

# Long-Term Surgical Complications in the Oral Cancer Patient: a Comprehensive Review. Part II

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## ABSTRACT

**Objectives:** Surgery remains the preferred treatment for the majority of oral cancers. The aim of the present article was to provide a comprehensive review of complications associated with surgical treatment of oral cancer including hardware failure; complications associated with choice of reconstruction, donor site morbidity as well as functional and aesthetic issues that impact on the quality of life.

**Material and Methods:** The available English language literature relevant to complications associated with surgical treatment of oral cancer was reviewed. Complications associated with potential for disfigurement, choice of reconstruction, donor site morbidity as well as functional and aesthetic issues that impact on the quality of life are summarized.

**Results:** In total 35 literature sources were obtained and reviewed. The topics covered in the second part of this review series include hardware failure, scars and fistula formation; complications associated with choice of reconstruction, donor site morbidity as well as functional and aesthetic issues.

**Conclusions:** Cancer resection should be planned around two very important concepts. First and foremost is the eradication of disease. This should be the ultimate goal of the ablative team and all potential complications that may be the result of appropriately executed oncologic resection should be discussed in details with the patient. Adequate reconstruction of the defects with restoration of form and function is the second, but not of less importance, goal for the successful care of the head and neck cancer patient.

**Keywords:** oral cancer; postoperative surgical complications; hardware failure; donor site complications; scarring; fistula.

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## INTRODUCTION

In Part I of this series of comprehensive review of long-term complications associated with surgical treatment of oral cancer we covered issues with disease eradication, speech, swallowing and mastication as well as neurological problems that are commonly encountered. The high complexity of the anatomy and functions of oral cavity and head and neck though further harbors the potential severe disfigurement. Cancer ablation in this region often results in defects that require use of local regional or distant tissue transfer very often with the combination of hardware that provides for structural support.

The aim of the present article was to provide a comprehensive review of complications associated with surgical treatment of oral cancer including hardware failure; complications associated with choice of reconstruction, donor site morbidity as well as functional and aesthetic issues that impact on the quality of life.

## MATERIAL AND METHODS

Literature was selected through a search of PubMed, Embase and Cochrane Central Register electronic databases. The keywords used for search were oral cancer, postoperative surgical complications, hardware failure, donor site complications, scarring, fistula. The search was restricted to English language articles and books published from February 1961 to June 2010. The included publications were relevant to long-term surgical complications associated with surgical treatment of oral cancer. The potential common as well as rarer complications that may be encountered and their treatment are summarized.

The topics covered in the second part of this review series include complications associated with potential for disfigurement, chronic fistulas and healing issues; complications associated with reconstruction and donor site morbidity, prosthetic rehabilitation and aesthetic considerations, functional limitations at donor site as well as long-term quality of life and psychological considerations.

### **Cancer resection: complications associated with potential for disfigurement**

Of primary importance in the surgical management of oral malignancies is surgical access for visualization and assessment of margins and anatomic considerations for resection. This may be considerably complicated in cases where the tumour occupies the posterior aspect of

the lateral tongue and floor of mouth as well as the retromolar area, the mandibular gingiva, or the posterior maxilla. The complex anatomy of the oral cavity makes surgery more challenging and requires incorporation of various incisions and flap designs to facilitate adequate exposure and subsequent tension free closure.

For the neck dissection, on the other hand, the need to protect the carotid sheath and its contents has led to incision and flap designs that specifically address this anatomic limitation. Aesthetic considerations have not, until recently, been a primary concern when access for tumour resection is planned. Lip split and extensive facial incisions have been utilized over the years, recognizing that the main concern has been adequate exposure, and not aesthetics.

