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Interdisciplinary Dental, Laboratory, and Nursing Considerations in Glossectomy Management

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Abstract

Background: A glossectomy is a major surgical procedure involving the partial or total resection of the tongue, primarily performed for oncologic management of oral cancers. The procedure's complexity arises from the tongue's intricate anatomy, critical roles in speech, swallowing, and airway protection, and its rich vascular and neural supply.

Aim: This article comprehensively reviews the interdisciplinary management of glossectomy patients, detailing the surgical approaches, indications, and the essential collaborative roles of dental, laboratory, and nursing professionals in optimizing patient outcomes.

Methods: The review synthesizes established surgical techniques, including transoral, lip-split mandibulotomy, and transcervical pull-through approaches. The selection of the appropriate method is based on tumor characteristics (size, location, stage), patient anatomy, and reconstructive needs. The integral contributions of the interdisciplinary team—from preoperative dental assessment to intraoperative pathology and postoperative nursing care—are systematically outlined.

Results: Each surgical approach offers distinct advantages and limitations in exposure and morbidity. Glossectomy invariably leads to significant functional complications, most notably dysarthria and dysphagia, the severity of which depends on the extent of the resection. Successful management relies on meticulous preoperative planning, precise surgical execution with intraoperative margin assessment, and robust reconstruction, often with free tissue transfer, to restore form and function.

Conclusion: The effective management of glossectomy patients is fundamentally an interdisciplinary endeavor. A coordinated team, including surgeons, dentists, pathologists, nurses, and rehabilitation therapists, is crucial for achieving oncologic control, minimizing complications, and facilitating functional recovery, thereby improving overall quality of life.

Keywords: Glossectomy, Head and Neck Cancer, Surgical Oncology, Multidisciplinary Care, Dysphagia, Microvascular Reconstruction, Oral Rehabilitation.

1. Introduction

Glossectomy refers to a group of major surgical procedures involving the resection of a portion or, in more advanced cases, the entirety of the tongue. It is a cornerstone intervention in the management of a wide spectrum of lingual pathologies, particularly those of oncologic significance, and is therefore central to head and neck surgical practice.[1] Although several classification systems have been proposed, glossectomy is most commonly categorized according to two principal parameters: the laterality of the resection (left, right, or midline) and the proportion of tongue tissue removed. This dual framework facilitates precise communication among surgeons, oncologists, and rehabilitation teams, and also provides a structured basis for treatment planning, prognostication, and comparative outcome analysis.[2] Within this scheme, partial glossectomy denotes removal of less than half of the tongue, hemiglossectomy indicates resection of exactly one half, subtotal glossectomy involves excision of more than half but not the entirety of the

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organ, and total glossectomy represents complete removal of the tongue.[1][2] In contemporary practice, glossectomy is performed primarily for the management of malignant and premalignant lesions of the tongue, most frequently squamous cell carcinoma. The extent of resection is determined by tumor size, depth of invasion, anatomical subsite, lymphatic spread, and functional considerations, including anticipated effects on speech, swallowing, and airway protection.[3] Beyond oncologic indications, glossectomy may be required in selected non-malignant conditions. These include severe macroglossia causing functional impairment, significant obstructive sleep apnea attributable to tongue base hypertrophy, and bulky benign tumors that compromise the upper aerodigestive tract or interfere with oral function.[1][4] In such cases, the goal of surgery is not only removal of the pathological tissue but also restoration or preservation of adequate airway patency, mastication, deglutition, and intelligible speech, often requiring coordinated input from maxillofacial surgery, prosthodontics, and speech and swallowing therapy.[3][4] A variety of surgical approaches and techniques can be applied across the spectrum of glossectomy indications, ranging from traditional open transoral resections to more advanced methods such as transoral robotic or endoscopic-assisted procedures, depending on tumor location, size, and surgeon expertise.[3] These approaches are tailored to maximize oncologic control while minimizing morbidity, particularly with respect to hemorrhage, airway compromise, and long-term functional deficits. Careful preoperative assessment, meticulous intraoperative technique, and comprehensive postoperative rehabilitation are therefore integral components of glossectomy management pathways, irrespective of whether the underlying pathology is malignant, premalignant, or benign.[2][4]

Anatomy and Physiology

Muscles and Divisions of the Tongue

The tongue is a highly specialized muscular organ located within the oral cavity, playing an essential role in mastication, deglutition, gustation, and speech production. Functionally, it integrates complex neuromuscular activity with finely tuned sensory feedback to coordinate movements required for bolus manipulation, swallowing, and articulation. Structurally, the tongue is a midline organ with a largely symmetrical arrangement of muscles, innervation, and vasculature. It is divided into two mirrored halves by an avascular midline fibrous septum or raphe, which may contain small amounts of adipose tissue and lymphatic channels, providing a central partition that can influence the spread of infection and malignant disease.[5] Histologically, the dorsal and ventral surfaces of the tongue are lined by stratified squamous epithelium, which may be keratinized or nonkeratinized depending on region and functional demand. Superimposed on this epithelium is specialized sensory mucosa containing various papillae and taste buds, enabling gustatory perception and contributing to oral texture discrimination. The topographic anatomy of the tongue includes the tip (apex), lateral borders, ventral surface, dorsal surface, and base. The tip represents the most anterior portion and is particularly important in fine manipulative movements during speech and bolus control. The lateral edges demarcate the transition between the dorsal and ventral aspects and are common sites for traumatic ulceration and neoplastic lesions. The ventral surface, facing the floor of the mouth, is comparatively smooth and thinly mucosalized, allowing for the visualization of prominent sublingual veins. The dorsal surface, in contrast, is thicker, more irregular, and covered by filiform, fungiform, circumvallate, and foliate papillae, which contribute to both mechanical function and taste sensation.[5] Posteriorly, the base of the tongue comprises approximately the posterior one-third, extending from the circumvallate papillae to the vallecula, a space located between the tongue base and epiglottis.[6] This posterior region is embryologically distinct from the anterior two-thirds, developing from pharyngeal arches rather than the first arch-derived oral tongue, and this developmental distinction underlies differences in innervation, lymphatic drainage, and oncologic behavior.[6]

From a clinical and surgical perspective, the tongue is often divided into thirds. The anterior one-third largely corresponds to the tip and adjacent portion of the oral tongue, the middle third occupies the central portion, and the posterior one-third constitutes the tongue base. The anterior two-thirds lie within the confines of the oral cavity, whereas the posterior one-third belongs to the oropharynx, an important distinction when classifying tumors and planning surgical or radiotherapeutic interventions.[6] These anatomical divisions correlate with different patterns of lymphatic spread, symptomatology, and surgical accessibility, and therefore must be clearly understood in procedures such as glossectomy. The muscular architecture of the tongue is complex and composed of eight paired muscles, categorized as intrinsic or extrinsic according to their origin and function.[7] Intrinsic muscles are confined entirely within the tongue and do not attach to external skeletal structures. They include the superior longitudinal, inferior longitudinal, transverse, and vertical muscles. Acting in coordinated fashion, these muscles modify the tongue's shape by shortening, lengthening, narrowing, flattening, or curling its surfaces. Such refined control is essential for precise articulatory movements, bolus shaping during mastication, and the formation of an adequate lingual seal during swallowing.[7] The extrinsic muscles—the genioglossus, styloglossus, hyoglossus, and palatoglossus—originate from bony or soft tissue

structures outside the tongue and insert into its substance. Collectively, they reposition the tongue within the oral cavity and oropharynx, enabling protrusion, retraction, elevation, depression, and complex three-dimensional movements. The genioglossus is the principal protrusor and a critical muscle in maintaining airway patency, particularly during sleep. The styloglossus retracts and elevates the tongue, the hyoglossus depresses and retracts its sides, and the palatoglossus contributes to elevation of the tongue and lowering of the soft palate, functioning at the interface between the oral cavity and oropharynx.[7] This integrated muscular framework allows the tongue to act as both a highly mobile and structurally supportive organ, and disruption of these muscles during surgery has direct implications for postoperative function.

