Acta Scientific CANCER BIOLOGY (ISSN: 2582-4473)

Volume 8 Issue 6 June 2024

Review Article

# The Cutting Edge: A Review of Surgical Techniques in Oral Cancer Management-A Narrative Review

**Lohit Arora[1]*, Parul Tikoo[2], Rucha K Joshi[3], Srimayee Chaudhuri[4], Sumedha Sharma[5], Shubhi Nainwal[6] and C Pradeep[6]**

*[1]Consultant Head and Neck Oncology Department, Hindalco Hospital, Jharkhand, India*

*[2]Senior Lecturer, MDS (Oral Medicine and Radiology) ITS Dental College Muradnagar*

*[3]Stomatologist and Maxillofacial Radiologist, YMT Dental college and Hospital, Navi Mumbai, India*

*[4]IPGMER SSKM Hospital Kolkata West Bengal India*

*[5]PG Resident, OMFS, KD Dental College and Hospital, Mathura, India*

*[6]Dental Surgeon, Uttranchal Dental and Medical Research Institute, Dehradun, Uttrakhand, India*

*[7]Consultant Prosthodontist, Dentistrybytes superspeciality Dental care and Implant centre, Nagapattinam, Tamil Nadu, India*

***Corresponding Author:** Lohit Arora, Consultant Head and Neck Oncology Department, Hindalco Hospital, Jharkhand, India.

**DOI:** 10.31080/ASCB.2024.08.0494

**Received:** May 20, 2024

**Published:** May 31, 2024



## Abstract

Oral cancer continues to be a significant public health burden worldwide, with tobacco and alcohol use identified as the main culprits. Due to the varying locations within the oral cavity where this cancer can arise, a comprehensive and collaborative treatment plan involving multiple disciplines is crucial. Among available treatment options, surgery remains the most established and primary definitive therapy, particularly for early-stage and localized tumors.

Despite advancements in radiotherapy and chemotherapy, surgery holds its place as the foundation of oral cancer management, especially for advanced cases where it's often coupled with postoperative radiotherapy. The longstanding success and evolution of surgical techniques highlight their vital role in achieving optimal functional and cosmetic outcomes for patients with this complex condition.

**Keywords:** Oral Cancer Surgery; Surgical Techniques in Oral Cancer; Minimally Invasive Surgery; Reconstructive Surgery; Oral Oncology; Surgical Decision-Making

## Introduction

Oral cancer is the sixth most common cancer worldwide. Lifestyle, habits and demographic as well as genetic factors influence geographic variations in the incidence of oral cancer [1]. The etiology of oral cancer is well established in most instances with consumption of tobacco in any form and alcohol being the most common etiologic agents [2]. The exact mechanism of carcinogenesis in this setting still remains to be elucidated.

The distribution of oral cancer is approximately 32% in the buccal mucosa, 22% in tongue, 11% in lower lip, 11% in palate, 8% in vestibule, 5% in alveolus, 5% in floor of the mouth (FOM), and 3% in the gingiva [3]. Due to the heterogeneous nature of oral cancer, the functional and cosmetic results, and the coexistence of frequent medical comorbidities, treatment options should be evaluated through the multidisciplinary team and evaluated before reaching the final plan. In many countries, surgery remains the first option of treatment for oral cancer [4].

Surgery is the most well established mode of initial definitive treatment for a majority of oral cancers, with a longstanding history of being the accepted method of treatment for well over a century. Introduction of ionizing radiation, following the discovery of radium, became an important means of nonsurgical treatment of oral carcinoma. However, in the majority of patients with advanced cancer, radiotherapy is employed in conjunction with surgery, most often offered as post-operative treatment [5].

Chemotherapy in the management of oral carcinoma was considered palliative in the 1950's, 60's and 70's. However with the introduction of Cis-platinum, clinical trials of induction chemotherapy demonstrated that response to chemotherapy was observed in a significant number of patients. However, unlike other sites in the head and neck area, the response to induction chemotherapy did not translate into long term control of primary oral squamous cell carcinomas [6].

