulectomy	SOHND	no	no
5	Anterior tongue	T_3 N_0	partial glossectomy	radiation	–	yes
6[a]	Floor of the mouth	T_1 N_1	intraoral excision and marginal mandibulectomy	SOHND	yes	yes
7	Floor of the mouth	T_2 N_0	intraoral excision	bilateral SOHND	yes	no
8	Alveolar ridge	T_2 N_1	intraoral excision and marginal mandibulectomy	MRND (XI)	no	yes
9	Anterior tongue	T_2 N_0	partial glossectomy	SOHND	yes	no
10	Floor of the mouth	T_2 N_0	intraoral excision	bilateral SOHND	yes	no

RND = Radical neck dissection; MRND = modified radical neck dissection; SOHND = supraomohyoid neck dissection.
[a] Patient with recurrence after local intraoral excision.

prosthetic rehabilitation [5, 6]. The use of STSG is limited, however, by several inherent disadvantages which include: unpredictable contracture, initial malodorous discharge, occasional intraoral hair growth, and donor site morbidity consisting of pain, external scarring, and other potential complications. Also, after floor of the mouth resections involving the mylohyoid muscle, significant depression remains which STSGs fail to correct. This leads to saliva and food pooling, often requiring instrument or finger removal of debris [3]. Furthermore, this dead space prevents adequate mobilization of the food bolus by the tongue during the oral preparatory phase of swallowing. The use of STSGs is additionally suboptimal after marginal mandibular resections because of somewhat unpredictable take over bony surfaces, and inability to create sufficient bony height necessary for conventional dental prosthesis [5, 9].

Buccal mucosal free grafts share many of the disadvantages of STSG, including the lack of bulk. Nevertheless, they are readily available in a sizable surface area in the surgical field, do not require an external scar, and result in minimal disturbance of function of the oral apparatus [8].

We have reported the use of a free graft taken from the mucoperiosteum overlaying the hard palate to reconstruct a case of recalcitrant pharyngeal stenosis [12]. The properties of this graft were appealing and in this article, we describe its use for reconstruction of oral cavity defects.

Methods

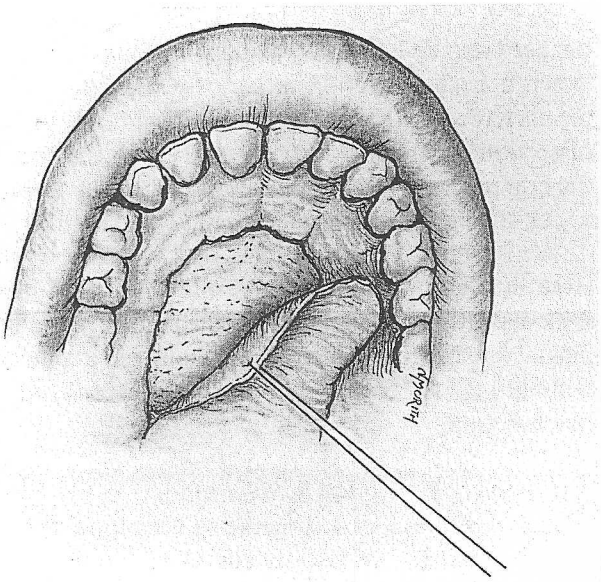
The characteristics of the 10 patients studied, including the location of the squamous cell carcinoma, its TNM classification, the surgical treatment of the primary site and neck, and status of postoperative radiation therapy, are shown in table 1. None of the patients had preoperative radiation. In 3 cases a prior local excision of the oral cancer was performed. The time to recurrence in these cases was 6, 9 and 14 months, respectively.

Most of the lesions were located in the floor of the mouth (50%), with the remaining lesions divided between the alveolar ridge and ventral aspect of the oral tongue. The majority of the lesions were small (T_1 or T_2) leaving a surgical defect of about 4–5 cm in its greatest dimension. All surgical defects were covered with a full thickness free graft from the palatal mucoperiosteum.

Concomitant neck dissections were performed in 9 patients. The remaining patient, without palpable neck disease, had his neck treated with radiation alone. In 4 patients, the neck dissection was done in continuity with the primary resection and therefore resulted in through-and-through floor of the mouth defect. The size of these defects was variable but averaged 3–4 cm. The floor of the mouth musculature was reapproximated when possible taking care not to tether the tongue. The remaining defect was covered with a palatal mucoperiosteal graft. Radiation therapy always followed surgical resection. It was delivered, in 4 patients, with standard external beam techniques.