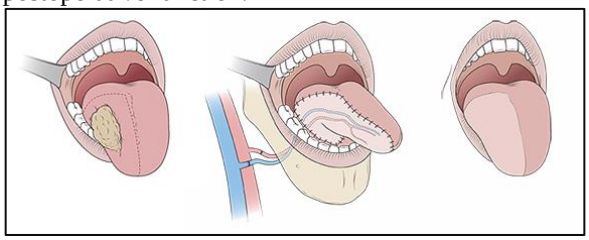

Fig. 1: Glossectomy.

Tongue Innervation

The tongue receives a rich and intricate innervation supplying motor, general sensory, and special sensory (taste) modalities. Motor innervation to almost all intrinsic and extrinsic tongue muscles is provided by the hypoglossal nerve (cranial nerve XII). This nerve originates from the hypoglossal nucleus in the medulla, exits the skull through the hypoglossal canal, and descends into the neck, where it courses anterior to the internal and external carotid arteries.[7] It typically lies deep to the posterior belly of the digastric muscle and the stylohyoid muscle, then passes forward, often inferior to the posterior belly of the digastric as it travels anteriorly. This anatomical relationship renders the hypoglossal nerve vulnerable during surgical dissections of neck levels 1B and 2A, particularly during neck dissection or submandibular gland surgery. The nerve then turns superomedially, passing deep to the mylohyoid muscle, and divides into terminal branches that innervate both intrinsic and extrinsic tongue muscles. Preservation of the hypoglossal nerve is essential in glossectomy and neck dissection to maintain residual tongue mobility and optimize postoperative speech and swallowing. The sensory and special sensory innervation of the tongue is distributed according to its anatomical subdivisions. General somatic sensation (touch, pain, temperature) from the anterior two-thirds of the tongue is mediated by the lingual nerve, a branch of the mandibular division of the trigeminal nerve (cranial nerve V3). This nerve courses in the floor of the mouth, in close relationship to the mandibular third molar region, which explains its susceptibility to iatrogenic injury during dental extractions and oral surgery.[5] The posterior one-third of the tongue, including the circumvallate papillae and tongue base, receives general sensory innervation from the glossopharyngeal nerve (cranial nerve IX), which also contributes to the gag reflex and plays an important role in oropharyngeal sensation.

Taste perception follows a similarly region-specific pattern. Special sensory fibers conveying taste from the anterior two-thirds travel via the chorda tympani branch of the facial nerve (cranial nerve VII). The chorda tympani joins the lingual nerve in the infratemporal fossa, hitchhiking within it before ultimately reaching the tongue, where it innervates taste buds in the fungiform and other papillae.[5] Taste from the posterior one-third of the tongue is mediated primarily by the glossopharyngeal nerve, while regions near the epiglottis and vallecula receive taste fibers from the superior laryngeal branch of the vagus nerve (cranial nerve X). This complex innervation pattern reflects the tongue's dual embryologic origin and underscores the need for precise anatomical knowledge when interpreting sensory deficits or planning resections for malignancy involving the oral tongue and oropharynx.

Arterial Supply and Lymphatic Drainage of the Tongue

The tongue has a robust arterial supply, mainly derived from the external carotid system. The principal vessel is the lingual artery, a branch of the external carotid artery that typically arises between the superior thyroid and facial arteries.[8] After originating from the external carotid, the lingual artery runs deep to the hyoglossus muscle, giving off several branches, including the dorsal lingual branches to the posterior tongue and the deep lingual and sublingual arteries to the anterior tongue and floor of the mouth. Additional vascular contributions, such as the tonsillar branch of the facial artery, may supply adjacent regions including the palatine tonsil and tongue base.[8] Venous drainage mirrors the arterial supply and occurs through the lingual veins, which empty into the internal jugular vein. This rich vascular network has implications for both intraoperative bleeding risk and the potential hematogenous spread of malignancy. Lymphatic drainage of the tongue is of paramount importance in the context of oral and oropharyngeal cancer, as it strongly influences patterns of regional metastasis and guides the extent of neck dissection. The oral tongue (anterior two-thirds) drains predominantly to cervical lymph node levels 1 through 3.[9][10] These include the submental nodes at level 1A, the submandibular nodes at level 1B, and the upper jugular chain nodes at levels 2 and 3. Because lymphatic channels often cross the midline, unilateral lesions may give rise to bilateral nodal metastases, particularly when tumors approach or involve the midline raphe.[9] In contrast, the tongue base, which is part of the oropharynx, drains mainly into levels 2 through 4 along the upper and mid-jugular chains.[10] This difference in drainage pathways explains the

higher rates of clinically occult nodal involvement in tongue base carcinomas and supports more extensive bilateral neck management in such cases.

A detailed understanding of lingual lymphatic anatomy is critical for locoregional control of tongue cancers. Even in clinically N0 necks, there is a substantial risk of occult lymph node metastases, with reported rates of approximately 20% for squamous cell carcinoma of the tongue.[11] Tumor thickness and depth of invasion are strongly correlated with the likelihood of cervical nodal metastasis, and increasing tumor thickness has been consistently associated with worse regional control and survival outcomes.[12][13][14] Consequently, the burden of nodal disease serves as a powerful predictor of mortality in tongue cancer. Multiple studies have demonstrated that elective neck dissection in patients with early-stage oral tongue carcinoma confers a survival advantage and leads to higher disease-free survival when compared with observation or delayed therapeutic neck dissection performed only when nodal disease becomes clinically evident.[15][16] Occasionally, metastatic deposits may be found in lower jugular nodes at levels 3 and 4, even when levels 1 and 2 appear uninvolved, reflecting the complex and sometimes unpredictable nature of lymphatic spread.[17] This phenomenon supports a more comprehensive approach to neck management in selected high-risk cases. Therefore, neck dissection is strongly recommended in many patients with tongue carcinoma, not only as a therapeutic procedure but also as a staging tool that allows for precise pathological assessment of lymph node status. Accurate evaluation of nodal involvement informs the need for adjuvant therapy, refines prognostication, and ultimately contributes to improved overall and disease-free survival.[11][15][16][17]

Indications

Glossectomy is a surgical procedure most commonly undertaken for the management of malignant and premalignant lesions of the oral cavity, particularly squamous cell carcinoma of the oral tongue. In this context, the goal of surgery is complete oncologic clearance with adequate margins while preserving, as far as possible, speech, swallowing, and airway function.[18] In addition to clearly malignant lesions, glossectomy may be indicated for dysplastic or precancerous changes not amenable to conservative local excision, especially in patients with high-risk features or recurrent disease. It is also employed for diagnostic purposes, such as excisional or incisional biopsy of tongue lesions of uncertain origin, when less invasive approaches fail to provide sufficient tissue for histopathologic assessment.[18][19] Beyond oncologic indications, glossectomy can be performed for benign tumors of the tongue that are symptomatic or enlarging, for macroglossia that interferes with occlusion, speech, airway patency, or oral hygiene, and in selected cases of obstructive sleep apnea in which tongue base enlargement significantly contributes to upper airway obstruction.[19] Thus, the scope of glossectomy extends from limited diagnostic resections to extensive ablative procedures as part of comprehensive head and neck cancer management. Multiple surgical approaches are available to perform a glossectomy, each with distinct advantages and limitations. The principal approaches include transoral glossectomy, glossectomy via lip-split mandibulotomy, and glossectomy via transcervical pull-through.[20] The choice among these techniques is influenced by tumor size, depth, and location, as well as by patient-specific anatomical factors, prior treatments, and reconstructive requirements. In all cases, the overarching objective remains the same: to achieve a microscopically margin-negative resection while minimizing functional impairment and procedural morbidity.[18][20]

Glossectomy Approaches

Transoral glossectomy, in which the lesion and surrounding tongue tissue are removed entirely through the oral cavity, is conceptually the most straightforward of the three main approaches. It generally involves the fewest procedural steps, avoids external incisions, and is therefore often associated with shorter operative times and less conspicuous scarring.[18] In appropriately selected patients, particularly those with smaller, more anterior lesions, transoral resection can provide excellent oncologic and functional outcomes. However, this approach has inherent limitations in terms of exposure and access, particularly to the posterior tongue, tongue base, and deep infiltrative components of larger tumors.[19] Since most glossectomies are performed for malignant disease, where achieving clear three-dimensional margins is crucial, inadequate exposure can compromise the ability to perform a complete oncologic resection. For this reason, careful preoperative assessment and intraoperative judgment are essential to avoid underestimating the extent of disease and attempting a transoral approach in cases where visibility and access are insufficient to ensure margin-negative surgery.[18][20] The lip-split mandibulotomy approach provides the widest surgical exposure of the oral cavity, tongue, floor of mouth, and oropharynx, but it is also the most time-consuming and technically demanding option. This technique requires a sagittal osteotomy of the mandible, typically combined with a midline or paramedian lip-split incision, to allow the mandible to be opened like a hinged door.[20] Once the mandible is divided and mobilized, the surgeon gains excellent access to the posterior tongue, tongue base, and pharynx, enabling precise assessment of tumor extent and facilitating en bloc resections that might otherwise be impossible. The price of this exposure is a higher risk of complications, including those associated with osteotomy and fixation, such as malocclusion, nonunion, infection, and sensory disturbances of the

lower lip or teeth.[20] At the conclusion of the ablative procedure, mandibular reconstruction and rigid fixation are required, adding operative time and complexity. Nonetheless, for very large or deeply infiltrative tumors, lip-split mandibulotomy may represent the only feasible route to a truly adequate resection.