The change in the patient population demographics suffering from oral cancer, along with concerns about long-term facial scarring, has forced surgeons to consider incision and flap design based upon facial aesthetic units. The stigma of oral cancer surgery are no longer acceptable in the face and neck regions due to a desire for continued social interactions and reasonable quality of life, especially when survival rates improve, and patients live longer lives following treatment [1-5]. Incisions in the neck, with trifurcation extensions, that do not follow natural skin creases, have a higher incidence of dehiscence and unaesthetic scar formation. In addition, the effects of radiation treatment further worsens the appearance of the scars and risk exposure of the carotid artery, or other vessels, if superficial skin necrosis occurs [6,7]. Also, unaesthetic tracheotomy scars are very common, especially when the need for the tracheotomy is delayed, or the site has been infected. The advantages and disadvantages of vertical versus horizontal incisions for access to the trachea with regards to scarring and aesthetics are debated extensively due to individual surgeon preference and experience. Attempts should be made to handle tissue gently, to provide protection of the skin from iatrogenic trauma from traction or electrocautery, to consider elevation of thick soft tissue flaps, with adequate blood supply, in order to minimize the creation of unaesthetic scars [6,8,9].

For surgical access to some of the tumours in the oral cavity, the lips may need to be divided, and incisions on the face may be required. The original description of the lower lip split procedure in the 1900s placed the incision at the middle of the lip and chin causing severe scarring postoperatively. Since that time, various modifications have been described to this technique, with the main endpoint the achievement of an aesthetically acceptable result that does not compromise access or restrict adequate resection. Precise alignment and restoration of the vermilion border of the lip, and alignment

and interdigitation of the orbicularis oris muscle, and reorientation of the lip skin and oral mucosa are paramount in order to achieve excellent lip competence, function and aesthetics [4,10].

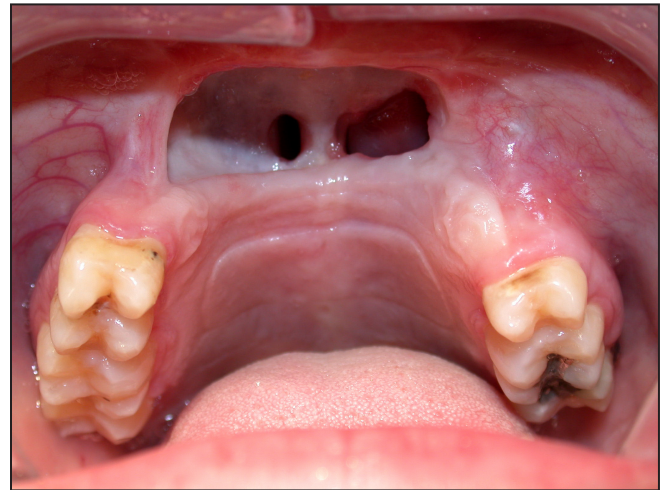
For maxillectomy procedures, it is often necessary to elevate the skin over the midface region to gain access to the underlying tumour. The classic Weber-Ferguson incision, with or without an extension to involve the lower eyelid, has been used for many years to accomplish wide surgical access in the midfacial area. This incision incorporates splitting of the upper lip, and failure to realign the vermilion border of the upper lip, or to reconstruct the philtrum, can lead to aesthetic and functional limitations. The lower lid incision extension, if required, can cause severe scarring, especially if postoperative infection further delays healing. Despite accurate surgical attention to detail during flap elevation, normal postsurgical scarring of the lower lid incision can result in lower lid retraction and ectropion with ophthalmologic consequences, and present a difficult aesthetic and functional dilemma [11-13].

Reconstruction of maxillectomy defects is commonly accomplished with a prosthetic device or surgical “stent” that serves to obturate the surgical site defect. While less than ideal, the obturator provides adequate support of the soft tissues, and speech and swallowing are preserved. However, major aesthetic concerns and functional limitations are apparent when the device is removed (Figures 1 and 2).

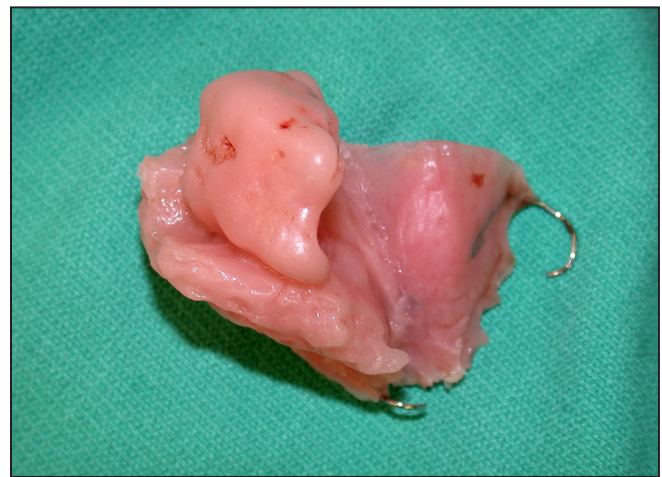
These patients cannot perform normal speech, mastication, or swallowing functions without the maxillary obturator in place. Also, lack of stability of the obturator, even with an experienced maxillofacial prosthodontist, can be a clinical challenge [14].

