Chapter

Modalities and State of Art in Oral Cancer Reconstruction

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Abstract

The treatment of the oral cancer is complex in terms of resection and reconstruction. Adequate multidisciplinary approach is needed to plan the oncological resection and functional reconstruction to obtain optimal results and adequate rehabilitation of the patient. Many factors should be considered in order to reconstruct the surgical defects, including patient factors, the expertise of the team, and other tumor and defect factors. Early cancer and its subsequent defects can be reconstructed merely with a primary closure or a skin graft, but as soon as the cancer stage worsens, the devastation of primary tumor is bigger needing a more complex surgery and skilled reconstructive techniques to implant a new safe tissue, starting from a local flap, a pediculate flap, and up to a free composite flap. Nowadays there is a trend to perform microvascular free flaps in most of the reconstructions, but if a rational approach is planned, even in the most advanced cases, it can be solved with locoregional flaps, limiting the need of a microvascular surgery and its subsequent overcost in care and special skills in reconstruction. This chapter pretends to give a rational approach to get that goal.

Keywords: oral cancer, head and neck reconstruction, local flaps, pediculate flaps, free flaps

1. Introduction

One of the most common cancers of the head and neck region is the oral cavity cancer. Globally, over 300,000 people are diagnosed with oral cancer each year, being the eight most common cause of malignancy [1]. In early stages, a cure is possible with minimum morbidity; unfortunately, such disease is not usually diagnosed until it has set to an advanced stage impacting survival, including in that stage morbidity due to tumor invasion or tissue devastation, and its consequent treatment negatively impacts the quality of life [2]. With that in mind, every effort must be done to reconstruct the defect of the primary resective procedure in order to restore swallowing, speech, esthetics, and color match, among others. A complete evaluation must be done to define the optimal reconstruction without compromising the oncological resection and first of all evaluating each patient in terms of age, functional capacity, adjuvant therapies, airway protection, survival, etc. There are many options to reconstruct the defect, so a comprehensive approach should be planned, principally considering its location in the oral cavity, the size of the anatomical structure resected, as well as the consequence of the

defect that may affect a complex functional unit that could include the mucosa, muscle, bone, skin, or a combination of them, which additionally may develop a continuity solution that creates a communication between the oral cavity with the neck and its subsequent salivary fistula, infection, risk of a major vessel blood bleeding or carotid blowout, and death. The reconstruction might be done just with a primary closure and skin graft or may be left to heal by second intention with no closure; some cases will need a pediculate, local, or regional flap, and in complex and huge defects, a microvascular free flap might be needed. Currently there is a trend to perform a microvascular reconstruction for most of the defects, but even in a two-team approach, the microvascular reconstruction increases the cost and duration time of the surgery; furthermore some health centers lack surgeons with the necessary skills to perform a microvascular surgery. The purpose of this chapter is to review the state of art in oral cavity reconstruction after an oncological resection and especially provide a rational approach to reconstruct each defect in order to restore it as similar as normal tissue before resection, discussing pros and cons of reconstruction.

2. Anatomic landmark

The oral cavity begins at the lips and ends at the anterior surface of the faucial arch. It is lined by squamous epithelium with interspersed minor salivary glands. It contains the lips, buccal mucosa, mandibular and maxillary alveolar ridge, retromolar trigone, hard palate, floor of the mouth, and anterior oral tongue. Motor innervation of intrinsic musculature is supplied by the hypoglossal nerve and sensation is provided by trigeminal nerve V2 and V3 branches. The sensation of the anterior two-thirds of the tongue is provided by the lingual nerve (CN V3), and its taste comes via the chorda tympani (CN VII) [3]. For the purposes of this chapter, only the proper oral cavity is considered, so lip reconstruction is excluded.

3. Defect characteristics

Assessing the characteristics of the defect is the first step to decide which is the best option to reconstruct. The size and specific subsite of the primary resection including its function will determine the need for subsequent reconstruction. Small or medium defects may not disturb function, so minimal intervention to reconstruct is necessary; on the other hand, composite defects that include several units and structures like the muscle, mucosa, bone, or even skin can affect the function in many ways, so in order to restore it, a specific composite tissue is needed, which is also a technique to avoid scars, nonfunctional tissue, or retractions with its subsequent unit dysfunction. Previous treatment like chemotherapy and especially radiation will also entail special needs in terms of reconstruction since providing a new normal tissue is essential to prevent local complications like fistula, dehiscence, infection, or a permanent scar.

4. Specific subsites

With the aim to choose correctly from a range of different technics, although it is frequent to face a combination of subsites and structures after surgical resection, each subsite must be considered independently to assist the decision.

4.1 Floor of mouth

The subsite floor of mouth (FOM) is limited anteriorly by the inferior alveolar ridge, posteriorly by the ventral surface of the lingual tongue, and laterally by the anterior tonsil pillar. The FOM avoids the spillage of saliva to the neck and is also necessary to support the tongue in speech and deglutition as well as to maintain the humidity of the mouth due to the big amount of minor salivary glands and to the outlet of the submandibular gland duct. The resection may result in a small or big defect that could or could not include the mucosa, bone and skin. The main goal of reconstruction is to restore the anatomic limits of the sulcus to avoid communication with the neck with the corresponding spillage of saliva and food, and to avoid retraction or fixation of the tongue then maintaining the adequate tongue mobility to support articulation and speech as well as allowing the tongue to move freely to push the food bolus back.

4.1.1 Small defects

A very small deformity could be let alone without closure and permit healing by second intention with a granulation tissue. A facial artery myomucosal flap (FAMM), which blood supply is provided by the facial artery, could similarly be used for a defect limited up to a width of 2 cm and permit the primary closure of the donor site [4]. A split-thickness skin graft (STSG) or a full-thickness skin graft (FTSG) could be used for a defect smaller than 3–4 cm that does not spare the suprahyoid musculature or expose the bone (**Figure 1a** and **b**). The graft is usually secured with a pad dressing, which is removed 6–7 days after surgery. Usually remucosalization can be expected, and complete healing is obtained in about 4 weeks. The restriction to the skin graft is related to the difficulty to maintained it insetted due to its exposition to swallowing movements.

The advantage to let the defect to granulate by itself is the shortest time of the procedure; however, it usually takes up to 3 weeks to obtain a complete healing, implying some minor disturbances for the patient including pain and difficulty to swallow. The disadvantage of the graft is the secondary scar of the donor site but is offsetted by the result in the zone of resection and a shortened time of recovery.