Glossectomy via transcervical pull-through offers an intermediate option in terms of exposure and morbidity. In this technique, the tongue is released inferiorly into the neck by opening the floor of the mouth and connecting it to the cervical dissection field. This is accomplished by entering and expanding the sublingual and submental compartments from a neck incision, thereby allowing the tongue to be displaced downward and forward, improving visualization of the posterior and deep aspects of the lesion.[20] Although the mandible remains intact, limiting exposure compared to lip-split mandibulotomy, transcervical pull-through often provides sufficient access for many tumors of the middle and posterior oral tongue and tongue base, without the need for a sagittal osteotomy or subsequent mandibular reconstruction. This approach may reduce operative morbidity and avoid some of the complications associated with bony division, while still facilitating a safe and thorough oncologic resection.[20]

Technique-Specific Indications

Selecting the optimal glossectomy approach requires a nuanced consideration of tumor characteristics, patient anatomy, and planned reconstructive strategies. Central to this decision-making process is the TNM staging system for head and neck cancers, which classifies tumors based on their local extent (T), regional nodal involvement (N), and distant metastasis (M). For tumors of the oral tongue, T-category staging incorporates both maximal tumor diameter and depth of invasion (DOI).[21] Carcinoma in situ is designated as Tis. T1 tumors measure 2 cm or less in greatest dimension with a depth of invasion of 5 mm or less. T2 tumors are either 2 cm or less with a DOI greater than 5 mm, or between 2 and 4 cm in size with a DOI of 10 mm or less. T3 tumors are defined as lesions greater than 4 cm in diameter or having a depth of invasion greater than 10 mm. T4 disease reflects advanced local invasion into adjacent structures. T4a tumors invade nearby structures such as the mandible, maxilla, or skin of the face, while T4b tumors represent very advanced disease with involvement of the pterygoid plates, skull base, or encasement of the carotid artery.[21] In general, smaller and shallower tumors—classified as Tis, T1, and many T2 lesions—are well suited to transoral resection, provided that adequate exposure can be ensured and that the surgeon can confidently obtain clear margins.[18][21] Larger tumors, particularly those falling into the high T2, T3, and T4a categories, may extend deeply into the tongue musculature or posteriorly toward the tongue base and oropharynx. In such cases, a transcervical pull-through or lip-split mandibulotomy often provides superior access to the full extent of the tumor and its surrounding tissues, enabling an en bloc resection with appropriate oncologic margins.[20][21] T4b disease is typically considered unresectable due to involvement of critical skull base structures or major vascular encasement; for these patients, non-surgical or palliative approaches are usually favored.[21]

Tumor location is equally important in selecting an approach. Lesions confined to the anterior tongue are more amenable to transoral techniques, even when they are relatively large, because they can be adequately visualized and mobilized within the oral cavity. For example, a bulky T3 lesion at the tip or within the anterior half of the tongue may still be approached transorally if exposure is satisfactory.[18] By contrast, a more modestly sized tumor—such as a 3 cm T2 lesion—in the posterior middle-third of the tongue, particularly if it extends toward or onto the tongue base, may be poorly visualized and difficult to resect safely through a purely transoral route. In such situations, a transcervical pull-through approach can provide the additional inferior and posterior exposure needed to achieve a margin-negative resection.[20] Additional surgical considerations become critical when planning more extensive tongue resections. Neck dissection is almost always considered in the setting of glossectomy for malignant disease due to the substantial risk of cervical lymph node metastases from oral tongue carcinoma.[22] The choice of unilateral versus bilateral neck dissection and the levels to be included are guided by tumor size, depth, location, and midline involvement. When the floor of the mouth is involved and must be resected along with the tongue, and when this is combined with a submandibular triangle (level IB) nodal dissection, reconstruction may be necessary to reconstitute the floor of the mouth and to maintain separation between the neck and oral cavity.[23] Failure to do so risks the development of an orocervical fistula and prolonged wound complications. In cases where a significant portion of the tongue is removed, reconstructive procedures using local, regional, or free flaps may be required to restore volume, mobility, and contour, thereby optimizing postoperative speech and swallowing. Both advanced reconstruction and comprehensive neck dissection generally necessitate a transcervical approach, which can be combined with either transcervical pull-through or lip-split mandibulotomy depending on the extent of exposure required.[20][23]

Patient-specific factors also influence the choice of approach. Severe trismus can make transoral glossectomy impractical, even if the tumor is otherwise suitable for this method. In such cases, despite the use of muscle relaxants, inadequate mouth opening may preclude the safe introduction of instruments and the clear visualization necessary for precise resection. Under these circumstances, a lip-

split mandibulotomy or transcervical pull-through may be indicated to overcome limited access.[20] However, transcervical pull-through still requires the performance of transoral mucosal incisions, which may be technically impossible in extreme trismus. Prior head and neck irradiation is another important consideration. In previously irradiated patients, lip-split mandibulotomy carries a heightened risk of osteoradionecrosis of the mandible due to compromised bone vascularity and healing capacity.[20] When feasible, a cervical pull-through approach may therefore be preferred in these patients to avoid osteotomy and reduce the risk of mandibular complications. Ultimately, the most effective surgical approach is the one that enables a microscopically margin-negative resection while balancing operative risk, functional outcome, and reconstructive needs.[18][22][23] The fastest or least invasive route is not necessarily the optimal one if it compromises exposure or jeopardizes oncologic adequacy. A careful weighing of the risks and benefits of each technique—considering tumor stage, location, patient comorbidities, prior treatments, and reconstructive requirements—allows the surgeon to select the approach that offers the best chance of durable locoregional control with acceptable morbidity.[20][21][22][23]

Contraindications

Beyond significant medical comorbidities that render a patient unfit for general anesthesia or major head and neck surgery, the principal contraindication to glossectomy is unresectable disease in the setting of malignancy. Unresectability is typically defined by oncologic and anatomical factors that preclude the achievement of a safe, margin-negative resection without unacceptable morbidity. These factors include the presence of distant metastatic disease, where systemic spread shifts the therapeutic focus from curative local surgery to palliative or systemic modalities, as well as extensive or circumferential carotid artery encasement, in which resection would carry a prohibitive risk of catastrophic neurologic injury or stroke. Similarly, direct tumor extension to the skull base or invasion into the paraspinal musculature generally signifies advanced, fixed disease that cannot be removed en bloc with clear margins. In such circumstances, radical glossectomy does not provide meaningful survival benefit and may impose severe functional impairment, so alternative non-surgical or palliative strategies are typically favored.