## Diagnosis

Early recognition and diagnosis of PMDs (such as erythroplakia, leukoplakia, lichen planus, oral submucous fibrosis, discoid lupus erythematosus and actinic keratosis) and oral cancer can improve the survival rate and reduce treatment-related morbidity [7,8]. Advancements have been made in many technologies for the diagnosis of PMD and oral cancer, such vital staining, oral cytology, light-based detection, oral spectroscopy, and blood and saliva analysis; these details are summarized in table 1 [9,10].

| Diagnostic method | Summary |
|---|---|
| Vital staining | Toluidine blue, 5% acetic acid, methylene blue. Lugol's iodine, rose bengal iodine staning Tolonium chloride |
| Cytological techniques | Oral brush biopsy (Oral CDx), liquid based cytology, laser capture microdissection |
| Light-based detection system | Tissue fluorescence imaging (VELscope, identafi 3000), chemiluminiscence (Vialite plus Microlux/DL Orascoptic-DK), tissue fluorescence spectroscopy |
| Optical biopsy | Tissue florescence spectroscopy Raman spectroscopy, elastic scattering spectroscopy differential path-length spectroscopy, nuclear magnetic resonance spectroscopy confocal reflectance microscopy, optical coherence tomography angle resolved low coherence interferometry |
| Saliva-based oral cancer diagnosis other techniques | Genomic substances, transcriptomic substances, proteomic substances |
| | Molecular analyses (gene alterations, epigenetic alterations loss of heterozygsity and microsatellite instability, via genom studies, proliferation index and AgNOR analysis, oncochips |

**Table 1**

## Factors affecting choice of treatment

### Tumour factors

The tumor factors that affect the choice of initial treatment of oral cancer are primary site, size (T Stage), location (anterior versus posterior), proximity to bone (mandible or maxilla), status of cervical lymph nodes, previous treatment, and histology (type, grade and depth of invasion) [11].

### Patient factors

Several factors relative to patient characteristics are crucial in the selection of initial treatment for oral cancer. These are the patient's age, general medical condition, tolerance of treatment, occupation of the patient, acceptance and compliance by the patient, lifestyle (smoking and drinking) and other socioeconomic considerations. In general, older age is not a contra-indicator for implementation of appropriate surgical treatment [12,13].

### Physician factors

The factors related to the treatment delivery team are also important in making the selection of initial definitive treatment for oral cancer. Expertise in various disciplines including surgery, radiotherapy, chemotherapy, rehabilitation services, dental and prosthetic support, and psycho-social support are all crucial in bringing about a successful outcome of the therapeutic program [14].

## Principles of surgical management

In majority of oral cavity squamous cell cancers, surgery has been the mainstay of treatment, and hence, the need-to-know intricate surgical aspects has to be emphasized. As there has been improved understanding of disease pattern, biologic behavior of the disease at the molecular level, and the potential aggressive nature, the need has arisen for several technical modifcations in this era. Hence as surgeons, we have to evolve and adapt to the required changes to improve outcomes of ablative surgery (oncological and functional) in patients with squamous cell carcinoma of oral cavity. For early-stage oral cavity cancers, especially tongue, it has been proven that both surgery and radiotherapy/brachytherapy offer similar outcome (single modality). For advanced lesions with extensive disease, multimodality treatment is required; surgery being the primary modality and followed by adjuvant radiotherapy +/− chemotherapy (depending on the histopathological evaluation) has been the standard of care [9].

## Treatment decision algorithm

Critical decisions which have to be made are as follows: [10].

- Intent of treatment-curative vs. palliative treatment.
- Primary modality-surgical vs. non-surgical treatment.
- Need for addressing neck in clinically node-negative patients.
- Type of neck dissection in patients with metastatic lymph nodes.
- Need for adjuvant treatment.
- Type of adjuvant treatment.
- Best supportive care.

## Principles of Ablative Surgery [9]

- Adequate access to the tumor.
- To achieve negative surgical margins.
- Utilization of intraoperative frozen section for margin assessment.
- Wide excision versus compartment resection.

## Surgical approach

Choosing the method of surgical approach is the first step in planning surgery for oral cancer. The goal should be to achieve adequate clear surgical margins and long-term survival. Therefore, parameters such as location and extent of invasion, depth of infiltration, and proximity to the mandible or maxilla should be used to guide surgical decisions. Oral cavity conditions such as trismus, dentition, tongue mobility, and the size of the oral aperture, and other factors such as dentition, size of the oral aperture, degree of mouth opening, and the size and mobility of the tongue should also considered while selecting the surgical method. Surgery for oral cancer often leads to unaesthetic patient appearance and functional problems, so surgery should also be aimed at preserving functions such as speech, swallowing, and deglutition, in addition to reducing scarring [15,16].