Recently with the increasing regional availability of free flap reconstruction, many of these limitations are no longer significant, provided that the patient is a good surgical candidate, and the surgical team is capable of performing the reconstructive procedure [15-18]. Often there is the need for local or regional flap coverage to obturate major defects, and these procedures are not without aesthetic consequences. Traditionally the tongue, buccal mucosa, palate, and the temporalis and delto-pectoral systems have been the reconstructive “workhorses” for oncologic surgeons for many years [19-21].

A myriad of aesthetic and functional limitations have been described throughout the years in the literature using these types of soft tissue flap reconstructions. It should be noted that the majority of patients who undergo partial or total maxillectomy or mandibulectomy procedures for tumour resection, or mandibulotomy for surgical access, will require postoperative radiation which may further worsen soft tissue scarring.



**Figure 1.** Oral nasal communication post anterior maxillectomy without the obturator in place.



**Figure 2.** Maxillary stent/obturator for use post maxillectomy procedures for speech, swallowing and aesthetics correction.

The deleterious effects of radiation and the use of chemotherapeutic agents on the skin and existing scars have been discussed in the literature [6,22]. Additionally, many oral cancer patients have a significant social history of tobacco use and abuse due to its etiologic relationship with oral cancer, and therefore, the skin and other soft and hard tissue vascularity may be already severely compromised. This prior history, and possibly continued smoking by a majority of patients, may contribute not only to poor wound healing, but also to postoperative wound dehiscence, compromised flap viability, and resultant unaesthetic scarring.

### Chronic fistulas and healing issues

Any procedure that involves entering the mucosa of the upper aerodigestive tract via a neck incision may lead to formation of a fistulous tract due to persistent salivary leakage into the neck wound. Fistulas occur often following oral oncologic surgeries, and depend to a great

deal on the general physical and nutritional status of the patient, the incision design, and the tumour type and stage, all of which may lead to an increased risk of this problem. These fistulas are more difficult to manage and completely eradicate when radiation therapy (XRT) has been employed. The effects of radiation in delaying surgical wound closure or preventing healing are generally attributed to low oxygen tensions and vasculitis that promote infection, as well as endothelial fibrosis and decreased blood supply to the surgical site. The higher the dose of radiation, and the longer the interval between radiation treatment and surgery, the higher the rate of wound complications when XRT is used preoperatively. When XRT is employed post-tumour resection, adequate time is required in order to prevent delayed healing, fistula formation, and wound dehiscence.

Salivary fistulas can occur as early as 1 week, to as late as 3 - 4 weeks, postsurgery. Fistulas that are present at one month after surgery are considered chronic, or persistent fistulas. Patients may present with a low grade fever of unknown origin, and other vague complaints indicating chronic inflammation. Usually the skin flap under the area of dependant drainage becomes inflamed and indurated. The best treatment involves prevention; but, if a developing fistula is noted, then surgical exploration of the wound with an attempt to direct saliva away from vital structures, such as the carotid vessels, is clinically indicated. The wound should be irrigated and packed open, and the patient should be prescribed empiric antimicrobial therapy for oral and skin flora, supportive care, and hyperalimentation, or, at the minimum, adequate nutritional support. If drainage is persistent for more than 4 weeks, then excision of the fistulous tract with closure of the oral mucosa and the skin should be attempted [6,22,23]. This surgery may be combined with attempts to transiently decrease salivary flow, with anti-cholinergic medications, if not contraindicated.

Loose or contaminated hardware from previous infections and or wound breakdown may be another reason for chronic fistulas (Figures 3 and 4). Usually there is a nidus of bacteria that cannot be eliminated with antibiotics alone, and local debridement, removal and/or replacement of existing hardware, and closure with local and regional flaps are indicated [6,22,23].