Equipment

Appropriate equipment is fundamental to achieving optimal exposure in glossectomy and thereby ensuring an adequate oncologic resection. Visualization within the oral cavity is inherently challenging due to its confined space, complex anatomy, and frequent presence of bleeding. For this reason, high-quality illumination is indispensable; in addition to standard operating room lighting, a focused headlight is strongly recommended to provide consistent, directed light deep into the oral cavity and oropharynx.[24] Mechanical aids for exposure are equally important. Mouth gags, bite blocks, and lip retractors are routinely employed to maintain mouth opening, displace soft tissues, and provide a stable operative field, allowing the surgeon and assistants to work with both hands free. Mouth gags can be combined with bite blocks, cheek retractors, and lip retractors to further optimize visualization of specific subsites, such as the lateral tongue or tongue base. Intraoperative manipulation of the tongue is often facilitated by traction sutures or specialized forceps. Placing 2-0 or 3-0 silk traction sutures through the anterior tongue enables gentle but secure delivery of the tongue outside the oral cavity, which can significantly improve access to more posterior lesions.[24] Locking fine-tipped forceps serve a similar function, allowing controlled traction while minimizing trauma to the tissue. For mucosal and muscular incisions, electrocautery is commonly used because it combines cutting with effective hemostasis, thereby limiting blood loss and maintaining a clear operative field. However, excessive thermal injury may distort tissue architecture and complicate histopathologic margin interpretation. To mitigate this, cold dissection with a scalpel can be supplemented by bipolar cautery for precise hemostasis when margin assessment is critical.[24] The carbon dioxide laser represents another valuable tool for glossectomy, offering the advantage of precise cutting with minimal collateral thermal damage, thereby helping preserve tissue margins for accurate pathological evaluation. Its main limitation is relatively limited hemostatic capacity, often necessitating adjunctive methods of bleeding control.[24] In cases where a mandibulotomy or mandibulectomy is anticipated as part of the surgical approach, appropriate bone-cutting instruments—such as oscillating saws or osteotomes—and a mandibular plating set are required for osteosynthesis and reconstruction of the jaw following completion of the glossectomy.[25] The availability and proper use of all these instruments directly influence operative safety, oncologic adequacy, and functional outcomes.

Personnel

Successful performance of a glossectomy requires a well-coordinated multidisciplinary team, with clearly defined roles and effective intraoperative communication. Essential personnel include the primary surgeon, one or two surgical assistants, a circulating or operating room nurse, a surgical technologist, and an anesthesiologist. The primary surgeon is responsible for operative planning, execution of the resection, and intraoperative decision-making regarding margins, extent of resection, and need for reconstruction or modification of the approach. Surgical assistants play a crucial role in

maintaining exposure, managing suction, handling instruments, and assisting with hemostasis and tissue manipulation, particularly in deep or poorly accessible areas of the oral cavity and oropharynx. The anesthesiologist is integral to perioperative management, with special emphasis on airway security, given that many patients have large or obstructive oral lesions and may require awake fiberoptic intubation or tracheostomy. Preoperative discussion between the primary surgeon and anesthesiologist regarding airway strategy, patient positioning, and the potential need for postoperative airway support is essential to minimize complications. The circulating nurse coordinates overall operating room flow, manages documentation, and ensures that required equipment and implants are available and sterile. The surgical technologist prepares and passes instruments, anticipates the needs of the surgeon, and helps maintain an organized operative field. In complex cases, additional team members such as a reconstructive microsurgeon, speech and swallowing therapist, or intensivist may become involved in perioperative care. Collectively, this coordinated team structure supports safe anesthesia, adequate exposure, efficient operative workflow, and optimal oncologic and functional outcomes.

Preparation

Thorough preparation for glossectomy begins long before the patient enters the operating room and is centered on careful preoperative assessment of the tumor and the formulation of a detailed perioperative airway and surgical plan. This process starts with a comprehensive clinical history and physical examination, with attention not only to the characteristics of the primary lesion but also to the patient's overall oncologic status, comorbidities, and prior treatments. Because glossectomy is often performed in the context of head and neck malignancy, preparation must integrate oncologic principles, airway safety, and reconstructive considerations into a single coherent strategy that can be executed safely on the day of surgery.[26][27]

Clinical History

At the initial clinical consultation, a detailed history is essential to guide decision-making and anticipate potential complications. The surgeon should first review any previous oncologic diagnoses and treatments, including current or past cancers elsewhere in the body, their stage, and treatment outcomes. Particular attention is given to prior head and neck surgeries, such as previous tongue resections, neck dissections, or reconstructive procedures, as well as a history of chemotherapy or radiation therapy to the head and neck region.[26] Prior radiation is especially important because it can impair wound healing, alter tissue planes, increase the risk of osteoradionecrosis, and complicate both ablative and reconstructive phases of the operation. The history should also elicit information about other head and neck procedures, including vascular surgeries, trauma reconstructions, or airway operations such as tracheostomy, laryngotracheal reconstruction, or previous prolonged intubations. These may significantly alter anatomy or create scar tissue that complicates dissection, airway management, or flap inset.[26] Systemic conditions that influence wound healing and postoperative recovery must be systematically reviewed. These include malnutrition, which can be suggested by weight loss, poor oral intake, or low body mass index; endocrine disorders such as poorly controlled hypothyroidism; chronic steroid use; autoimmune conditions; and active smoking or heavy alcohol use. Each of these factors is associated with impaired healing, increased infection risk, or poorer overall outcomes and may need optimization before surgery when feasible.[26][28] If free tissue transfer is under consideration for reconstruction, a focused assessment for peripheral vascular disease is necessary, as this may limit the suitability of common donor sites or compromise microvascular anastomoses. A history of claudication, previous vascular bypass procedures, or known arterial disease should prompt further vascular evaluation. Equally vital is a focused airway history: the clinician should ask specifically about any previous difficult intubations, episodes of airway obstruction, subglottic stenosis, prior tracheostomy, or prolonged intubation requiring intensive care. These details will influence the choice between standard intubation, awake fiberoptic techniques, or primary tracheostomy for airway control.[29][30]

Clinical Examination

The physical examination performed at the preoperative visit serves two critical purposes: evaluation of transoral exposure and detailed assessment of the primary tumor. Assessment of transoral exposure begins with asking the patient to open the mouth maximally and measuring the inter-dental distance between the upper and lower incisors or alveolar ridges. Limited mouth opening, or trismus, may markedly restrict the feasibility of a transoral approach and can instead necessitate a lip-split mandibulotomy or transcervical pull-through approach.[26] The status of the dentition must be evaluated carefully. Loose, carious, or periodontally compromised teeth may be at risk of damage during instrumentation or may complicate flap inset. For these reasons, a formal preoperative dental evaluation is often advisable, particularly in patients with significant dental disease or in those planned for postoperative radiotherapy.[26] Interestingly, edentulous patients can be advantageous candidates for glossectomy. Absence of teeth improves access and visualization by removing dental obstacles, eliminates the risk of dental injury, and allows for flap inset without the need for circum-dental sutures. Even in patients with poor dentition and periodontal hygiene, the benefits of an edentulous state with respect to exposure and manipulation of the tongue can outweigh potential drawbacks.[26] The tumor itself must be examined visually and by palpation. Visual

inspection should document the precise size, surface characteristics, and location of the lesion, noting whether it involves the lateral tongue, midline, tip, dorsal surface, ventral surface, base, or adjacent structures. The surgeon must anticipate the necessary mucosal margins and identify nearby anatomic structures that may need to be included in the composite specimen to achieve microscopically negative margins. These structures may include the floor of the mouth, contralateral tongue, tongue base, pharyngeal wall, soft palate, retromolar trigone, maxilla, buccal mucosa, hyoid bone, mandible, or even the larynx.[27][28]

Equally crucial is careful palpation of the tongue and surrounding tissues to assess the submucosal extent of the tumor and determine whether it is fixed to deeper structures. A superficial ulcerative lesion might initially appear to correspond to a T1 or T2 tumor based on surface dimensions alone; however, deep induration or submucosal extension discovered on palpation may reveal a more advanced T3 tumor that crosses the midline or infiltrates intrinsic tongue musculature.[27] Such findings can fundamentally change the operative plan, converting what seemed a suitable candidate for transoral partial glossectomy into a case requiring a mandibulotomy with subtotal glossectomy and complex soft tissue reconstruction.[27][28] Palpation of tumors in the middle third of the tongue is particularly important because achieving oncologic margins in this region may necessitate removal of the tongue base, retromolar trigone, or soft palate. Similarly, when the lesion extends into the floor of the mouth, palpation may suggest involvement of the mandible, in which case marginal or even segmental mandibulectomy with osseous reconstruction could be required.[28] Patients with severe pain can be difficult to examine thoroughly in the clinic, as tonguemobilization and palpation may be intolerable. For such patients, a complete examination under anesthesia at the start of the operative procedure is invaluable and often reveals more extensive disease than initially appreciated.[27][28]