Technique of Palatal Mucoperiosteal Graft Harvest

The palatal mucosa graft is harvested by sharply incising a central strip of palatal mucosa down to the bony hard palate (fig. 1). The graft shape and size are determined by the dimensions of the defect and size of the palate. Grafts measuring up to 4 × 4 cm are easily procured. Subperiosteal dissection proceeds from anterior to posteri-



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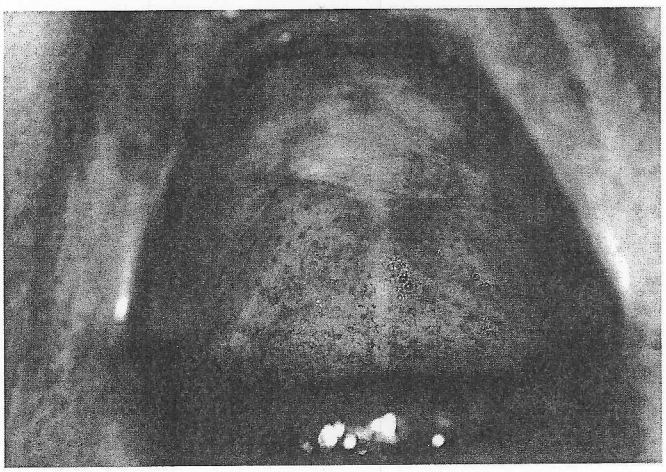

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Fig. 1. Design of palatal mucoperiosteal graft incisions. The size of the graft depends on the defect to be covered and the size of the palate. Anterior and lateral incisions should leave a 5-mm perialveolar rim in order to permit palatal reepithelization. The posterior incision should remain on the bony palate to avoid an opening to the nasopharynx and away from the greater palatine vessels to preserve the blood supply of the remaining palate.

Fig. 2. Free palatal mucoperiosteal graft sutured to cover a floor of the mouth defect that extends on the ventral aspect of the tongue. The center of the graft is firmly secured in several locations and no bolster is used.

Fig. 3. Palatal donor site 3 months after removal of a mucoperiosteal graft and following radiation therapy for a floor of the mouth lesion. Although the palate is less thick, the mucosa has normal healthy appearance.

or with graft division just before the posterior edge of the hard palate. A cuff of palatal mucosa of at least 5 mm is left in place along the alveolus to allow for mucosal regeneration. The greater palatine neurovascular bundle is spared. The graft can be thinned by hand, depending on the depth of the defect to be reconstructed or the desired thickness to be replaced. It is pie-crusted, the extent of which depends on the surface area to be covered. The graft is sutured into the defect with resorbable sutures (fig. 2). No stenting or bolstering is employed. The patient is fed through a nasogastric tube for a 3–5 days. The bony palate is left uncovered. It reepithelializes and a thin mucosal layer is present within 2 weeks (fig. 3).

Results

In all 10 patients the palatal mucoperiosteal graft survived and provided adequate coverage of the defect. In 3 patients, minor debridement of the graft was performed in the clinic approximately 2 weeks after the initial surgery. One of these patients had a floor of the mouth resection in continuity with the neck dissection.

No neck salivary fistulas were observed, even in the patients that had a through-and-through resection of the floor of the mouth in continuity with the neck dissection. No donor site morbidity was observed. Radiation therapy

did not interfere with the growth of mucosa of the denuded hard palate.

Tongue mobility was not formally quantified, but appeared satisfactory in that patients had good tongue mobility including protrusion and lateral intraoral movements. All patients resumed a normal diet and there were no complaints of pooling of food or liquids in the floor of the mouth. Inspection of the surgical site revealed that the level of the resected region in the floor of the mouth was essentially even with the contralateral side, though lacking its mobility. In patients with marginal mandibular resections, dental prosthetic rehabilitation was successfully achieved in 2 patients, and is pending in the remaining 2 patients.

Discussion

The basic principles for reconstruction of oral defects resulting from cancer ablation have been outlined previously [3, 7] and include: (1) no limitation on oncologic resection; (2) complete functional rehabilitation; (3) minimal secondary deformities, both functional and cosmetic; (4) quick and reliable procedure, and (5) rapid restoration of form and function. Since the free palatal mucoperiosteal flap addresses the repair following the excision of T_1 to T_2 carcinomas of the lower oral cavity (alveolar ridge, floor of the mouth, and oral tongue), our discussion is oriented towards medium-size (3- to 5-cm) oral defects.

No Limitation on Oncologic Resection

Surgery alone is generally recommended for the treatment of T_1–T_2 squamous cell carcinomas of the oral cavity [5, 7, 13] because: (1) the results are similar to or better than those achieved by radiation therapy [13, 14]; (2) no increased survival is noted with combined therapy [13]; (3) compared to radiation, the surgical treatment is completed faster, has less functional side effects, and carries no risk of osteoradionecrosis of the mandible [13], and (4) radiation can be used at a later time for the treatment of frequent second primaries (up to 45%) [15].

Control of the primary site after surgical excision alone has been reported from as low as 40% [16] to as high as 100% [17]. Surgical margins of 2 cm of healthy mucosa and submucous tissue are recommended [17, 18] and lower local control rates are related to less extensive resection [15] and the presence of positive margins [19, 20]. The management of clinically negative (N_0) necks in floor of the mouth cancer is still controversial, but the presence of occult nodal disease has been reported in the 25–30% range [21, 22] even for T_1 lesions [23]. This suggests that the neck should be treated along with the primary lesion. When a neck dissection is performed, better oncologic results have been shown in a randomized trial when neck dissection is performed in continuity with the excision of the oral primary [21], in an en bloc fashion, as opposed to a 'pull-through' type of maneuver [24].