4.1.2 Medium defects

For FOM defects up to 6 cm which may include a limited bone exposure, a regional pediculate flap can be employed to reconstruct; the most used are the

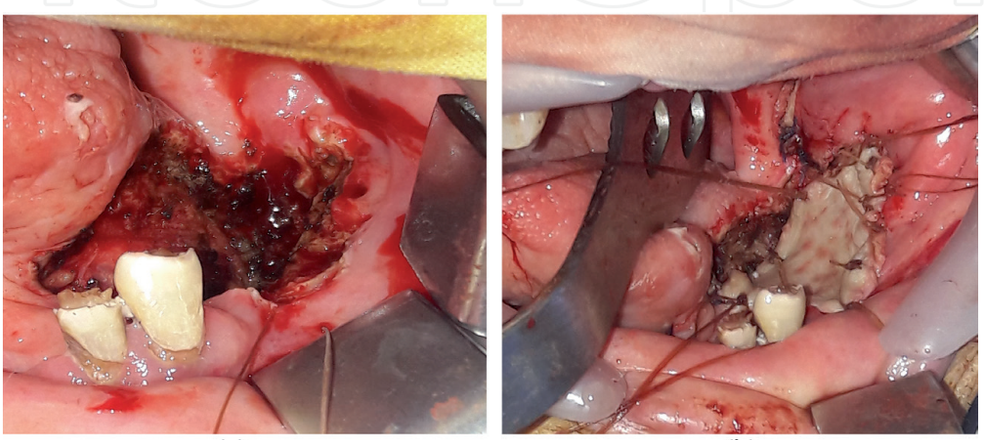


Figure 1.
(a) FOM resection and (b) skin graft.

submental (SMF) and the supraclavicular flap (SCF). Additionally, in that kind of defects, especially when postoperative radiotherapy is projected, a pediculate flap must be planned if possible.

4.1.2.1 The submental pediculate flap

The submental pediculate flap is vascularized by the submental artery, a branch of facial artery. It must include a segment of the anterior belly of digastric to perfuse the overlying skin through perforants. The amount of tissue available to harvest depends on the pitching test that predicts the possibility of primary closure of the donor site. This flap entails to avoid sacrifice of its vascular pedicle so the clue is that it should be planned and harvested at the beginning of neck dissection [5] (**Figure 2a–c**). Sometimes nodal disease levels Ia and Ib limit the ability to harvest the submental flap without impairing the oncological resection. The main advantage of this flap is the proximity between the donor site and the floor of the mouth so it can be insetted easily; the main problem is that if it is harvested with a big amount of muscle, the result once insetted may be a bulky flap resulting on swallowing and speaking problems.

4.1.2.2 The supraclavicular pediculate flap

The supraclavicular pediculate flap is an alternative to the submental flap particularly when a larger amount of skin is needed and in cases of huge nodal

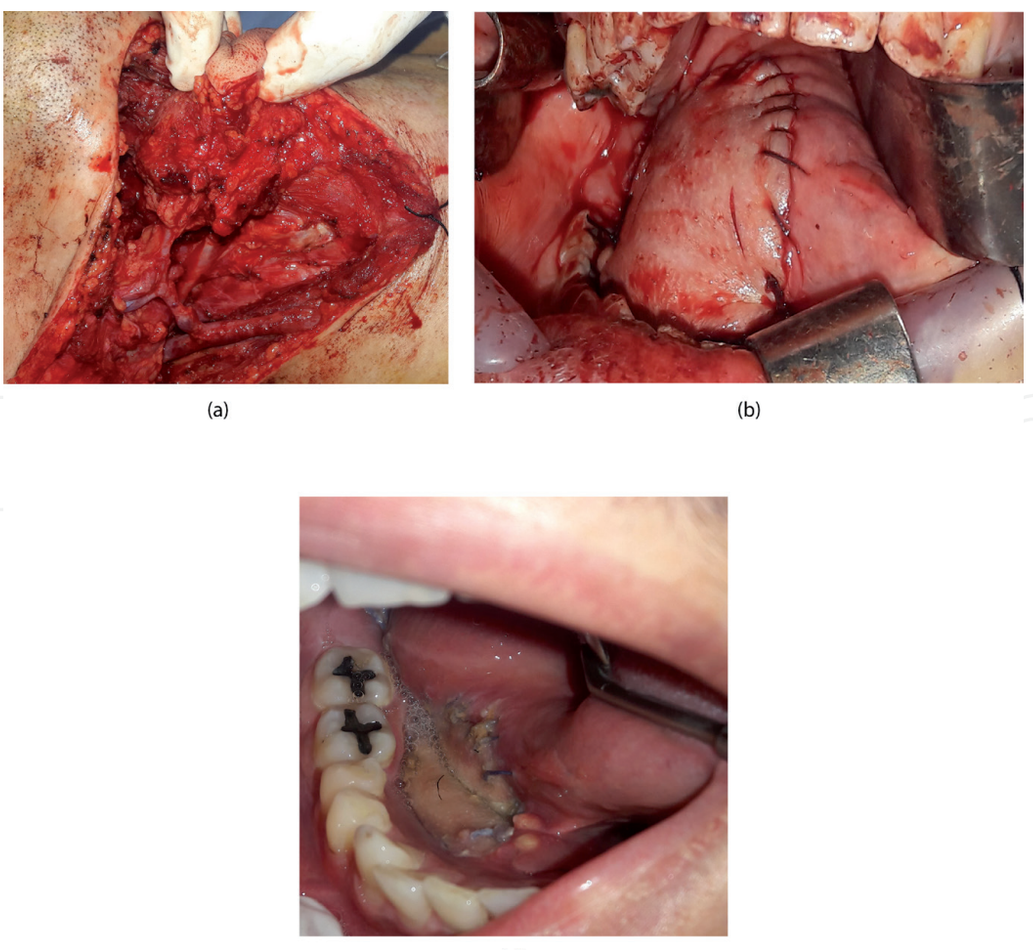


Figure 2.
(a) Submandibular flap harvest, (b) submandibular flap insetting, and (c) final result.

disease in level I. The flap can be raised if there are no bulky nodes in the neck in the level IV. The SCF is based on axial circulation from the supraclavicular artery which arises from the transverse cervical artery and in a small percentage of cases from the suprascapular artery. It can be used to reconstruct soft tissue defects measuring up to 20 cm in size after tumor excision, being an advantage over the SMF in FOM defects. As well as the submandibular flap, usually there is low donor site morbidity permitting its primary closure, and of course the main restriction is related to neck dissection in level IV due to the possibility to injure the cervical transverse pedicle impairing its vascularization [6]. Another advantage is that it can be raised at the end of the surgery after neck dissection or in cases when you do not plan to dissect level IV or there is no doubt about the probability to alter its vascularization; it can be harvested at the beginning of neck dissection once you have defined the size of the defect you need to reconstruct (**Figure 3a–b**).