Preoperative Tumor and Airway Assessment

Preoperative flexible laryngoscopy and imaging are powerful adjunctive tools in the assessment of both tumor extent and airway anatomy. Flexible laryngoscopy allows dynamic evaluation of the oropharynx, tongue base, vallecula, epiglottis, and larynx, providing real-time visualization of any tumor extension beyond the oral tongue. If laryngoscopy or imaging studies, such as contrast-enhanced CT or MRI, demonstrate involvement of the pharynx or larynx, then a purely transoral approach will generally be inadequate, and a more extensive approach such as transcervical pull-through or lip-split mandibulotomy must be considered.[27][29] These assessments also help predict airway difficulty. In early-stage oral tongue cancers, the airway is often sufficiently patent to permit routine oral or nasal intubation. Nasal intubation is frequently preferred because it keeps the endotracheal tube away from the operative field and allows better intraoral access.[29] In contrast, more advanced-stage cancers may present with tongue fixation, bulky mass effect, or trismus, all of which can compromise visualization of the glottis and complicate intubation. When laryngeal landmarks remain at least partially visible, video-assisted laryngoscopy or awake fiberoptic intubation—either nasal or oral—may offer a safe way to secure the airway without precipitating obstruction.[29][30]

In situations where flexible laryngoscopy reveals severe laryngeal obstruction or when laryngeal landmarks are completely obscured, awake tracheostomy may be the safest option. This is particularly relevant for patients in whom attempted intubation could dangerously worsen obstruction or precipitate complete airway compromise. A clear, preformulated airway management plan is therefore critical, and this plan must be discussed in detail with the anesthesiologist prior to surgery.[29][30] Many patients who undergo extensive tongue resection with flap reconstruction will require temporary tracheostomy to protect the airway from edema, hematoma, or bulk effect of the flap in the early postoperative period.[29][30] Patients with severe trismus present additional difficulties. They may not allow adequate visualization for either direct laryngoscopy or transoral tumor assessment. In such cases, awake nasal fiberoptic intubation may be appropriate if airway landmarks are identifiable and the anesthetist is comfortable with the technique. If airway landmarks are not visible or if nasal fiberoptic intubation appears unsafe, an awake tracheostomy may again be the preferred strategy. Once the airway is secured, an examination under anesthesia should be performed, including a full transoral exposure and palpation of the tumor.[27][29] This examination may lead to modification of the planned surgical approach if the tumor has progressed since the last clinic visit or if its full extent was previously underestimated due to pain or limited access. Direct laryngoscopy at the beginning of the procedure can further clarify involvement of the tongue base, vallecula, or larynx and guide the extent of resection required.[27][28]

Patient Preparation and Draping

Patient preparation and draping are determined by the anticipated extent of surgery, including whether neck dissection and reconstruction will be performed. For a transoral glossectomy without neck dissection, the operation is typically categorized as “clean-contaminated,” since the oral cavity is entered and contains endogenous flora.[31] In these cases, the focus is on maintaining a controlled operative field within the mouth while minimizing contamination of external sites. When neck dissection and reconstruction are planned, the strategy for skin preparation and draping must integrate both oral and

cervical fields. In many institutions, the patient is prepped and draped once for a procedure conducted under "sterile" conditions, even if a communication between the oral cavity and neck is expected. This allows continuity of the operation and avoids the need for redraping once the mucosa is violated.[31] Some surgeons, however, prefer a staged approach for combined transoral glossectomy and neck dissection when the neck is not initially entered from the oral cavity. In such cases, the glossectomy may first be performed in a nonsterile fashion, focusing on achieving negative margins without immediate concern for sterility of the neck. Once the primary tumor resection is complete and margins are confirmed, the operative field is then re-prepped and draped in a strictly sterile fashion for the neck dissection and any reconstructive procedures.[31] The choice and timing of perioperative antibiotic prophylaxis are at the surgeon's discretion, but regimens typically target oral flora and skin organisms, particularly when both intraoral and cervical fields are involved. Antibiotics are generally administered before incision and may be continued postoperatively depending on the duration of surgery, complexity of reconstruction, and presence of drains or hardware.[31] Proper positioning of the patient, securing fixation of the endotracheal or tracheostomy tube, and careful padding of pressure points are also part of preparation, ensuring that exposure is optimized without compromising patient safety. In summary, preparation for glossectomy encompasses a comprehensive clinical history, meticulous physical examination, detailed preoperative tumor and airway assessment, and thoughtful planning of patient preparation and draping. Each element contributes to selecting the optimal surgical approach, minimizing intraoperative and postoperative risks, and maximizing oncologic and functional outcomes.[26][27][28][29][30][31]

Technique or Treatment

Transoral Glossectomy Approach

Transoral glossectomy is the least complex of the primary approaches to tongue resection and, in appropriately selected patients, can achieve excellent oncologic clearance with comparatively low morbidity. This technique is best suited for T1 and T2 tumors and for lesions that are anteriorly located or relatively superficial within the tongue musculature. Because exposure is achieved entirely through the oral cavity, access to the posterior tongue and tongue base is inherently limited. Consequently, the more anterior the lesion, the more likely it is that a purely transoral approach will be oncologically adequate. When intraoperative visualization or access is found to be insufficient to confidently obtain margin-negative resection, the surgeon must be prepared to convert to a more extensive approach such as lip-split mandibulotomy or transcervical pull-through to avoid compromising oncologic principles. Achieving optimal exposure is the first critical step in transoral glossectomy. Self-retaining retractors and mouth gags are used to maintain mouth opening and free the hands of the surgeon and assistants. Commonly used mouth gags include Molt, Fergusson, and Jennings designs, which can be tailored to patient anatomy and tumor location. A bite block may be employed to support the jaws in an open position, reducing strain on the temporomandibular joints and preventing inadvertent closure. Mouth gags may be supplemented with cheek and lip retractors, which pull the soft tissues laterally and anteriorly, enhancing illumination and visualization of deeper aspects of the tongue while protecting the cheeks and buccal mucosa from trauma or thermal injury [31][32].

Traction on the tongue is essential for effective retraction and exposure of the lesion. This can be accomplished by placing traction sutures, usually 2-0 or 3-0 silk, through the anterior tongue or by using fine-point ratcheting (locking) forceps. Locking forceps provide stable control of the bulky, mobile tissue of the tongue, which can be difficult to grasp securely with nonlocking toothed instruments due to its softness and fluidity. Traction sutures also offer the advantage of distributing tension over a wider area of tissue, reducing focal trauma and facilitating multi-directional traction vectors as the resection progresses. Mucosal and muscle incisions in transoral glossectomy may be made using monopolar electrocautery, laser, or cold steel instruments. Monopolar cautery is widely used because it allows simultaneous cutting and hemostasis, which is valuable given the tongue's rich vascularity. However, excessive use of thermal energy can lead to charring and distortion of the tissue margins, complicating histopathologic evaluation, particularly in malignant and premalignant lesions where accurate margin interpretation is critical. In situations where monopolar cautery is relatively contraindicated, such as in patients with certain implanted electronic devices like cochlear implants or cardiac defibrillators, the surgeon may instead rely on a combination of cold steel dissection and bipolar cautery for hemostasis. The carbon dioxide laser represents another useful tool, providing precise cutting with minimal collateral thermal damage and thereby enhancing the clarity of margin assessment. Its limitation lies in relatively limited hemostatic capacity, often necessitating additional measures to control bleeding. The operative technique relies heavily on both visual and tactile feedback. Once exposure is established and traction is secured, the surgeon outlines mucosal margins—typically 1 to 2 cm circumferentially around malignant lesions—and makes initial incisions through the mucosa down to underlying muscle. Anterior margins are usually addressed first because visualization is more favorable and the surgeon can more confidently estimate the necessary margin width. When possible, making the posterior mucosal cuts earlier in the procedure may be advantageous, as bleeding from the anterior portion of the wound can otherwise obscure

the posterior field and complicate precise dissection [31][32].

