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Available Reconstruction Algorithms for Ablative Oral Cavity Defect. A Review of the Literature

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Abstract

Introduction: Functional and aesthetic reconstruction of anatomic defects following ablative surgery is crucial for the successful treatment in current patients with head and neck pathology. The overall patient rehabilitation and postoperative quality of life should guide the reconstruction decisions and choices. Locoregional tissue transfer or free composite tissue transfer from distant sites, has provided with a variety of options for accomplishing these goals.

Methods: We provide a comprehensive review of the existing literature for available reconstructive algorithms, in addition to our experience in repairing surgical defects following ablative surgery in the oral/ head and neck area using such algorithms. Main advantages and limitations of its technique are also discussed in detail.

Results: The type, size and location of every individual defect requiring reconstruction guide the reconstruction available options. The current trend is to prefer local or regional flap, keeping the free tissue transfer for specific difficult to repair cases.

Conclusion: Today, meeting oral cancer patients' reconstructive expectations after tumour resection process involves is a challenge for the current reconstructive head and neck surgeons. With various reconstructive options available, it is crucial for the patient's post-surgery quality to adapt the most proper technique that meets the unique demands of each case.

Keywords: Reconstruction; Guidelines; Algorithm's; Oral cancer; Local flaps; Regional flaps; Free flaps

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Introduction

The impact of head and neck cancer ablative surgery can be devastated for patients' postoperative quality of life. Appropriate aesthetic and functional reconstruction of the arising defect is highly required for postoperative rehabilitation. Depending on its extent and location, the ablative defect may include mucosal lining, underneath soft tissues or bony framework, in any combination. Ideally, any loss of tissue should be replaced by tissue of the same type, to achieve the best possible aesthetic and functional reconstructive outcome [1,2]. The reconstructive efforts are mainly focused in maintaining a close to normal speech, mastication and swallowing ability, together with an aesthetically acceptable face contouring and appearance of the patient. As primary closure or secondary healing can only be performed for small defects, more complicated surgical reconstructive procedures cannot usually be avoided. Skin grafts, local tissue mobilization, regional flaps and microvascular free tissue transfer are among the available reconstructive alternatives, used in head and neck region. Ideally, the quality and the magnitude of the transferred tissue should be planned preoperatively and the current reconstrive algorithms could assist in this direction [3-5].

Materials and Methods

In this article, we aim to provide a comprehensive review of the available reconstructive algorithms for various ablative defects in oral cavity, utilizing local, regional or distant tissue transfer. In addition, we present our experience in repairing ablative defects following such algorithms.

Results

The individual characteristics of each defect (type, size and location) in combination with the

patient's expectations and the surgeon' s experience, usually guide the selection of the most proper reconstructive alternative. The current trend is to prefer local or regional flap, keeping the free tissue transfer for specific difficult to repair cases.

Discussion

Floor of mouth defects

Small, superficial floor of mouth defects, of less than 1.0 cm, consisted of mucosal lining and/or underlying soft tissues, without communication with neck or any involvement of the tongue, could be easily managed with primary closure. More extensive defects, calculated from 1.0 cm to 2.0 cm or defects with tongue, that are more likely to lead in unacceptable functional incompetence, skin grafts or allograft materials should be strongly considered. Split thickness skin grafts provide skin of the desired quality and in adequate volume for covering these defects and should be the surgeons first choice [6,7].

For large (more than 2 cm in diameter) floor of mouth defects, that may be extended to the neck or have significant tongue or mandibular (marginal mandibulectomy) involvement, the utilization of regional fasciocutaneous flap such us submental or nasolabial flap, seems to be the most optimal reconstructive choice [8,9]. The radial forearm and the lateral arm free flap are also a reliable alternative for more extensive defects that could not be easily covered with regional flaps. The thin and pliable skin of the forearm can be drape over the contours of oral cavity with excellent functional results. These flap offers several advantages, including adequate blood supply by a long and large pedicle, negligible donor-site morbidity combined with easy donor-site management and simultaneous flap harvest, as there is no need for changing patient' s position during the operation [10,11].