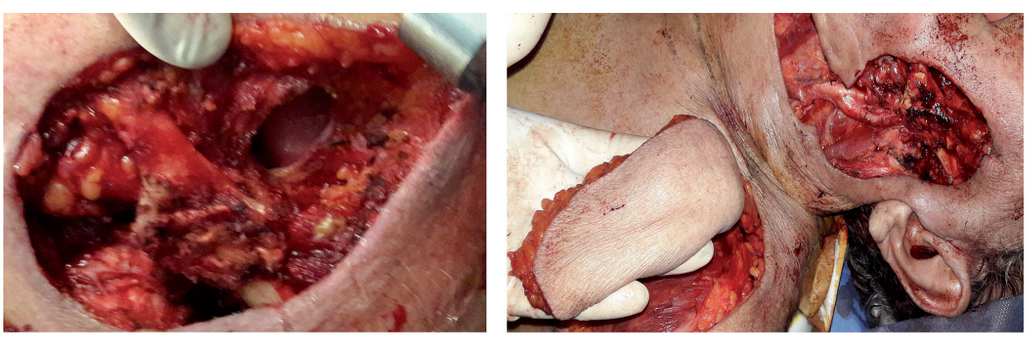
The main complication for both flaps is the loss of the flap due to arterial or venous ischemia. To prevent that fatal complication, a meticulous dissection is needed to preserve its vascularization during harvesting and trying to avoid tension during insetting. When only venous congestion is present, the flap may recover without additional intervention, but if ischemia is established, the lost flap must be retired to avoid infection and systemic complication, and if possible, a new way of reconstruction must be considered.

4.1.3 Large defects

In a bigger or composite defect of FOM, the reconstruction can be a challenge, especially when the bone, tongue, and skin are involved. It is important to assess preoperatively the degree of bone invasion to suitably plan possible mandibulectomy requiring additional bone tissue for reconstruction. If only soft tissue is required, a radial forearm free flap (RFFF) or an anterolateral free flap (ALT) can be harvested, but if the bone required a fibula free flap (OCFF), the iliac crest flap (VICF) or the scapula free flap (SFF) are the main options.

4.1.3.1 The radial forearm free flap

The radial forearm free flap based on the radial artery provides a pliable and thin skin that makes the RFFF an ideal choice for reconstruction of the floor of the mouth; in few cases if a small marginal segment of the bone is required, a composite radial free flap including a limited segment of radial bone can be obtained [7]; if furthermore the tongue is compromised, the RFFF can be insetted with a bilobed design allowing one lobe to restore the volume of the tongue and the second one to



(a) (b)

Figure 3.
(a) Yugal mucosa resection and (b) supraclavicular flap harvest.

resurfaces the FOM [8]. The RFFF is considered the battle horse in microvascular reconstruction due to the skin quality, the length of the pedicle, the size of the vessels, and the easy preoperative assessing since it does not require vascular images just the Allen test to evaluate distal perfusion of the hand provided by palmar arch, and additionally, it is easily harvested. Its limit is usually referred to the size in cm that can be harvested (up to 20 × 12 cm), but it almost never applies as an exception in oral cavity reconstruction. The principal risk and disadvantage of the osteocutaneous radial free flap is the risk of fracture when a segment of the bone is included in the RFFF, so prophylactic fixation of the radius with the appropriately sized 2.4-mm locking reconstruction plate is performed to avoid fracture of the donor site [9]. The disadvantages of this flap are the hairy non-mucosalizing skin paddle, the cosmetic deformity of the donor site due to skin grafting that sometimes let an ugly scar and, in some cases, a bulky dysfunctional flap. The hairy skin can atrophy after radiation, or it can be treated with laser peeling, so in most of the cases, the final reconstruction result is excellent. To improve the cosmetic result of the donor site, any effort must be done to preserve the paratenon over the flexor tendons; setting a 4 mm better than a 2 mm skin graft over the donor site with an appropriate plaster bandage for temporal immobilization is also suggested. This usually ends in a better cosmetic result. Finally, to avoid a bulky dysfunctional flap, planning an adequate design of the size and form of the flap before harvesting is advisable.

4.1.3.2 The ALT flap

The ALT flap is also proposed as an excellent recourse when only the skin and soft tissue are required, especially in thin patients; it is advocated by many as a first choice to avoid the donor site morbidity. This flap pending on a septocutaneous branch coming from the lateral circumflex femoral artery involves a more difficult dissection due to the smaller diameter of the vessels [10]. It can be harvested thinner (supra fascial) or thicker (subfascial) depending on specific needs of skin and soft tissue. One important advantage is that can be raised even bigger allowing primary closure. The disadvantage of a hairy non-mucosalizing skin paddle is like the RFFF, and in an obese patient the flap is unacceptably bulky. Another disadvantage occurs when the nerve branch to the vastus lateralis muscle is cut unnoticed causing knee instability. In rare occasions the donor site needs to be skin grafted.

4.1.3.3 The osteocutaneous fibula free flap

The osteocutaneous fibula free flap is considered by many, the gold standard when oncological resection includes a large segmental mandibular defect that may or no include skin and is generally the first choice [8, 11] and the iliac crest and scapula [12] are alternatives chiefly in segmental small defects. The osteocutaneous fibula free flap (OCFF) based on peroneal artery is a reliable, and versatile flap for mandibular reconstruction and is considered the gold standard in mandibular reconstruction. It usually offers enough length of bone and skin to reconstruct a partial or complete mandibular resection and allows to place bone-integrated implants. It is essential to plan its harvesting and design from the beginning at the outpatient clinic, since it is mandatory to perform limb vascular imaging studies to assess the normal vascular anatomy and avoid fatal vascular morbidity or ischemia of the donor limb after bone resection. It does not need to plate the remaining fibula that remains attached to the tibia, and if harvesting in the right way, it does not cause limb instability. As a norm, it is easy to harvest and one-stage reconstruction can be performed. There are some downsides to it; first the size of the skin

paddle is limited just to permit primary closure of skin donor site; but if needed it also can be skin grafted. Second the hairy and non-mucosalizing skin paddle that is placed intraorally could end in an disturbing sensation, usually temporally if radiation is added to the treatment, and third in cases of arterial or venous disease in the lower extremities or previous surgery, there is a formal contraindication for flap harvesting [13].

4.1.3.4 The scapula free flap (SFF)

The scapula free flap (SFF) based on the circumflex artery arising from the subscapular artery, which is a branch of the axillary artery in the upper thorax, similarly provides acceptable bone length while supplying significantly larger skin and soft tissue paddles (up to double in overall area). It is an excellent alternative to small and wide to medium defects when wide bone is necessary. The main disadvantage of this flap is the need of repositioning during the surgical procedure restraining a double team approach [14].

4.1.3.5 The vascularized iliac crest bone flap (VICF)

The vascularized iliac crest bone flap (VICF) has also been proposed as a new approach to reconstruct a mandibular deformity, especially in lateral mandibular defects [15]. This flap is based on the deep circumflex iliac vessels and usually harbors consistent anatomy; the length of the vessel averages 8–10 cm, and its diameter averages 2–3 mm. Pending on specific reconstruction needs may be harvested as a full thickness bicortical or as a partial thickness unicortical bone, and its main advantage is the natural curved contour of the bone that is ideal for lateral mandibular reconstruction. It can be raised with skin or muscle when needed. The donor site morbidity is related to the local appearance deformity and the probability to develop a future hernia.