Manual handling of the specimen during resection is extremely important. As the dissection progresses, the surgeon palpates the tissue to assess tumor depth and ensure that an adequate deep muscle margin is being incorporated. Additional traction sutures placed into the specimen itself provide a second vector of counter-traction, helping to mobilize the lesion and expose deeper tissue planes. Muscular dissection is performed in a manner that purposefully includes a cuff of normal tongue musculature beneath the tumor to achieve a safe deep margin. Ventral margins may need to be extended onto the floor of the mouth; in such cases, elements of the sublingual compartment, including mucosa and submucosal tissue, may be incorporated into the specimen to ensure oncologic clearance of the deep margin. As the glossectomy proceeds and more tissue is released, the specimen usually becomes more mobile, allowing improved retraction and visualization of posterior aspects of the lesion. Forward traction on both the tongue remnant and the specimen can facilitate the completion of the posterior mucosal cuts, which should preserve at least a 1 cm margin around malignant tumors whenever anatomical constraints permit. Ultimately, the deep muscle dissection is connected with the posterior mucosal incision to create a single en bloc specimen that includes the tumor with its circumferential and deep margins. Mucosal and deep muscle margins are submitted for intraoperative frozen section analysis when available, enabling immediate margin assessment and additional resection if necessary. Depending on the volume of tissue removed and the shape of the defect, the tongue may be closed primarily, left to heal by secondary intention, or reconstructed using local, regional, or free flaps to optimize functional outcomes [31][32].

Lip-Split Mandibulotomy Glossectomy Approach

The lip-split mandibulotomy glossectomy combines the principles of transoral resection with a sagittal mandibular osteotomy to dramatically enhance exposure. While the transoral approach offers a “bird’s eye” view of the tumor from above, mandibulotomy adds a more direct “head-on” perspective into the depth of the lesion and the sublingual and submental spaces. This expanded access is particularly beneficial for large, deeply infiltrative, or posteriorly located tumors and for those that extend toward the tongue base or floor of the mouth. The approach enables extensive visualization of the suprahyoid musculature, sublingual compartment, and posterior tongue and pharynx, but it also involves multiple additional steps that increase operative time and the risk of complications. The procedure begins with transcervical exposure of the mandible and a trans-facial lip-split incision. Because neck dissection is frequently performed in conjunction with this approach, the neck incision used for lymphadenectomy can be extended superiorly in the midline toward the lower lip. A mucosal incision is placed approximately 1 cm anterior to the gingiva to preserve an adequate cuff of tissue for closure. This incision is carried in the sagittal plane along the mucosal surface of the lip and directed either through a median mandibulotomy between the central incisors or a paramedian mandibulotomy between the lateral incisor and canine. The incision continues anteriorly to the cutaneous lip and across the vermilion border. During this stage, the labial artery is commonly encountered and must be controlled by ligation or cauterization. For the cutaneous component, the incision may follow the midline along the subunit of the chin, or it may be fashioned as a compound Z-type incision that can yield superior cosmetic results by breaking up linear scar contracture and better aligning with relaxed skin tension lines [31][32].

Following the skin and mucosal incision, the underlying muscles—principally orbicularis oris, mentalis, and the depressor muscles of the lip and chin—are divided to expose the periosteum of the mandible. At this point, gingival incisions are made. Management of the central incisors is at the surgeon’s discretion; if left in situ, the roots may be exposed or destabilized during the sagittal osteotomy. A No. 15 blade is generally preferred for gingival incisions, as it allows precise cuts while preserving the maximum amount of mucosa and avoids thermal damage, which is especially important in previously irradiated tissue where monopolar cautery may ablate gingiva and leave gaps that predispose to postoperative salivary fistula. The soft tissue flaps overlying the mandible are then elevated in the subperiosteal plane, exposing just enough bone to accommodate placement of a fixation plate across the intended osteotomy site. In patients with a history of radiation, the periosteal elevation should be as conservative as possible to minimize disturbance of blood supply and reduce the risk of osteoradionecrosis. If broader osseous exposure is necessary beyond the canine teeth, care must be taken to identify and preserve the mental nerve as it exits the mental foramen.

While the mandible is still intact, a reconstruction or fixation plate is contoured to the inferior border. Drill holes and screws are placed to create a template, then the plate and screws are removed and stored in the correct orientation until they are needed for re-fixation at the end of the procedure. The sagittal osteotomy is performed next, often in a stair-step fashion to increase stability and reduce shear forces across the osteotomy line. Once the bone is divided, the mandibular segments are retracted laterally in an “open-book” configuration, revealing the mylohyoid muscle bridging the two halves. If the tumor involves the mylohyoid, it should be resected with a negative margin. A deliberate myotomy of the mylohyoid fully releases the mandibular segments, greatly improving the exposure to the floor of the

mouth, tongue base, and pharynx [31][32]. The oncologic advantages of this approach become obvious at this stage. The surgeon can now appreciate the true depth of tumor infiltration and obtain an expansive transoral/transcervical view for glossectomy. The tongue can be pulled anteriorly through the oral cavity while the specimen is drawn inferiorly into the neck, allowing direct visualization of posterior cuts and deep margins. Frozen section analysis of mucosal and deep muscle margins is performed intraoperatively to confirm complete excision. Close communication with the pathologist when examining the specimen helps correlate clinical and histologic findings, guiding any additional resections. In some patients, tumors that extend along the floor of the mouth may adhere to or invade the mandible. Preoperative clinical examination may reveal fixation of the lesion to the jaw, and imaging may demonstrate cortical erosion or altered marrow signal suggesting osseous involvement. In such cases, a midline mandibulotomy alone may not be sufficient. Segmental mandibulectomy through a transcervical approach can be employed to remove the involved bone as part of the primary composite resection. Subplatysmal flaps are elevated beyond the mandibular body, and the marginal mandibular branch of the facial nerve is identified and protected. Soft tissues overlying the planned bone cuts are dissected down to cortical bone, osteotomies are performed, and the mobilized segment of mandible is retracted to provide both oncologic clearance and another traction vector for combined transoral/transcervical resection.

Glossectomies that require mandibulotomy or mandibulectomy almost always necessitate reconstructive procedures for both soft tissue and bone. Soft tissue defects may be reconstructed using local or regional flaps or with free tissue transfer, depending on the size and complexity of the defect and anticipated functional goals. Resected bone can be reconstructed with nonvascularized bone grafts or vascularized bone-containing free flaps, such as fibula or scapula flaps, combined with rigid fixation using mandibular plates or lag screws. The mucosal closure must be executed meticulously to reduce the risk of orocutaneous or salivary fistula. Closure of a lip-split incision requires layered repair of the gingiva, mucosal lip, muscle layers, and skin, often using chromic or synthetic absorbable sutures for intraoral mucosa and layered closure techniques externally to optimize both function and aesthetics [31][32].

Transcervical Pull-Through Glossectomy Approach

While mandibulotomy provides unmatched exposure, its added procedural steps, including lip splitting, osteotomy, and subsequent fixation, increase operative time and potential complications, especially in patients with comorbidities such as hypothyroidism, diabetes, or previous head and neck radiation. These patients are at higher risk for wound dehiscence, fistula formation, infection, delayed healing, and osteoradionecrosis of the mandible. For such individuals, glossectomy via transcervical pull-through offers a valuable alternative that balances improved exposure with reduced osseous morbidity [31][32]. The transcervical pull-through approach is a combined transoral/transcervical technique in which the tongue, floor of the mouth, and sublingual compartment are mobilized inferiorly into the neck by connecting them to the submental and submandibular spaces. Compared with transoral glossectomy alone, this method provides superior visualization for posterior resections, particularly of the middle and posterior thirds of the tongue and tongue base. A significant advantage is that a purely transoral glossectomy can be converted intraoperatively to a pull-through with relatively little added time if it becomes apparent that posterior exposure is inadequate. Although the exposure is not as extensive as that obtained with lip-split mandibulotomy, the key benefit is that no mandibular osteotomy is required, thereby avoiding the need for bony reconstruction and eliminating the direct risk of osteotomy-related complications. Nonetheless, meticulous flap inset and closure are crucial to minimizing the risk of postoperative fistula due to the creation of communication between the oral cavity and neck.