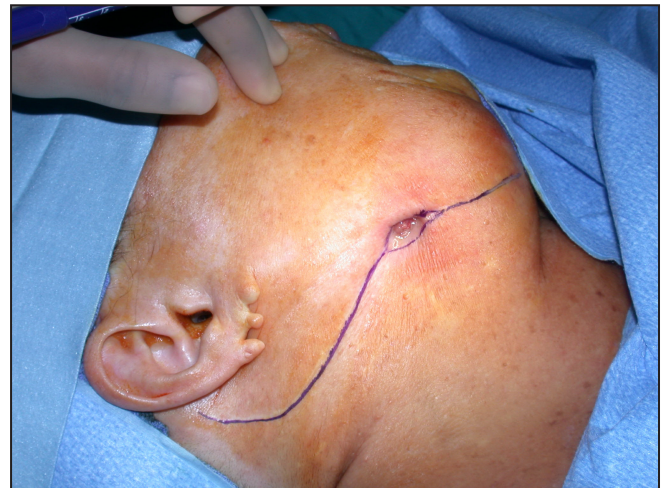
### Complications associated with reconstruction and donor site morbidity

#### Hardware failure

Osteotomies of the mandible used for access purposes or mandibular resection require utilization of plates and screws to span continuity defects, stabilize bone



**Figure 3.** Chronic fistulas with drainage on the face and neck due to saliva leak and bacterial contamination of existing hardware.



**Figure 4.** Fractured displaced plate of the right mandible with draining fistula.

segments, or secure bone flaps. The complex bony anatomy and muscle attachments require careful planning for hardware placement. Failure to adhere to basic reconstruction principles, fatigue of the metal due to over-manipulation during contouring and adaptation, extensive defects and unbalanced masticatory force distribution may all lead to hardware failure. Usual problems with hardware include fracture of the reconstruction plates, or loosening of the screws with mobility of the mandibular segments (Figure 4). The plates may become exposed through the overlying soft tissues and secondarily infected. This leads to drainage further damage of the adjacent tissues and chronic fistulas.

Hardware exposure may occur even without fracture or mobility if the overlying tissue is of inadequate thickness due to the resection, or scarring due to the effects of radiation (Figure 5). Careful incision planning, adequate soft tissue coverage of plates used,



**Figure 5.** Exposed reconstruction plate due to contraction and scarring of the soft tissues.

careful consideration of the defect size, and adherence to reconstruction principles is critical in order to avoid plate exposure. Serious consideration should be given toward complete and appropriate coverage of any hardware used for reconstruction with local, regional or free flaps.

In the cases of fractured, or loose and infected plates and screws with cutaneous fistulas, removal of the existing hardware is usually required. Early intervention is preferred, but the majority of the patients requiring bone resection receive adjuvant radiation therapy. Radiation therapy causes severe scarring of the soft tissues and compromises healing ability. Preoperative preparation with hyperbaric oxygen treatments may be indicated to improve the healing abilities of the soft tissue envelope prior to removal and replacement of hardware [6,23-25].

### Prosthetic rehabilitation considerations

The ultimate goal once disease is controlled and the patient is cancer-free is appropriate prosthetic and functional rehabilitation. Reestablishment of a functional maxillomandibular complex that provides an adequate dentition for mastication, adequate underlying bony support for the facial features, and adequate soft tissue for restoration of speech and swallowing represent the desired endpoint, and there are many potential options for reconstruction (Table 1). Local tissue re-arrangement and local and regional flaps do not always provide restoration of function, but can serve to obturate the surgical defects. It is difficult to provide a patient with a functional denture prosthesis using a reconstruction plate as the sole underlying support. This scenario frequently leads to chronic plate exposure with inflammation, and possibly the need for plate removal with or without replacement.