Nowadays three of the osteocutaneous free flaps previously mentioned could be combined with the use of a three-dimensional virtual technology to preoperatively plan the resection, the design of the plates for bone fixation, and the cutting guides to enhance the functional and cosmetic results. This new technology is proposed to optimize surgical outcome and as a safer way of modeling. It can also be implemented in mandibular or midface reconstruction using fibula free flap or iliac crest flap. It requires a preoperative CT scan planning design and preparation of the customized mandibular reconstruction plate and cutting guides providing a most precise reconstruction [16, 17]. Current communication between the resective surgeon, reconstructive surgeon, and team that supports the technology is necessary to assess all the information previous to surgery. The principal limits are the cost and access to the technology but usually are over headed by the benefit of a precise reconstruction. With this tendency to a more precise reconstruction and rehabilitation, one important aim of bone reconstruction is to restore the chewing function so dental implants are required to best accomplish that. The moment to inset them in the postoperative scenery usually takes up to 3 or 4 years waiting to finish healing and therapies including radiation and preventing osteoradionecrosis of the new mandible. With that in mind, there is a new trend to inset dental implants during the first reconstruction procedure and before radiation so that the chewing can be restored earlier [18]. To accomplish that goal, a preoperative consult with the maxillofacial surgeon is mandatory so can be involved in planning implants setting.

The additional fatal complications of the micro vascularized flaps are the arterial or venous ischemia. A strict postoperative care must be done for an early detection

of venous or arterial suffering which may allow an appropriate reoperation in an intent of saving the flap. In the fatal case of flap loss, again it is crucial to retire the dead tissue and if possible cover the defect with a new pediculate or micro vascularized flap.

4.2 Tongue

In the oral cavity the more common defects requiring reconstruction are those from glossectomies. The tongue is a highly functional organ, with a complex muscle mobility that functions as a coordinate unit to articulate words, swallow, and push the bolus back, so the primary goal of reconstruction is to preserve the ability to move it intelligibly and not tethered with adequate soft tissue coverage, avoiding bulky flaps. The three-dimensional oncological resection needs adequate margins up to 1 cm, so the size of the defect may be variable, a quarter, half, near total, or total and can be simultaneously related or not with other structures like the floor of the mouth, cheek, skin, or bone. Based on that, reconstruction may be just a primary closure, a local or a pediculate flap, or a simple or composite free flap.

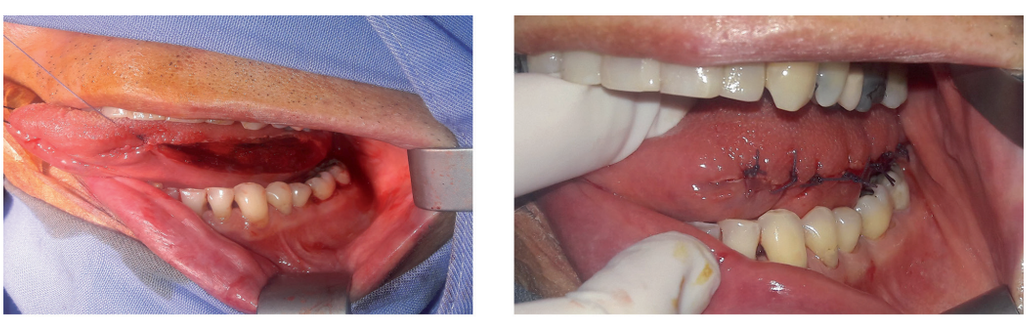
4.2.1 Small defects

In cases of small defects up to one-third of the tongue, primary closure could be done (**Figure 4a** and **b**), and if needed, due to a small floor of mouth resection, a skin graft is added in order to avoid a scar combined with tongue fixation. Usually the functional results are optimal, but sometimes skin graft contraction and hyperpigmentation can result, or graft fixation may be inadequate leading to shearing and wound dehiscence [19].

4.2.2 Larger defects

4.2.2.1 Pediculate flaps

In a bigger defect up to half of the tongue or particularly in a huge composite defect that may include the floor of the mouth, cheek, or both, a pediculate and free flap are the alternatives preferred. In a defect up to 6 or 7 cm, the pediculate submandibular flap can be harvested and is my first choice as long as the neck is N0 or N+ with no fixed nodes and small metastatic nodes (**Figure 5a** and **b**). It usually provides a non-bulky flap that can be harvested to cover the defect and can be tied to the tongue to allow mobility for swallowing and speech [20–21]. In cases of N2 neck with huge or fixed metastatic nodes that impacts the possibility of preserve the submandibular pedicle, a supraclavicular pediculate flap can be harvested specially



(a) (b)

Figure 4.
(a) Primary closure and (b) primary closure outcome.

Figure 5.
(a) Submandibular flap harvest and (b) submandibular flap insetting.

to reconstruct tongue with a composite cheek defect [22]. This flap previously described, is also recommended in cases when a free flap cannot be performed due to any specific contraindication such as inexperience or lack of a reconstructive team in microvascular surgery or if the patient is in a poor physical condition and a shortened procedure is mandatory [23].

4.2.2.2 Free flaps

In cases of a near total or total glossectomy that frequently is associated with composite resections of the floor of the mouth, cheek, skin, or mandible, a free flap is required (**Figure 6a–c**). Speech and swallowing functions after reconstruction for those defects remain disappointing due to the reduced mobility of the flap and the poor functional muscle quality, therefore, the more tongue musculature left, the better rehabilitation of speaking and swallowing will be achieved, and of course, a better functional outcome. The reason for that is that the coordinate movement of the tongue cannot be replaced and the new tissue attached to the rest of the tongue relies on its mobility and just leaves a bulk. If sensation is attempted, a sensory nerve reconstruction provided by the free flap should be intended at the time of reconstruction. If a total glossectomy is performed, the main goal of reconstruction is to provide an adequate amount of soft tissue and bulky flap to allow the neo-tongue to get in touch with the palate to push food toward the hypopharynx and in some way to help in speech [24]. Nevertheless, normal movement will not be accomplished, fundamentally affecting speech and articulation. If only soft tissues are essential, a radial forearm free flap (RFFF) or an anterolateral thigh flap (ALTF) (**Figure 7a** and **b**) are the first option to reconstruct the defect, both of them provide a good amount of soft tissue that can be sentient, just to fulfill the objective mentioned before. The use of free flaps to transfer muscle to achieve motor innervation of the neo-tongue, like the latissimus dorsi or gracilis free flap has been intended with disappointing results in terms of function [25].