The transcervical and transoral components of the operation can be performed in either sequence, and surgeons often move back and forth between them as needed. The transcervical approach typically begins via the incision used for neck dissection. Subplatysmal flaps are raised to expose the cervical compartments. After lymphadenectomy of the submandibular triangle is completed, the muscular floor of the neck is inspected for evidence of tumor extension or indications that a lip-split mandibulotomy might still be required for adequate oncologic clearance. If the disease appears confined to the tongue and floor of mouth without gross mandibular involvement, the procedure can proceed as a pull-through. From the transoral side, an anterior glossectomy is performed as far as can be safely and effectively accomplished before the need to mobilize the tongue into the neck. Mucosal incisions are made on the anterior tongue along both dorsal and ventral surfaces, respecting oncologic margins. Because the essence of the pull-through technique involves releasing the floor of the mouth, these mucosal incisions are extended along the floor-of-mouth mucosa. When the tumor involves the floor of the mouth, margins may reach the gingivoalveolar mucosa. In such circumstances, the lingual mucosa of the alveolus is incised, and the periosteum is elevated off the lingual cortex of the mandible to incorporate the entire floor-of-mouth tissue between the tongue lesion and the mandible into the composite resection. Depending on the planned reconstruction, tooth extraction, alveoloplasty, circum-dental sutures, or inset to the gingivobuccal mucosa may be required to accommodate flap design and ensure a sealed closure [31][32].

A traction suture is placed into the tumor-bearing specimen to facilitate the eventual pull-through maneuver. Once the anterior and lateral mucosal cuts and the necessary floor-of-mouth incisions are completed and the specimen is separated from the tongue remnant anteriorly, the surgeon turns to the cervical field. Through the neck, the mylohyoid and anterior digastric muscles are released from their mandibular attachments. Depending on the tumor's extent, these muscles may be cleanly transected or, if involved by tumor, excised as part of the composite specimen or sent separately as margins. The mylohyoid may be divided at its insertion on the mylohyoid line, at its mid-portion, or in the midline to gain access to the sublingual compartment, which is then entered and connected to the floor-of-mouth dissection from above. If necessary, the sublingual gland may be excised as part of this process if it lies within or adjacent to the planned resection margins. Once the continuity between the oral cavity and neck is fully established, the traction suture on the specimen is gently pulled from the cervical side, drawing the tongue segment and associated tissues inferiorly into the neck. This maneuver provides an excellent view of the posterior margins and allows the surgeon to complete any remaining muscular or mucosal cuts under direct vision. After the specimen is removed, margin analysis is performed, ideally with intraoperative frozen sections to confirm that all edges are free of tumor. If margins are inadequate, additional resection can be undertaken either transorally, transcervically, or through a combination of both. Because the pull-through technique typically creates a sizable composite defect involving the tongue and floor of mouth, soft tissue reconstruction is almost always necessary. Reconstruction aims to restore oral competence, tongue bulk and mobility, separation of the oral cavity from the neck, and an adequate surface for swallowing and speech. A combined transcervical/transoral inset strategy is generally recommended to achieve a well-sealed closure and to allow precise placement of the flap within the three-dimensional defect. Proper flap design and tension-free closure help reduce the risk of wound dehiscence, salivary leakage, and fistula formation. Careful postoperative monitoring and appropriate supportive care, including airway protection, nutrition, and speech and swallowing therapy, complete the treatment pathway for patients undergoing this complex but valuable surgical approach [31][32].

Complications

The risks associated with glossectomy encompass both general complications common to major head and neck surgery and procedure-specific sequelae that reflect the tongue's critical role in speech, swallowing, and oral competence. As with any operative intervention, patients are vulnerable to pain, bleeding, hematoma formation, infection, impaired wound healing, and injury to adjacent neurovascular and muscular structures. These risks must be considered alongside the potential need for reoperation for complications such as salivary fistula, hardware failure, or local recurrence. In addition, the inherent risks of general anesthesia, including cardiopulmonary events, thromboembolism, stroke, and even death, though relatively rare, must be explicitly discussed as part of informed consent. For glossectomy specifically, the most functionally significant consequences involve speech and swallowing, as even limited resections alter tongue anatomy and biomechanics. Thus, comprehensive preoperative counseling should emphasize realistic expectations regarding dysarthria, dysphagia, altered sensation, taste disturbance, and the possibility of long-term dependence on enteral feeding or augmentative communication strategies.[34][35]

Dysarthria and Dysphagia

Dysarthria and dysphagia are among the most prominent and almost inevitable functional complications following glossectomy. Their severity varies widely and is determined by the extent, location, and depth of resection, as well as the quality of reconstruction and the patient's preoperative functional reserve.[34] The tongue's intrinsic muscles shape the bolus and articulate speech sounds, while its extrinsic muscles position the tongue within the oral cavity and oropharynx; removal of these structures compromises both precision and strength of movement. Even shallow partial glossectomies may disrupt the fine coordination required for clear articulation, resulting in subtle to moderate dysarthria. For many patients, careful rehabilitation can allow compensation through residual musculature and adaptive speech patterns, but some degree of alteration is common.[34][37] The functional pattern of impairment relates closely to tumor site. Resections involving the oral tongue, particularly the anterior two-thirds, tend to produce more pronounced dysarthria than dysphagia because these regions are central to consonant articulation and rapid lingual movements within the oral cavity. In contrast, tongue base resections involving the posterior one-third predominantly impair swallowing by disrupting the tongue's ability to generate pharyngeal pressure, propel the bolus, and protect the airway.[35] Loss of tongue base function compromises epiglottic inversion and vallecular clearance, often leading to residue, penetration, or aspiration. Subtotal and total glossectomies, even with sophisticated reconstruction, are associated with severe impairment in both speech and swallowing and may result in profound oral handicap, chronic aspiration risk, and long-term gastrostomy dependence.[35][39]

Reconstructive flaps, although indispensable for restoring volume and lining, cannot replicate the complex, volitional, multidirectional motion of native tongue musculature. The reconstructed tongue is typically passive and dependent on whatever residual

muscle remains for movement; thus, outcomes are highly influenced by the balance between remaining functional tongue and flap bulk.[36] Excessive bulk may obstruct oral space and hinder articulation or bolus transit, while insufficient bulk can lead to inadequate contact with the palate and poor bolus control. Postoperative rehabilitation led by speech-language pathologists is therefore critical to optimize functional outcomes, employing targeted exercises, compensatory techniques, dietary modification, and, when necessary, alternative communication strategies.[37] Healing-related sequelae can further compound these issues. Tongue tethering may occur after primary closure when scar contraction restricts mobility, or after secondary intention healing when opposing raw surfaces inadvertently adhere. Such tethering can exacerbate both dysarthria and dysphagia and may occasionally require revision surgery.[34][37]

Altered Tongue Sensation and Taste

Altered sensory function of the tongue is another frequent and often permanent complication after glossectomy. Patients may report numbness, paresthesias, dysesthesias, or phantom sensations in the region of resection, reflecting both direct loss of tissue and neurosensory disruption.[38] Sensory changes can arise from deliberate sacrifice or inadvertent injury of the lingual nerve during tumor resection or neck dissection, particularly when the lesion extends toward the floor of the mouth or mandible. In more extensive resections, the dominant cause of altered sensation is the loss of sensory innervation intrinsic to the resected tissue rather than focal nerve trauma. In cases reconstructed with regional or free flaps, the transplanted tissue is often initially nonsensate. Some centers perform reinnervated free flap reconstructions, coapting donor nerves to branches of the lingual or other sensory nerves, with the aim of restoring protective sensation to the neotongue.[38] While such techniques can improve tactile perception and awareness, they do not reestablish taste, which depends on specialized receptors and their unique neural pathways. Muscle contained within the flap cannot meaningfully restore motor function, as it lacks the intricate, highly coordinated neural inputs characteristic of native tongue musculature.