Tongue defects

The reconstructive effort of any tongue defect aims to maintain a close to normal tongue mobility and minimize any postoperative speech or swallowing incompetence. For small-to-medium tongue defects, that not extended beyond the 1/3rd of the tongue, can usually be successfully managed by primary closure. Skin grafts or allograft materials are also among the primary reconstructive choices, especially for defects close to 1/3rd of the total tongue volume. Secondary intention healing should be avoided, as may lead to tongue dysfunction [1,12].

Reconstruction of medium-to-large size tongue defects, extended from the 1/3rd to 2/3rd of the tongue, with minimal or without communication with the neck, should be preferable attempt by utilizing a fasciocutaneous radial forearm free flap. The radial forearm free flap provides tissue of the desired thickness and surface lining for tongue reconstruction. A neurosensory fasciocutaneous design of this flap could also be considered if the hypoglossal nerve supply has remained intact [13,14].

When the ablative defect extends more than the 2/3rds of the total tongue volume or has significant communication with the neck, the radial forearm flap may not always provide sufficient soft tissue coverage to obliterate the dead space, and this may lead to a subsequent orocervical fistula. The anterolateral thin myocutaneous flap should then be the main reconstructive alternative [15]. Large, composite intraoral defects, following the simultaneous performance of near-total glossectomy and hemimandibulectomy, should be preferable managed with free fibula osseomyocuteneous flap. The free fibula flap could transfer to the recipient site adequate vascularized bone graft in conjunction with large and reliable skin paddle, giving us the ability to successfully close these defects. A combination of a radial or anterolateral thin flap with an osseomyocuteneous free fibula flap should be strongly considered if the defect extents to oropharyngeal region or a there is a significant risk in limited tongue mobility [14,15].

Mandible defects

The reconstructive options for the management of mandibular ablative defects have significantly evolved over the last years, due to important innovations in instrumentation and virtual planning technology. The principal objectives of mandible reconstruction are divided into functional, anatomic and aesthetic. The functional reconstruction efforts focus on maintaining the speech, mastication and deglutition competence, as close to normal as possible. The replacement of the missing bone framework and the preservation of the mandible inter-arch distance and alignment are the main anatomic objectives. The efforts of aesthetic reconstruction are focused on acceptably restoring the facial contouring and symmetry [16,17].

Marginal resection mandibular defects could usually be managed with regional flaps like Facial Artery Musculo Mucosal (FAMM), submental or nasolabial flaps [8,18,19]. The decision between these three most used alternatives is basically depends on the location of the defect. Buccal Fat Pad (BFP) flap is also a reliable and easy to harvest alternative for posterior marginal mandible defects [20].

When a segmental mandibulectomy is required for adequate oncologic control of the primary the reconstructive effort is mainly focused on replacing the loss of the bone framework. The utilization of autogenous non-vascularized bone graft is not considered as a reliable option even for small defects, as its nutrient supply by the surrounding tissues would be adversely affected by the subsequent postoperative radiotherapy [21]. The vascularized free fibula bone graft is widely accepted as the most reliable reconstructive option after segmental mandibulectomy. The fibula provides an unlimited available length, up to 40 cm, well vascularized bone by the peroneal artery, which could span even the entire length of the mandible [16,17]. Fibula could also reliably tolerate multiple osteotomies, without risking the viability of the flap, due to its secondary arterial supply from the periosteal branches. This is significantly important for the management of most of the mandibular defect, as the transferred bone would usually need to be appropriate configured to adapt to the shape of the recipient site. In case of composite mandible ablative defects, the free fibula osseomyocuteneous flap also offers a large and reliable skin paddle, that could also cover mucosa and soft tissue defects in conjunction with mandible bone reconstruction [4,22-24]. Additionally, the excellent bone quality of the fibula is proper for implementation procedures, with a high osseointegration success rate. It can be used implants of 4.3 mm or 3.5 mm in diameter and 13 mm long. Successful osseointegration has been described, even when the dental implants are inserted in the fibular bone during the harvesting procedure [25].