4.2.2.3 Alternative options

For selected patients in whom free tissue transfer is not an option, the pectoralis major myocutaneous flap offers a reliable reconstructive procedure following both

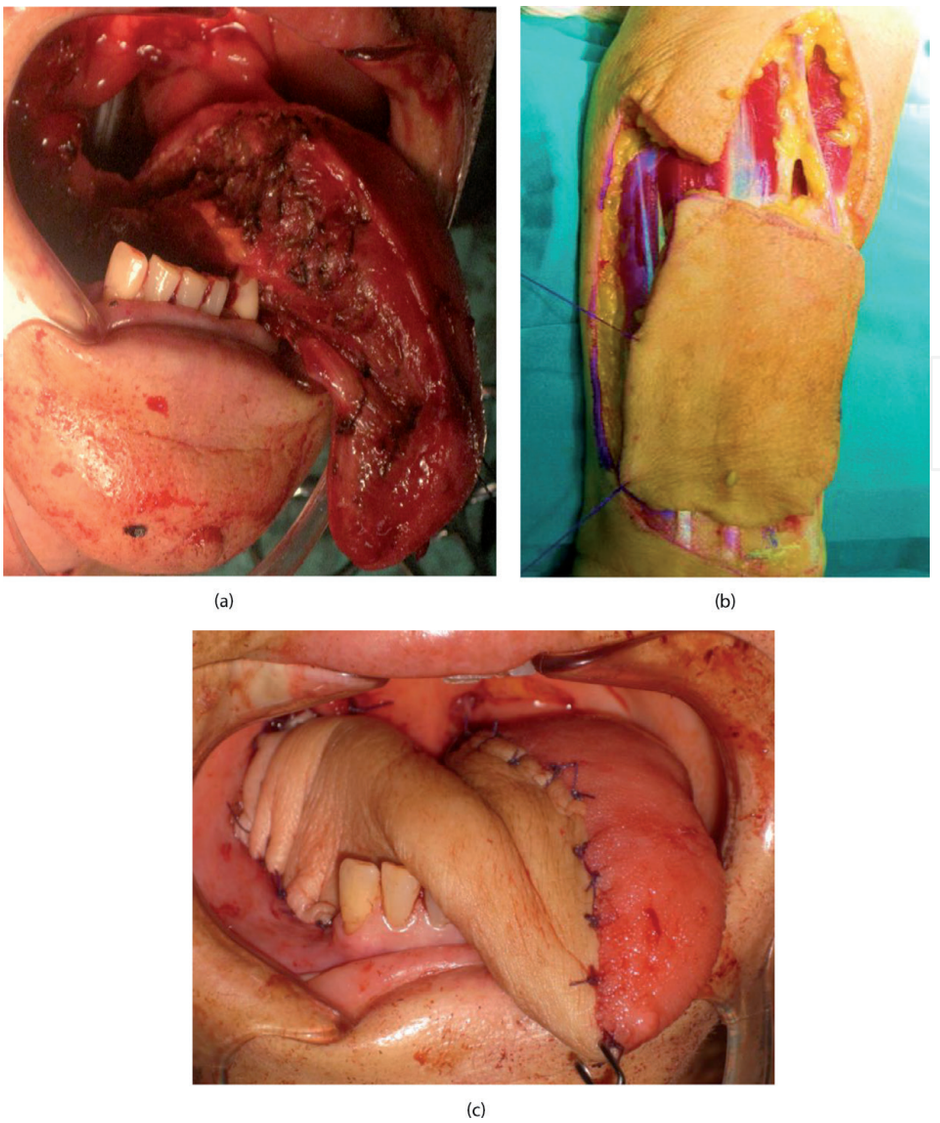


Figure 6.
(a) Tongue defect after resection, (b) RFFF harvest and (c) RFFF insetting.

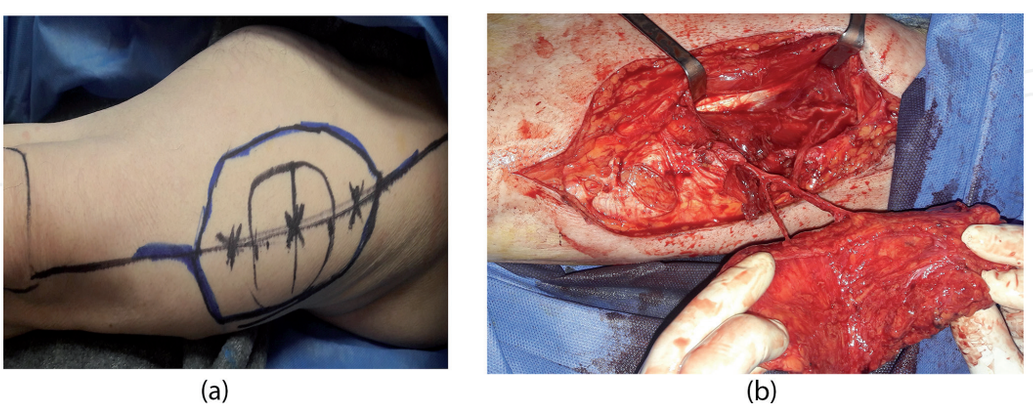


Figure 7.
(a) ALT flap design and (b) ALT flap harvest.

primary and salvage surgery (**Figure 8**). This flap based on the thoracoacromial artery can be raised as a myocutaneous or fasciocutaneous flap. It is reliable, robust, and easily harvested in terms to tongue reconstruction and can provide muscle and skin to fulfill the tongue and floor of the mouth and effectively separate the oral cavity from the neck. It must be suspended across the mandibular arch by either suturing

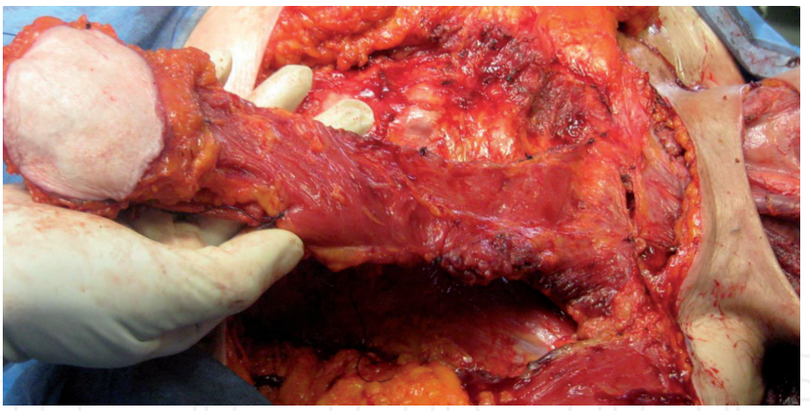


Figure 8.
Major pectoral flap harvest.

to the pterygoid musculature or securing to the mandible using drill holes to avoid and prevent the flap from falling [26]. This flap is considered a horse battle in rescue setting when a free flap fails. When the defect includes mandible, during the reconstruction it must have keep in mind that mandible contributes to airway stability, oral competence, speech, deglutition and mastication, so the goal of this reconstruction must include the preservation of the ability to open the mouth, occlusion, and the restoration of the inter arch continuity solutions to promote dental implants and restore chewing as mentioned in floor of mouth defects extended to mandibula. Not reconstructing the central defects will conclude in loss of the lip support with Andy Gump deformity, and not reconstructing the lateral defects will cause malocclusion and lateral shift in the position of mandible, so any intent must be done to reconstruct the mandible. Options in reconstruction include metal plates (**Figure 7**), non-vascularized bone grafts, osteomyocutaneous pedicled flaps, and osteocutaneous free flaps. Fixing soft tissues just with plates was widely used in the past and usually results in extrusion intraorally, external exposure or fracture of the plate up to 60% of the cases with a worst defect and a very poor functional outcome [27]. Autogenous bone grafts from iliac crest, scapula, or calvarium usually end in no vascularization of the new bone and its atrophy even more if radiation is added to the treatment, and finally similar results as the plating alone are obtained, so similarly they are no more used.