When resections involve the tongue base, the combined effects of sensory loss and muscular dysfunction can significantly elevate the risk of aspiration.[39] Patients may have diminished awareness of pharyngeal residue and reduced reflexive responses to penetration or aspiration events, making them particularly vulnerable to silent aspiration and recurrent pneumonia. These patients are more likely to require long-term enteral nutrition via gastrostomy. Patients often express concern about postoperative changes in taste. It is important to dispel the common myth that specific regions of the tongue are exclusively responsible for individual taste qualities. All five primary taste modalities—sweet, salty, sour, bitter, and umami—are represented broadly across the tongue's surface. While local resections can reduce the overall number of taste buds, especially when circumvallate or fungiform papillae are removed, many patients retain some taste function through remaining lingual receptors.[38] Moreover, higher-order flavor perception relies heavily on olfaction via retronasal airflow, which is usually preserved following glossectomy. Counseling should emphasize that while taste may be diminished or altered, complete loss of flavor perception is not inevitable.

Salivary Fistula

Salivary fistula, defined as an abnormal communication between the oral cavity and deep neck spaces, is a serious complication that can significantly prolong hospitalization, delay adjuvant therapy, and increase morbidity. It most commonly arises between the floor of the mouth and the submandibular triangle, where resection of the submandibular gland and surrounding vascularized fascia can leave a relatively unprotected interface between oral mucosa and cervical tissues.[40] Saliva, laden with digestive enzymes and oral flora, can leak into the neck, causing local inflammation, infection, wound breakdown, and, in severe cases, vessel exposure or hemorrhage.

Fistula formation may also occur at the site of a sagittal-split mandibular osteotomy when mucosal closure is compromised or when contamination tracks along osteotomy lines. In primary surgery with nonirradiated tissue, many fistulas may close with conservative measures such as drainage, pressure dressings, nutritional optimization, and minor local flap rearrangement. However, glossectomy is frequently performed as salvage surgery after radiation or chemoradiation, in which case tissue vascularity is compromised and wound healing is markedly impaired.[40] In these scenarios, salivary fistulas are more likely to be persistent or complicated. Vascularized tissue transfer—using regional or free flaps—has become a mainstay in reducing fistula risk by providing well-vascularized, robust coverage over exposed bone and vessels, and by recreating a durable barrier between the oral cavity and the neck, even in heavily irradiated fields.[40]

Additional Surgical Complications

Oncologic complications, particularly positive margins and tumor recurrence, represent another major concern following glossectomy. Inadequate resection margins not only compromise disease control but also complicate reconstruction and wound healing. When residual tumor is present at or near the inset margins of a flap, healing is often poor, and the risk of chronic, nonhealing wounds and salivary fistula is high. Persistent cancer must always be considered in the differential diagnosis for a nonresolving wound, especially in previously irradiated tissue or after complex reconstruction. Timely biopsy and imaging are essential when clinical suspicion arises. Patients undergoing lip-split

mandibulotomy are exposed to additional risks related to the osteotomy and hardware. Osteoradionecrosis of the mandible is a particularly feared complication in those who have received or will receive irradiation, characterized by devitalized, exposed bone that fails to heal, often accompanied by pain, infection, and pathologic fracture. Management may require hyperbaric oxygen, prolonged antibiotics, debridement, or ultimately segmental mandibulectomy with reconstruction.[32] Malocclusion, plate exposure, screw loosening, and hardware fracture are other potential complications that can compromise function and aesthetics and occasionally mandate revision surgery. Even when a microscopically margin-negative resection is achieved and the wound heals uneventfully, long-term surveillance can be challenging. After transoral glossectomy without reconstruction, dense scarring from primary or secondary closure may obscure the local anatomy, making it difficult to distinguish recurrent disease from postoperative changes.[34] Patients with severe trismus, whether due to prior radiation, surgical scarring, or both, are especially difficult to examine. In such circumstances, surveillance relies on a combination of imaging, flexible fiberoptic endoscopy, and careful clinical history, but may still be associated with diagnostic uncertainty and patient anxiety. These limitations may necessitate additional biopsies or even exploratory procedures to clarify suspicious findings.

Clinical Significance

Surgery is the recommended primary modality for oral tongue cancers in patients who do not have contraindications to operative management. Contemporary guidelines, including those of the National Comprehensive Cancer Network (NCCN), generally favor surgical resection over primary radiation therapy for most oral cavity malignancies, with adjuvant radiotherapy or chemoradiotherapy reserved for cases with high-risk pathologic features.[35] A detailed understanding of the benefits, limitations, and potential complications of each glossectomy approach—transoral, transcervical pull-through, and lip-split mandibulotomy—enables surgeons to tailor treatment plans that balance oncologic control with preservation of speech, swallowing, and quality of life. Recognizing the spectrum of expected complications, from dysarthria and dysphagia to salivary fistula and osteoradionecrosis, is essential for appropriate patient selection, risk stratification, and perioperative counseling. Informed discussion of these issues supports shared decision-making and helps patients and families develop realistic expectations regarding recovery trajectories, potential need for tracheostomy or gastrostomy, and the likelihood of long-term rehabilitation.[34][35][37]

Enhancing Healthcare Team Outcomes

Optimal management of patients undergoing glossectomy requires an integrated, interprofessional team approach that spans the preoperative, intraoperative, and postoperative phases of care. Surgeons, anesthesiologists, pathologists, radiation and medical oncologists, advanced practitioners, nurses, pharmacists, dietitians, and speech-language pathologists must collaborate in a coordinated, patient-centered framework to improve outcomes and minimize complications. Preoperatively, otolaryngologists or head and neck surgeons perform detailed clinical assessments, augmented by imaging and endoscopic evaluations, while cardiology, pulmonology, and anesthesia teams help optimize comorbidities and develop safe airway strategies. Interprofessional tumor boards synthesize clinical, radiologic, and pathologic data to individualize treatment plans and determine the timing and need for adjuvant therapy.[29][30][35] Intraoperatively, seamless communication between the surgical and anesthesia teams is crucial for airway management, hemodynamic stability, and responses to unexpected difficulties in exposure or bleeding. Pathologists provide real-time feedback through frozen section analysis to confirm negative margins, directly influencing the extent of resection. Operating room nurses and surgical technologists facilitate efficient workflow, maintain sterility, and ensure that required equipment and reconstructive materials are readily available.

Postoperative care further depends on a cohesive interprofessional effort. Nurses monitor vital signs, wound status, flap perfusion, and early signs of complications such as hematoma or fistula. Pharmacists assist in designing analgesic regimens that provide adequate pain control while minimizing sedation that could compromise airway protection. Dietitians tailor enteral and, when feasible, oral nutrition plans to support healing and maintain weight, working closely with speech-language pathologists who guide structured rehabilitation of speech and swallowing.[37][39][40] Psychological support and social work involvement are often needed to address the emotional and practical impact of altered appearance, communication, and diet. By maintaining open lines of communication and clear role delineation, the interprofessional team can detect complications early, adjust management promptly, and provide continuous patient and caregiver education. This coordinated strategy enhances functional recovery, promotes timely initiation of adjuvant therapies when indicated, and supports the patient's reintegration into daily activities, ultimately improving both oncologic and quality-of-life outcomes following glossectomy.

Conclusion:

In conclusion, the management of a glossectomy patient is a complex process that extends far beyond the surgical procedure itself. The choice of

surgical approach—whether transoral, transcervical pull-through, or lip-split mandibulotomy—must be carefully tailored to the tumor's characteristics to ensure oncologic efficacy while balancing functional preservation. However, the success of treatment is profoundly dependent on a cohesive, interdisciplinary team. From the preoperative dental evaluation that secures oral health and aids in planning, to the intraoperative pathological analysis that guarantees clear margins, and the dedicated postoperative nursing care that monitors for complications and supports recovery, each professional plays an indispensable role. This collaborative model is essential for mitigating the significant functional sequelae of glossectomy, particularly dysarthria and dysphagia, and for guiding patients through the challenging rehabilitation process. By integrating the expertise of surgeons, oncologists, dentists, pathologists, nurses, and speech-language therapists, the healthcare team can provide comprehensive, patient-centered care. This integrated approach is paramount for achieving optimal oncologic outcomes, managing complications, facilitating functional recovery, and ultimately enhancing the patient's long-term quality of life after this life-altering procedure.

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