**Table 1.** Potential reconstruction options

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1. Simple closure
    - a) Skin grafts
    - b) Allogenic material
    - c) Primary closure
    - d) Healing by secondary intention
    - e) Prosthetic devises
  2. Local flaps
    - a) Tongue flaps
    - b) Buccal mucosa advancement flap
    - c) Buccal fat pad
    - d) Palatal flap
  3. Regional flaps
    - a) Temporalis myocutaneous flap
    - b) Deltopectoral muscle flap
    - c) Latissimus muscle flap
    - d) Nasolabial flap
  4. Free Flaps
    - a) Soft tissue free flaps
      - i) Radial forearm free flap
      - ii) Anterolateral thigh free flap
      - iii) Rectus abdominus free flap
      - iv) Latissimus free flap
    - b) Hard tissue free flaps
      - i) Fibula free flap (osseous or composite)
      - ii) Deep circumflex iliac artery free flap
      - iii) Scapula free flap
      - iv) Radial composite free flap
- 

With the wide use of composite free flaps, surgeons can provide adequate soft tissue bulk and bone support to re-establish continuity, function and potentially provide sufficient bone for osseointegration of dental implants to restore masticatory function [14,16-18,26]. Great debate regarding which osseous flap is best for implant placement exist in the literature and various techniques are been proposed to provide the most ideal flap for this purpose [27,28]. Unfortunately, not all patients are candidates for free tissue transfer and oral rehabilitation is not always considered during all phases of the resection and reconstruction. Composite bone flaps may be used, but placement may not be appropriate for dental implant placement; or, implants may be placed into the bone, but restoration may not be achievable. Several factors may contribute to this prosthetic problem. Since this is a multidisciplinary issue, it is not always feasible to convene all members of the treatment team to discuss the treatment plan of the oral cancer patient prior to resection, so the plans for reconstruction may be created postoperatively and may not be ideal. Also, the extent of the resection may not allow ideal rehabilitation. Several postsurgical and radiation associated complications may prohibit execution of the ideal restorative plan. Finally, patients' compliance and financial issues contribute to delays or actually not achieving the final restorative goal.



**Figure 6.** Donor site scarring post pectoralis major myocutaneous flap harvest.

### **Aesthetic considerations and functional limitations at donor site**

Local and regional flaps, and free tissue transfer, employed for reconstruction of surgical defects inherently create an additional defect at the donor site. Even with the most carefully planned incisions, these defects may lead to unaesthetic scars, contraction, and tissue deficits at the donor site.

The tongue, buccal mucosa, and buccal fat pad are local tissues frequently used to address small defects in the oral cavity. Usual limitations from use of these sites are functional due to scarring and postsurgical tissue contraction.

For larger defects, regional tissue such as the deltopectoral, temporalis and latissimus myocutaneous flaps are used. These tissues have served well over the years, but the defect at the donor site remains a testament to the procedure performed [21,29,30]. Composite tissue transfer from distant sites such as the fibula or the radius and the iliac crest are considered the gold standard for reconstruction of defects of the oral cavity. Excellent functional outcomes and very acceptable aesthetic results at the recipient sites can be achieved with the potential for future dental rehabilitation. However, the donor sites are usually plagued by long scars and occasionally tissue mismatching and other

bulk-related defects (Figure 6). Functional limitations such as trismus, limitation in range of motion, and gait disturbances are some of the undesired long-term sequel at the donor sites. Aggressive physical therapy is required early and employed until near normal function is regained, while scar revisions may be employed to address the aesthetic considerations.

### **Long-term quality of life and psychological considerations**

Quality of life issues for the oral cancer patient are addressed in detail in other chapters of this text, but for completeness, the influence of surgical intervention on quality of life is briefly discussed here. Quality of life is a critical outcome measure in head and neck cancer management, mainly due to the inability to improve survival, especially in cases of advanced disease. Unlike other malignancies, oral cancer treatment has not drastically changed over the last 30 years. Except for modifications in the types and extent of neck dissections, surgery remains, for the most part, the treatment modality most commonly offered, with addition of radiation and chemotherapy when indicated. The focus on patient care has shifted towards preservation of form and function with the careful selection of appropriate reconstruction techniques [31,32].