Currently the gold standard in mandible reconstruction is the osteocutaneous free flaps (**Figure 9a–c**) and carries the same consideration as mentioned in floor of mouth reconstruction with a trend to perform a first time micro vascularized bone reconstruction with dental implants mainly in a previous dentulous young patient [28]. In an aged edentulous patient in the reconstruction setting, there is most likely no need to be aware for dental implants unlike dentulous young patient. Again, in selected patients with poor clinical condition and not suitable for a long procedure, a osteocutaneous pediculate flap such as a osteomyocutaneous trapezius flap [29] or a bicortical parietal osteofascial pedicled flap [30] can be perform providing a better functional result compared with just soft tissue coverage. Both flaps require experience, skills, and anatomic knowledge to harvest them in a short period of time but are an excellent alternative when needed.

4.3 Cheek

The cheek resection is done less frequently except in some countries like India, where cheek cancer is frequent and as a consequence of chewing tobacco; usually its oncological resections leave a complex defect that includes skin and mucosa in an area where a functional lip is required to avoid food spillage. The consequent

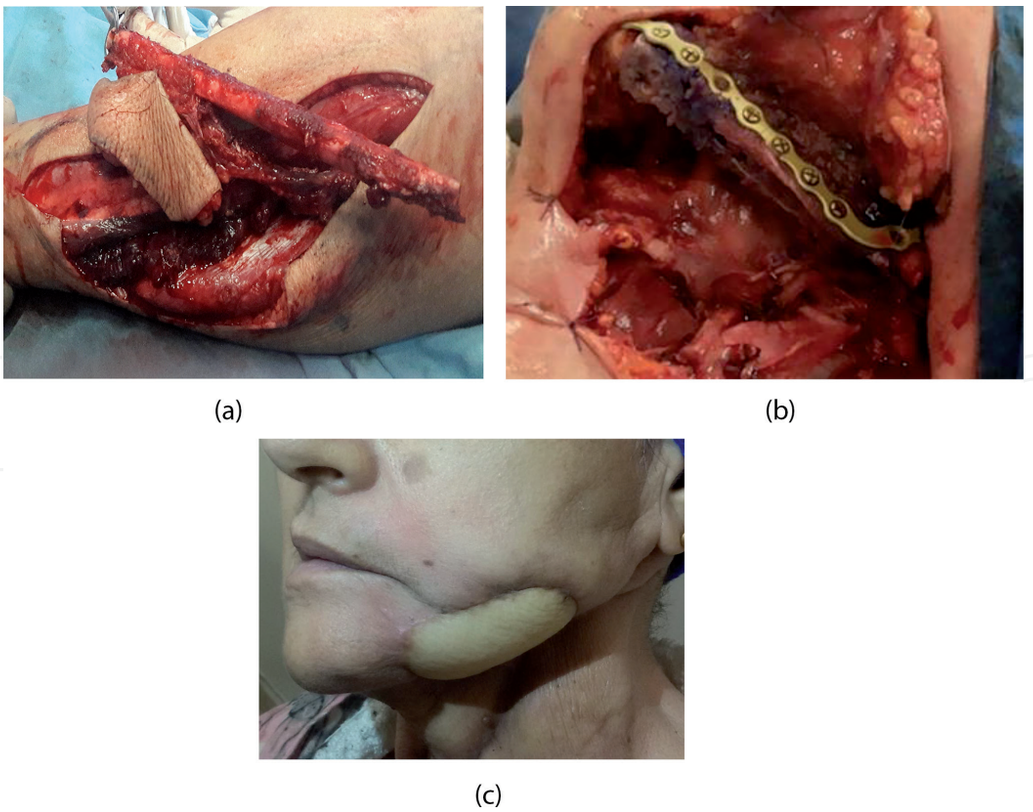


Figure 9.
(a) FFF harvest, (b) FFF insetting and (c) FFF early postoperative outcome.

defect may be small or big and simple or composite associated to another oral cavity subsite resection. Small lesions of the cheek could be let alone to epithelize, but a bigger one will end in a scar and retraction, so a reconstruction must be done. In most of the cases a facial artery mucomucosal flap (FAMM) could be used. This flap based on a branch of the facial artery is elevated in the layer underneath the facial artery including the overlying buccinators muscle and a small portion of orbicularis oris muscle close to the oral commissure; it is rotated to cover the defect commonly restoring it, and the donor site could be primary closed or let it to heal secondarily without impairing its final functional result. A huge defect might need a pediculate flap such as submandibular or supraclavicular flap or even a microvascular free flap. Some encourage for the supraclavicular pediculate flap as the first option in this scenery, which usually provides a good amount of a non-bulky tissue without affecting oncological resection of node neck dissection in level Ia and Ib, and adducing that submandibular flap is too bulky to placed it in this specific region.

4.4 Hard palate

The extent of resection of hard palate is crucial to define the type and modality of reconstruction. The defect may be small and involve any portion of the hard palate, the premaxilla, or any portion of the maxillary alveolus with or without tooth-bearing or may be as huge as more than 50% of the hard palate. Many of the times, it is associated with partial or total maxillectomy so ending in a complex defect. Small defects can be let just to re-epithelize with excellent results. For a bigger one, a skin graft can be used; the problem is to support it long enough to achieve its integration to the hard palate; sometimes, the flap is detached and lost in which case healing by second intention is required. Small to medium defects may demand to harvest a palatal mucoperiosteal flap (PMPF). This flap is based on the greater palatine artery; preserving this vascular pedicle allows to rotate

it to resurface the mucosal defect [31]. Its limit is related to the amount of tissue needed, and up to 3 cm can be covered with this flap. In a bigger 3–5 cm hole, also a submandibular pediculate flap could be used to cover it. In as much as in this location, there are no specific needs for muscle or for a thicker soft tissue; any attempt should be done to assemble it with just enough muscle behind that guarantees skin perfusion by perforants preventing necrosis and providing a flat new tissue. A composite defect that includes the maxillary alveolus with tooth-bearing or partial to total maxillectomy will end in oroantral communication (**Figure 10a** and **b**). This type of reconstruction needs special considerations that are not the subject of this chapter and are best described in midface reconstruction; in general terms the main goal of the reconstruction is to restore chewing and solve the oroantral communication, so options for small include lesions and the use of an obturator that covers the opening avoiding leaks through the paranasal sinus and improving chew. As the aperture gets bigger, soft tissue flaps like a radial forearm free flap or an anterolateral thigh free flap are needed [32], and if dental implants are planned, microvascular osteocutaneous flaps obtained from fibula free flap or iliac crest free flap must be designed.