Although donor-site morbidity is relatively low, and patients are usually able to resume normal ambulatory activities postoperatively, they might be serious if they should occur [17]. The Deep Circumflex Iliac Artery (DCIA) bone flap provides a thick and strong bone graft, and it could be a reliable alternative for segmental mandible defects up to 14 cm in length [26,27]. The scapula free flap, even though it provides an extensive bone graft, has limited indications in mandible defects management, as it is barely adequate for dental

implant osseointegration procedures [28]. In elderly or poor-risk patients, where major reconstructive procedures would be inhibitory or useless, the deltopectoral or the pectoralis major flap should be the primary reconstructive choice, despite the functional incompetence and long-term deformity [29].

Maxillary defects

Maxillary defects, following malignant tumour resection, could lead to significant facial deformity and functional incompetence, associated with oro-nasal and/or oro-sinus communication. Proper reconstruction of the ablative defect is thus important to maintain an acceptable postoperative quality of life. Clinical experience has resulted in the general agreement that local or regional flaps should be preferred for the restoration of defects within the maxillofacial region whenever possible, as their performance is associated with less complications, shorter intraoperative time and less donor site deformity in comparison with microvascular free tissue transfer procedures [3,30].

Local flaps, including palatal mucoperiosteal, buccinator myomucosal flaps or buccal fat pad flaps, could only be used for small size maxillary or palatal defects with minimal oro-antral fistula, because of their random blood supply and the fact that their width-to-length ratio cannot be more than 1:2 and could only be used for small size maxillary or palatal defects with minimal oro-antral fistula [20,31]. On the other, hand regional flaps are in general more reliable due to their axial blood supply by an identifiable vascular pedicle. The width-to-length ratio of a regional flap can thus be as much as 1:5 without risking its viability. The temporalis myofascial flap and the Facial Artery Musculo Mucosal (FAMM) island flap are the most used techniques for medium and medium-to-large, low maxillectomy defects, involving the alveolus and antral walls, and high maxillectomy defects that not involve the orbital floor [18,19,32,33]. Radial forearm myocutaneous free flap could also be a reliable alternative for high maxillectomy defects that do not involve the orbital floor [5]. In case of being medical contraindications for surgical reconstructive procedures or in poor-risk patients, maxillary restoration could possible based only on maxillofacial obturator prosthesis's, especially when the remained bone fracture is adequate to insure acceptable stability of the prosthetic constitution [3,32].

The temporalis muscle flap is usually the reconstructive method of choice for high maxillectomy defects that extend to the orbital floor, providing adequate tissue for covering, together with a quite suitable bed for a postoperatively dental prosthesis [32]. For more extensive or complicated maxillectomy defects, where the use of local or regional flaps is relative inadequate, reconstructive procedures should be based on distant tissues transfer [1-3]. The need of a specific surgical team, the donor site complications and the unavoidable prolongation of the operative time and hospital stay remain their major disadvantages. Free fibula osseomyocuteneous flap, DCIA free flap, scapula free flap and vascularized iliac crest are among the most preferred reconstructive options [3,26-28,34,35].

Conclusion

The functional and aesthetic reconstruction of the surgical defects following major oncologic operations presents a challenge for the current head and neck reconstructive surgeon, as patients' expectations for postoperative rehabilitation and quality of life are higher than before. With various reconstructive options available, the reconstructive surgeon should be able to choose and adapt the most proper technique that meets the unique demands of each defect. The use of local or regional flaps should be preferred, when possible, while free tissue transfer should be the reconstructive method of choice for major and complicated ablative defects within the head and neck region.

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