Chronic pain, difficulty with chewing, swallowing, and speech influences function and adversely impacts on the quality of life. In general, studies have demonstrated that improved function post resection is achieved with utilization of free tissue composite flaps that correct bone continuity defects and can support dental implants as well as a future prosthesis. Furthermore, free tissue transfer for reconstruction of tongue defects, and avoidance of primary closure typically improves tongue mobility. These reconstruction options improve patients' ability to chew and swallow their food appropriately, and to articulate and speak fluently. Both patient subjective perception of improved quality of life, and objectively measured improvement, has been demonstrated in multiple studies in the head and neck cancer literature [33-35]. Chronic pain issues from the temporomandibular joint and muscles of mastication are unique to the oral cancer patient. Together with some of the potential neurological complications mentioned earlier, as well as functional limitations, these factors impact on activities of daily living, and contribute to an overall poor quality of life. Finally, facial disfigurement, scarring, speech impairment, inability to control secretions, loss of taste, the need for removable prosthetic appliances, and difficulties with mastication have serious psychological impact on the oral cancer survivor. In conclusion, the oncology surgical principles

that ensure adequate tumour resection in order to prevent recurrence or limit metastasis should be combined with the principles of reconstruction that will provide the best long-term form and functional results.

## CONCLUSIONS

We have provided a comprehensive review of the potential commonly encountered long-term complications faced when treating oral cancer. As it has been demonstrated above and in Part I of this review series, the oncology team and the cancer patient can be faced with various serious long-term problems. It is emphasized here again that cancer resection should be planned around two very important concepts.

1. First and foremost been eradication of the disease. This should be the ultimate goal of the ablative team and all potential complications that may be the result of appropriately executed oncologic resection should be discussed in details with the patient.

2. Adequate reconstruction of the defects with restoration of form and function is the second, but not of less importance, goal for the successful care of the head and neck cancer patient. The key in providing the best results are detailed understanding of the complexity of the tissues and functions of the oral cavity and maxillofacial skeleton. This requires close collaboration between the ablative and reconstructive team with input from the radiation oncology team and dental rehabilitation team.

3. The patients' comorbidities, limitations, preoperative functional status and expectations as well as the treating teams' abilities and limitations ought to be seriously considered for long-term success.

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The author reports no conflicts of interest related to this study.

## REFERENCES

- Cilento BW, Izzard M, Weymuller EA, Futran N. Comparison of approaches for oral cavity cancer resection: lip-split versus visor flap. *Otolaryngol Head Neck Surg.* 2007 Sep;137(3):428-32. [Medline: [17765770](#)] [doi: [10.1016/j.otohns.2007.05.006](#)]
- Devine JC, Rogers SN, McNally D, Brown JS, Vaughan ED. A comparison of aesthetic, functional and patient subjective outcomes following lip-split mandibulotomy and mandibular lingual releasing access procedures. *Int J Oral Maxillofac Surg.* 2001 Jun;30(3):199-204. [Medline: [11420901](#)] [doi: [10.1054/ijom.2000.0038](#)]
- Kolokythas A, Fernandes RP, Ord R. A non-lip-splitting double mandibular osteotomy technique applied for resection of tumors in the parapharyngeal and pterygomandibular spaces. *J Oral Maxillofac Surg.* 2007 Mar;65(3):566-9. [Medline: [17307611](#)] [doi: [10.1016/j.joms.2005.06.025](#)]
- Ramon Y, Hendler S, Oberman M. A stepped technique for splitting of the lower lip. *J Oral Maxillofac Surg.* 1984 Oct;42(10):689-91. [Medline: [6592315](#)] [doi: [10.1016/0278-2391\(84\)90216-7](#)]
- Thankappan K, Sharan R, Iyer S, Kuriakose MA. Esthetic and anatomic basis of modified lateral rhinotomy approach. *J Oral Maxillofac Surg.* 2009 Jan;67(1):231-4. [Medline: [19070776](#)] [doi: [10.1016/j.joms.2008.07.012](#)]
- Kim DD, Ord RA. Complications in the treatment of head and neck cancer. *Oral Maxillofac Surg Clin North Am.* 2003 May;15(2):213-27. [Medline: [18088676](#)] [doi: [10.1016/S1042-3699\(02\)00100-0](#)]
- Friess CC, Fontaine DJ, Kornblut AD. Complications of therapy for oral malignant disease. *Otolaryngol Clin North Am.* 1979 Feb;12(1):175-81. [Medline: [440738](#)]
- Lewis VL Jr, Manson PN, Stalneck MC. Some ancillary procedures for correction of depressed adherent tracheostomy scars and associated tracheocutaneous fistulae. *J Trauma.* 1987 Jun;27(6):651-5. [Medline: [3599111](#)] [doi: [10.1097/00005373-198706000-00009](#)]
- Waldron J, Padgham ND, Hurley SE. Complications of emergency and elective tracheostomy: a retrospective study of 150 consecutive cases. *Ann R Coll Surg Engl.* 1990 Jul;72(4):218-20. [Medline: [2382943](#)] [FREE Full Text]
- Hayter JP, Vaughan ED, Brown JS. Aesthetic lip splits. *Br J Oral Maxillofac Surg.* 1996 Oct;34(5):432-5. [Medline: [8909737](#)] [doi: [10.1016/S0266-4356\(96\)90102-3](#)]
- Barbosa JF. Surgery of extensive cancer of paranasal sinuses. Presentation of a new technique. *Arch Otolaryngol.* 1961 Feb;73:129-38. [Medline: [13686835](#)]
- Eisig SB, Goodrich JT. Transfacial approaches to the cranial base. *Atlas Oral Maxillofac Surg Clin North Am.* 2002 Mar;10(1):73-84. [Medline: [12087867](#)] [doi: [10.1016/S1061-3315\(01\)00005-1](#)]
- Balm AJ, Smeele LE, Lohuis PJ. Optimizing exposure of the posterolateral maxillary and pterygoid region: the lower cheek flap. *Eur J Surg Oncol.* 2008 Jun;34(6):699-703. Epub 2007 Oct 29. [Medline: [18029135](#)] [doi: [10.1016/j.ejso.2007.08.009](#)]