A transoral (peroral) approach is recommended for small, anteriorly located, and easily accessible tumors which are located to the oral tongue, FOM, gum, cheek mucosa, and the hard palate. However, this approach may not be useful for deeply infiltrating and/or posterior located cancers and/or in patients with trismus and/or obstructive dentition.

For advanced oral cancers, lip-splitting and/or mandibulotomy should be considered, to obtain a clear surgical margin. The lower cheek flap approach requires a midline lip-splitting incision which is continued laterally into the neck, for exposure and neck dissection (ND). Except for tumors of the upper gum and hard palate, this approach provides excellent exposure for nearly all tumors of the oral cavity. The upper cheek flap approach is optimal for the resection of larger tumors of the hard palate and the upper alveolus, particularly if located posteriorly. The mandibulotomy approach usually involves a lip-split, and has been preferred for advanced oral cancer because it can provide excellent exposure to the oral cavity and the oropharynx [17,18]. Compared to midline mandibulotomy, a paramedian mandibulotomy has merits for swallowing function since it preserves the geniohyoid and genioglossus muscles, and the anterior belly of the digastric muscle [19]. Paramedian mandibulotomy is an excellent surgical approach for access to large posteriorly located lesions of the oral cavity. However, mandibulotomy may lead to many unfavorable complications such as exposure of metal fixation plate, fistula formation, fixation failure, osteonecrosis after radiation treatment, and unsatisfying appearance [20,21]. Due to interruptions of the mandibular continuity, disturbances of oral functions and temporomandibular joint problems can occur [22,23].

Therefore, to reduce such problems in cases without mandibular involvement, several methods of mandibular preservation such as the visor flap approach and the mandibular lingual release have been suggested. In a study comparing the mandibulotomy and mandibular lingual release approaches, no differences were observed in clinical outcomes and functions when the primary oral cancer was under 5.1 cm, and was anteriorly located [16]. A recent meta-analysis comparing mandibulotomy and mandibular preservation methods concluded that mandibular sparing may provide a similar clinical outcome of surgical margins and survival [24]. However, the mandibular-sparing group showed a lower complication rate compared to the mandibulotomy group. The authors recommended the mandibulotomy approach over mandible-sparing in cases with involvement of the maxilla, upper gingiva, hard/soft palate, or a combination of multiple anatomic structures [25,26].

## The crucial role of surgery in non-metastatic oral cancer

Oral cancer is a serious condition, but early detection and treatment significantly improve the chances of a successful outcome. Surgery plays a central role in treating non-metastatic oral cancer, where the cancer hasn't spread to distant parts of the body.

- **Curative Potential:** Surgery offers the potential for a complete cure by removing the entire tumor and potentially involved lymph nodes. This approach aims to eliminate all cancerous cells and prevent recurrence [27].
- **Improved Outcomes:** Studies have shown that surgery, often combined with other treatments like radiation therapy, leads to better survival rates and disease control in non-metastatic oral cancer compared to non-surgical approaches [27].
- **Precision and Targeting:** Surgical techniques allow for targeted removal of the cancerous tissue while minimizing damage to healthy surrounding structures. This is crucial for preserving function and improving quality of life after treatment [27].
- **Diagnostic Role:** During surgery, surgeons can also assess the extent of the cancer and involvement of lymph nodes. This information helps guide further treatment decisions like radiation therapy or chemotherapy [27].
- **Tissue Sampling:** Surgery allows for collection of tissue samples for pathological examination. This helps determine the specific type and grade of the cancer, which is crucial for tailoring the treatment plan effectively [27].
- Early detection of oral cancer is vital for successful surgical intervention. When cancer hasn't spread beyond the original site (non-metastatic), surgery offers the best chance of complete removal and a potential cure. Non-metastatic diagnosis is critical for surgical success:

- **Clear Margins:** In non-metastatic cases, the cancer is typically confined to a localized area, allowing surgeons to achieve clear margins (healthy tissue surrounding the tumor) during surgery. This minimizes the risk of leaving microscopic cancer cells behind, which could lead to recurrence [28].
- **Less Extensive Surgery:** Since the cancer is localized, the surgical approach can be more targeted and less extensive compared to situations where lymph node involvement or distant spread is suspected. This reduces potential complications and improves recovery time [28].
- **Preservation of Function:** Early intervention through surgery in non-metastatic cases allows for a greater chance of preserving oral structures like the tongue, jaw, and voice box. This minimizes long-term functional impairments associated with more extensive surgery needed in advanced cases [28].