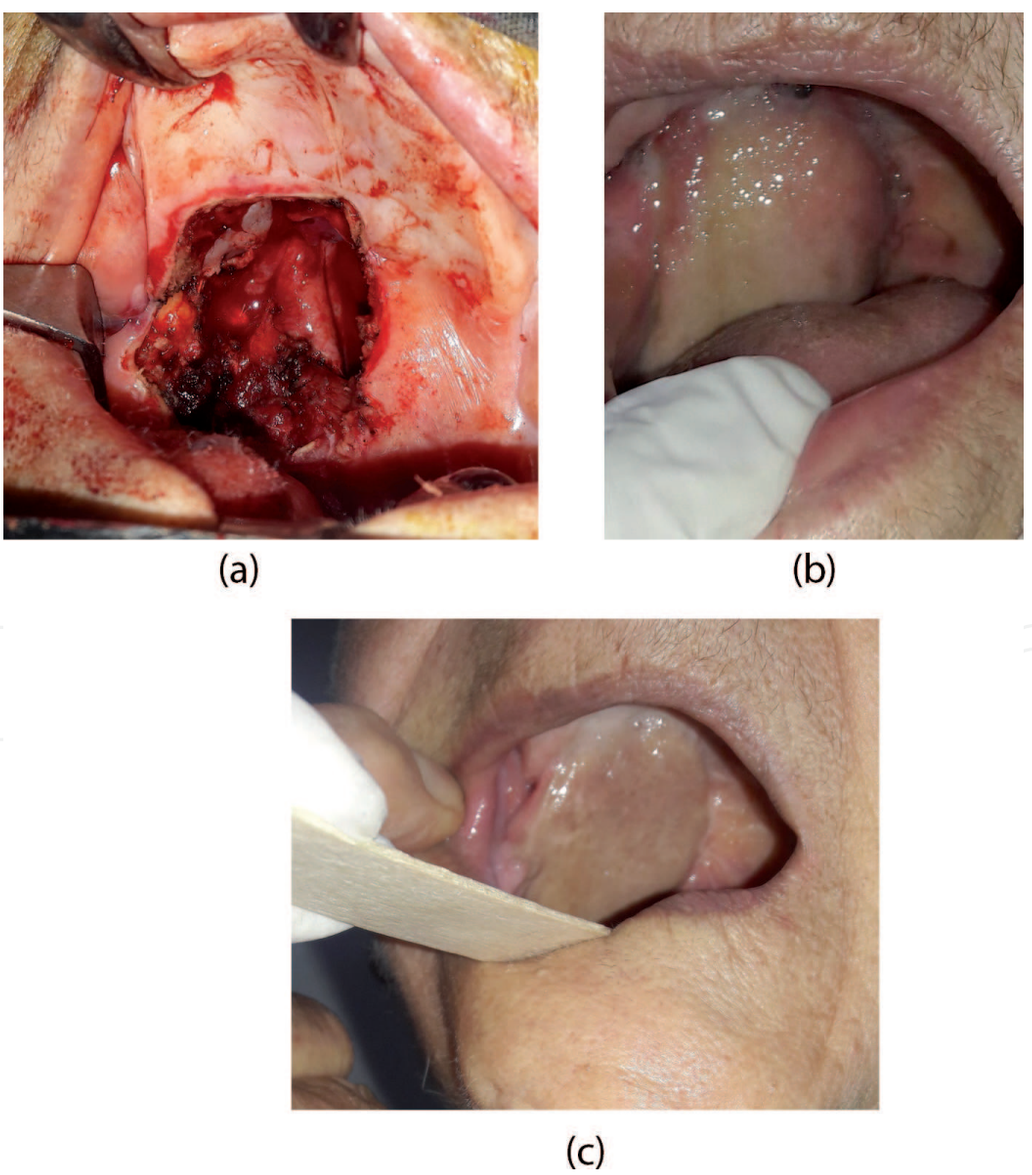


Figure 10.
(a) Hard palate defect after resection, (b) hard palate outcome after 1 month reconstruction and (c) hard palate outcome after 2 years of reconstruction.

5. Care of flaps and donor site

The use of flaps in reconstruction requires special care in terms of surveillance of perfusion and integration. The pediculate flaps usually do not jeopardize the perfusion, but sometimes a minor venous congestion can be expected. As a preventive measure, any intent must be done to avoid tension or compression of the vessel that perfuses the flap. The free flaps require special attention due to the risk of arterial or venous thrombosis and flap failure. Strict vigilance during the first 72 h after surgery and searching for signs of an early venous congestion or arterial occlusion can detect early failure of the flap and may permit in many cases a successful intervention to preserve the flap. The use of Doppler monitoring may help to reach that goal.

The donor site when skin grafted may be left secured and covered with wet gauze up to 8 days to reach adherence of the tissue. Sometimes small bleeding is expected with no need of a revision surgery. If the donor site is primary closed, surveillance of a compartment syndrome is necessary especially if it is closed is under tension.

6. Future directions

Reconstruction has been evolving during the last 20 years. Access to technology is assisting the planning of the resection and reconstruction. Additionally, 3D printers will better permit in the future to mimic tissue, so almost a perfect design of the tissue to reconstruct will be performed. Even that, function of some organs like tongue jet cannot properly be replaced, so much work is still necessary to reach that goal. New techniques in surveillance in microvascular perfusion like specific measurement of flap perfusion zones with heat chambers are being developing.

7. Tips in oral reconstruction

- In oncological resection, patient survival must be guaranteed being the main goal to take a decision in terms of reconstruction.
- Satisfactory reconstruction favors rehabilitation and quality of life.
- The best reconstruction is the less invasive and time consuming that could achieve the aim of adequate function, esthetics, and rehabilitation.
- Clinical condition of the patient, comorbidities, and status performance may limit a long-time procedure, so a local or pediculate flap must be choose.
- Whenever possible a local or pediculate flap is preferred if reconstruction outcomes are going to be as similar as to a free flap reconstruction.
- Free flap reconstruction when indicated must be done to restore or improve function and cosmetic end and needs a team with skills in microvascular reconstruction.
- Adequate knowledge of different alternatives in reconstruction provides the best comprehensive approach to reconstruct defects based on the location, size, color match, function, and complexity of structures involved.
- **Figures 11** and **12** show a rational approach in oral reconstruction.