14. Haug SP. Maxillofacial prosthetic management of the maxillary resection patient. *Atlas Oral Maxillofac Surg Clin North Am.* 2007 Mar;15(1):51-68. [Medline: [17434062](#)] [doi: [10.1016/j.cxom.2006.11.002](#)]
15. Fernandes R. Fibula free flap in mandibular reconstruction. *Atlas Oral Maxillofac Surg Clin North Am.* 2006 Sep;14(2):143-50. [Medline: [16959601](#)] [doi: [10.1016/j.cxom.2006.05.003](#)]
16. Fernandes R. Reconstruction of maxillary defects with the radial forearm free flap. *Atlas Oral Maxillofac Surg Clin North Am.* 2007 Mar;15(1):7-12. [Medline: [17434057](#)] [doi: [10.1016/j.cxom.2006.10.002](#)]
17. Kim DD, Dreher MA. The fibula free flap in maxillary reconstruction. *Atlas Oral Maxillofac Surg Clin North Am.* 2007 Mar;15(1):13-22. [Medline: [17434058](#)] [doi: [10.1016/j.cxom.2006.11.001](#)]
18. Rodriguez ED, Bluebond-Langner R, Martin M, Manson PN. Deep circumflex iliac artery free flap in mandible reconstruction. *Atlas Oral Maxillofac Surg Clin North Am.* 2006 Sep;14(2):151-9. [Medline: [16959602](#)] [doi: [10.1016/j.cxom.2006.05.004](#)]
19. Ariyan S. Further experiences with the pectoralis major myocutaneous flap for the immediate repair of defects from excisions of head and neck cancers. *Plast Reconstr Surg.* 1979 Nov;64(5):605-12. [Medline: [388479](#)] [doi: [10.1097/00006534-197911000-00002](#)]
20. Buchbinder D, St-Hilaire H. Tongue flaps in maxillofacial surgery. *Oral Maxillofac Surg Clin North Am.* 2003 Nov;15(4):475-86, v. [Medline: [18088698](#)] [doi: [10.1016/S1042-3699\(03\)00065-7](#)]
21. Ward BB. Temporalis system in maxillary reconstruction: temporalis muscle and temporoparietal galea flaps. *Atlas Oral Maxillofac Surg Clin North Am.* 2007 Mar;15(1):33-42. [Medline: [17434060](#)] [doi: [10.1016/j.cxom.2006.12.001](#)]
22. Shah JP, Candela FC, Poddar AK. The patterns of cervical lymph node metastases from squamous carcinoma of the oral cavity. *Cancer.* 1990 Jul 1;66(1):109-13. [Medline: [2354399](#)]
23. Kerawala CJ. Complications of head and neck cancer surgery - prevention and management. *Oral Oncol.* 2010 Jun;46(6):433-5. [Medline: [20435509](#)] [doi: [10.1016/j.oraloncology.2010.03.013](#)]
24. Shibahara T, Noma H, Furuya Y, Takaki R. Fracture of mandibular reconstruction plates used after tumor resection. *J Oral Maxillofac Surg.* 2002 Feb;60(2):182-5. [Medline: [11815918](#)] [doi: [10.1053/joms.2002.29817](#)]
25. Neovius EB, Lind MG, Lind FG. Hyperbaric oxygen therapy for wound complications after surgery in the irradiated head and neck: a review of the literature and a report of 15 consecutive patients. *Head Neck.* 1997 Jul;19(4):315-22. [Medline: [9213110](#)] [doi: [10.1002/\(SICI\)1097-0347\(199707\)19:4<315::AID-HED10>3.0.CO;2-8](#)]