We have used this approach in 4 patients in which a large intraoral excision in continuity with a functional neck dissection was performed. The reconstruction with a palatal mucoperiosteal free graft resulted in a solid closure without salivary fistulization and satisfactory postoperative function.

Complete Functional Rehabilitation

In order to assess postoperative functional deficits an elaborate battery of tests needs to be developed, validated, and then used in clinical trials. Early work has shown that the amount of tongue resected is related to postoperative speech [25, 26] and swallowing deficits [27, 28]. Tongue mobility is more critical than tongue mass [13, 27, 28]. Also, the absence of a depression in the floor of the mouth, which results in a dead space during deglutition, is essential to avoid stagnation of food in this area [13, 28].

We have not formally studied our patients with specific articulatory or deglutition tests, but as a group these patients have resumed a normal diet without drooling, dysphagia, or aspiration. These patients had little articulatory deficits and no obvious communication handicaps.

Compared to other methods of repairing lower oral cavity defects, the palatal mucoperiosteal graft appears to behave like STSG or mucosal grafts by producing little tongue thethering, and in its ability to conserve the normal contours of the floor of the mouth. Larger pedicled flaps are too bulky, and exhibit little flexibility to permit their precise molding into normal anatomical contours [5, 6]. The recent popularity of free fasciocutaneous flaps [4], such as the radial forearm free flap and the lateral arm brachial free flap, for the reconstruction of oral defects is largely due to their flexibility and pliability, allowing for precise molding. The excellent functional rehabilitation demonstrated for these thin free flaps [29] will make them the technique of choice, notwithstanding the complexity and length of the procedure, the secondary donor site defects, and the occasional unreliability.

Palatal mucoperiosteal grafts behave, for mid-size defects, like thin pedicled or free flaps in providing local bulk over the tongue, floor of the mouth and alveolar

ridge. STSGs and other simple closure techniques (primary closure, granulation, and buccal mucosal grafts) often result in a local depression where food and debris accumulate [3, 28]. The thickness of this graft has been recognized since its initial description, in the dental literature [30], for vestibuloplasty, a procedure in which the height of an edentulous mandible is increased in order to fit conventional dental prosthesis.

One of the most interesting features of the palatal mucoperiosteal graft is the lack of contracture, as we [12] and others [30–34] have noticed. We used this graft previously to reconstruct a hypopharyngeal stenosis refractory to several dilatations and laser excisions [12]. Other described indications include vestibuloplasty [30], eyelid reconstruction [31], tracheoplasty [32], nasal vestibular [33] and alar reconstruction [34]. Contracture of about 10–20% has been reported [31, 33]. This small contracture is probably due to the presence, at the nonmucosal surface, of the palatal periosteum. The need of an underlying fibrous structure under a nonvascularized graft in order to prevent contracture has been recently emphasized for posterior subglottic stenosis by the use perichondrocutaneus grafts [35].

Minimal Secondary Deformities

Most other reconstruction methods for oral defects carry significant external scars and functional deficits. Of the pedicled flaps, only the platysma myocutaneous flap results in little functional and cosmetic morbidity. Granulation and primary closure have little donor site morbidity, but cannot be used for deficits larger than 1 or 2 cm without significant tongue tethering. Buccal mucosal grafts have the advantage of not generating external scars but can lead to some contracture over the cheek mucosa and are at times quite painful. STSGs produce little functional problems if well taken, but still generate an external scar.

Palatal mucoperiosteal grafts have the advantage of not generating any external donor site scar, and produce no donor site morbidity. The palate granulates in 2–3 weeks and becomes covered with thinner but normally appearing mucosa. Little pain is experienced by the patients. Postoperative radiation has not presented any problems in our patient group.

While the donor site morbidity of free flaps is somewhat variable, depending on the type and size of the flap, there is always another surgical field, skin scars and possibly soft tissue and neuromuscular deficits.

Quick and Reliable Procedure

Although not as brief as primary closure, palatal mucoperiosteal grafting is an expedient procedure. No other surgical field is necessary, which makes this reconstruction method even faster than STSGs.

The reliability of this graft has been excellent in our experience. Although minor sloughing has occurred in 3 cases, the graft has remained solid enough to cover through-and-through floor of the mouth defects without fistulization. Like STSGs, palatal mucoperiosteal grafts should be through-and-through pie-crusted and sutured, not only at the edges but in the middle as well, in order to avoid hematomas and to achieve faster revascularization.

Postoperative radiation therapy was delivered in 4 patients without untoward side effects on either the palatal donor site or the grafted buccal area. In patients who were irradiated previously, the graft take remains unclear and similarly to STSGs [5], we will probably recommended other reconstructive options, such as local pedicles or free flaps.

Conclusion

Palatal mucoperiosteal free grafts are quick, reliable and technically simple procedures for the repair of small oral cavity defects. This reconstruction technique produces minimal donor site morbidity and has resulted in satisfactory articulation and deglutition. We recommend the free palatal mucoperiosteal graft as the reconstruction method of choice for mid-size (3–5 cm) oral defects, even in cases where through-and-through defects are present in the floor of the mouth.

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