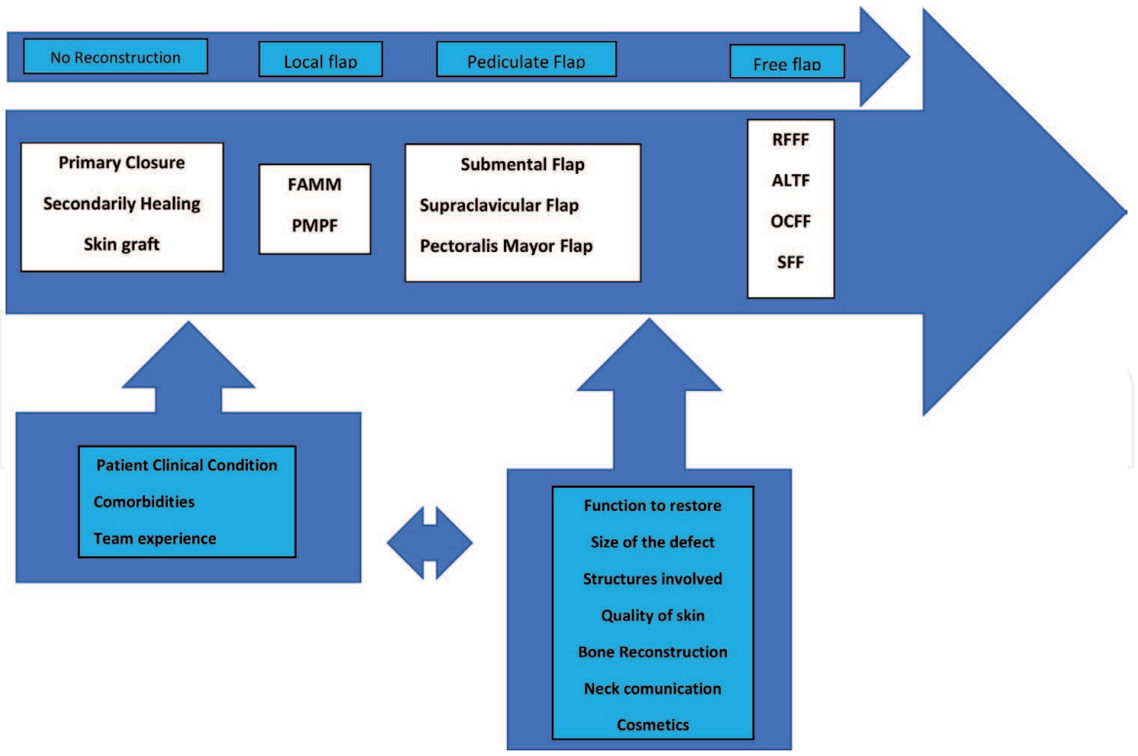


Figure 11.
Reconstruction based on patient status.

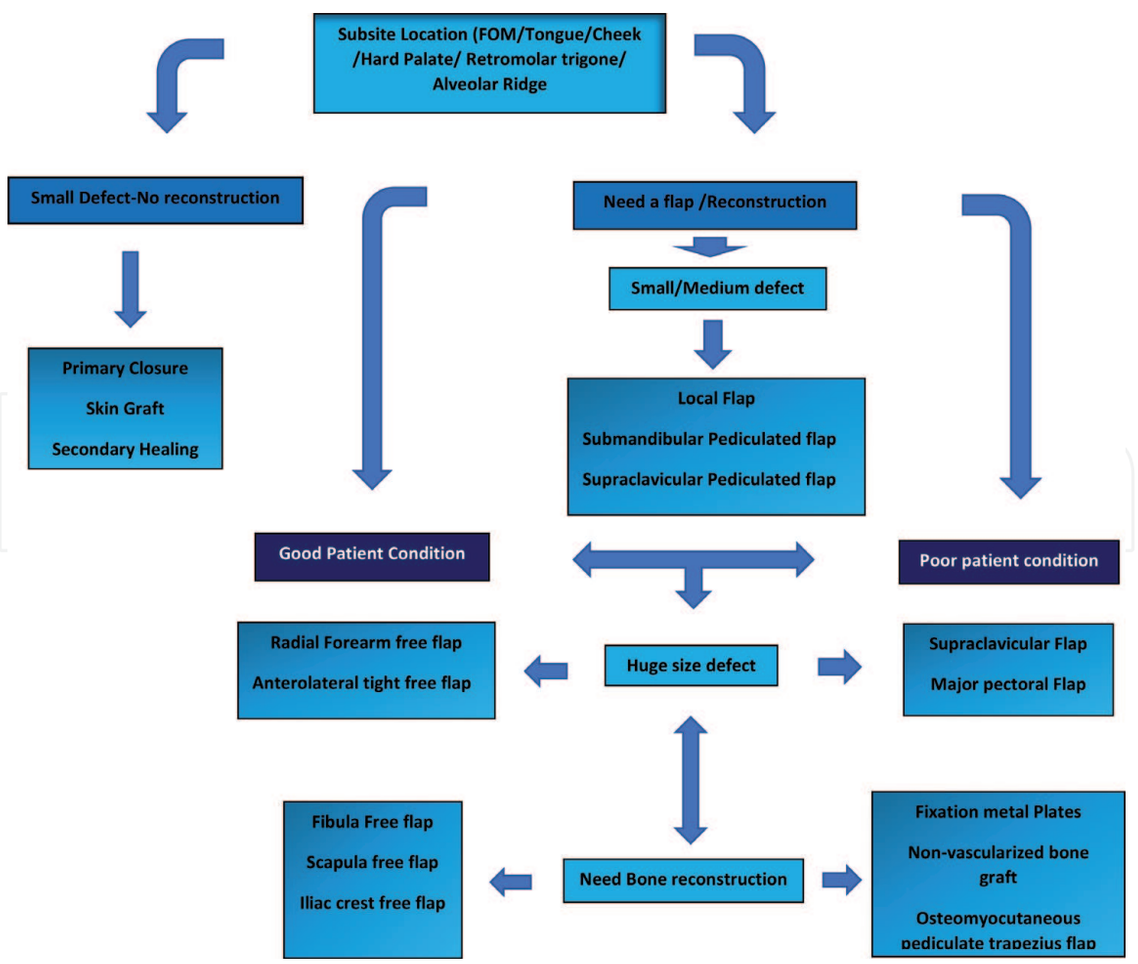


Figure 12.
Reconstruction based on size of the defect.

8. Conclusions

Head and neck cancer requires a multidisciplinary approach to face diagnosis, treatment, and rehabilitation. Oral cancer is one of the most frequent sites in which functional disturbance due to the primary tumor invasion or destruction of normal tissue or its treatment like extensive surgery, chemotherapy, radiation, or the combination of them ends in functional and cosmetic disturbance that impacts quality of life. Especially surgery creates a defect that alter function in terms of deglutition, swallowing, speech, breathing, and esthetics. Immediate reconstruction is necessary and must be intended to restore or improve rehabilitation.

Reconstruction calls to assay factors related to the patient, to the tumor defect, and to the team expertise. The best and simplest reconstructive option must be offered to refurbish as similar as possible to a new normal functional tissue, as well as guaranteeing patient survival with low morbidity, without neglecting the reasonable employment of technical and economic resources. Critical analysis must be done in every case to decide from a primary close to escalate up to a micro vascularized free flap.

Conflict of interest

The author declares no conflict of interest.

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