26. Schmidt BL. Maxillary reconstruction using zygomatic implants. *Atlas Oral Maxillofac Surg Clin North Am.* 2007 Mar;15(1):43-9. [Medline: [17434061](#)] [doi: [10.1016/j.cxom.2006.11.004](#)]
27. Cordeiro PG, Santamaria E. A classification system and algorithm for reconstruction of maxillectomy and midfacial defects. *Plast Reconstr Surg.* 2000 Jun;105(7):2331-46; discussion 2347-8. [Medline: [10845285](#)] [doi: [10.1097/00006534-200006000-00004](#)]
28. Davison SP, Sherris DA, Meland NB. An algorithm for maxillectomy defect reconstruction. *Laryngoscope.* 1998 Feb;108(2):215-9. [Medline: [9473070](#)] [doi: [10.1097/00005537-199802000-00010](#)]
29. Cordeiro PG, Wolfe SA. The temporalis muscle flap revisited on its centennial: advantages, newer uses, and disadvantages. *Plast Reconstr Surg.* 1996 Nov;98(6):980-7. [Medline: [8911467](#)] [doi: [10.1097/00006534-199611000-00008](#)]
30. Shah JP, Haribhakti V, Loree TR, Sutaria P. Complications of the pectoralis major myocutaneous flap in head and neck reconstruction. *Am J Surg.* 1990 Oct;160(4):352-5. [Medline: [2221234](#)] [doi: [10.1016/S0002-9610\(05\)80541-0](#)]
31. Urken ML, Buchbinder D, Weinberg H, Vickery C, Sheiner A, Parker R, Schaefer J, Som P, Shapiro A, Lawson W, et al. Functional evaluation following microvascular oromandibular reconstruction of the oral cancer patient: a comparative study of reconstructed and nonreconstructed patients. *Laryngoscope.* 1991 Sep;101(9):935-50. [Medline: [1886442](#)] [doi: [10.1288/00005537-199109000-00004](#)]
32. Wilson KM, Rizk NM, Armstrong SL, Gluckman JL. Effects of hemimandibulectomy on quality of life. *Laryngoscope.* 1998 Oct;108(10):1574-7. [Medline: [9778304](#)] [doi: [10.1097/00005537-199810000-00028](#)]
33. Rogers SN, Lowe D, Fisher SE, Brown JS, Vaughan ED. Health-related quality of life and clinical function after primary surgery for oral cancer. *Br J Oral Maxillofac Surg.* 2002 Feb;40(1):11-8. [Medline: [11883963](#)] [doi: [10.1054/bjom.2001.0706](#)]
34. Vaughan ED. An analysis of morbidity following major head and neck surgery with particular reference to mouth function. *J Maxillofac Surg.* 1982 Aug;10(3):129-34. [Medline: [6957515](#)] [doi: [10.1016/S0301-0503\(82\)80027-1](#)]
35. Vaughan ED, Bainton R, Martin IC. Improvements in morbidity of mouth cancer using microvascular free flap reconstructions. *J Craniomaxillofac Surg.* 1992 Apr;20(3):132-4. [Medline: [1613109](#)] [doi: [10.1016/S1010-5182\(05\)80095-2](#)]



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