## Main surgical techniques

### Tumor Resection

This is the foundation of oral cancer surgery, aiming for complete removal of the cancerous tissue with clear margins (usually at least 5 millimeters of healthy tissue surrounding the tumor) to minimize the risk of recurrence. The specific technique chosen depends on the tumor size, location, and other factors. Here's a breakdown of some common approaches:

- **Scalpel excision:** This traditional method uses a scalpel to remove the tumor. It's suitable for smaller, well-defined tumors [29,30].
- **Mohs micrographic surgery:** This is a specialized technique used primarily for lip cancers with close margins. It involves removing thin layers of tissue one at a time, microscopically examining each layer to ensure complete cancer removal while minimizing healthy tissue removal [30].
- **Laser surgery:** Lasers can be used for precise tumor removal, particularly for superficial lesions or in conjunction with other techniques [30].

- **Electrocautery:** This technique uses an electric current to cut and cauterize tissue simultaneously, minimizing bleeding [30].

Minimally invasive techniques: Whenever possible, surgeons prefer minimally invasive approaches to minimize scarring, tissue disruption, and recovery time. These might include

- **Endoscopic surgery:** This uses a thin, lighted instrument (endoscope) inserted through the mouth or a small incision for visualization and minimally invasive tumor removal [31].
- **Transoral robotic surgery (TORS):** TORS utilizes robotic arms for improved dexterity and visualization during surgery, allowing for smaller incisions and potentially better cosmetic outcomes [32].

## Neck dissection

Lymph nodes in the neck are the first place cancer cells from the oral cavity are likely to spread. Neck dissection involves removing some or all of the lymph nodes in the neck to check for cancer spread and potentially remove any involved nodes.

The extent of the neck dissection depends on several factors, including:

- **Tumor size and location:** Larger tumors or those located closer to the lymph nodes have a higher risk of spread, necessitating a more extensive dissection.
- **Clinical examination:** If enlarged or suspicious lymph nodes are felt during examination, a more extensive dissection might be needed.

- Types of neck dissection: [33].

- **Selective neck dissection:** This removes only the lymph nodes with the highest risk of harboring cancer cells, based on anatomical location and drainage patterns.
- **Modified radical neck dissection:** This removes a larger group of lymph nodes and some surrounding tissue.
- **Radical neck dissection:** This removes most or all of the lymph nodes on the affected side of the neck, along with surrounding muscles and nerves (performed in advanced cases).

## Margin assessment techniques

Ensuring complete removal of the tumor with clear margins is crucial for successful cancer control. Surgeons employ various techniques to assess margins during surgery

- **Frozen section analysis:** A small sample of tissue is removed during surgery, frozen quickly, and examined under a microscope to check for cancer cells at the margins. If cancer cells are found, the surgeon can adjust the resection margins accordingly [34].
- **Toluidine blue staining:** This dye can highlight abnormal tissues that might contain cancer cells, aiding in margin assessment during surgery [35].
- **Brush cytology:** A small brush is used to collect cells from the surgical margins, which are then examined under a microscope for cancer cells [36].

## Recent Advancements

Sentinel Lymph Node Biopsy (SLNB): [37].

Traditional neck dissection can be a major surgery with potential side effects like shoulder weakness and numbness. SLNB offers a more targeted approach [37].

- Surgeons inject a radioactive dye or tracer near the tumor.
- The first lymph node(s) to take up the dye are the sentinel nodes, most likely to harbor cancer spread.
- Only these sentinel nodes are removed and analyzed for cancer cells.

- Benefits of SLNB:

- Minimally invasive compared to extensive neck dissection.
- Reduced risk of side effects like lymphedema (fluid buildup).
- Faster recovery time and improved quality of life for patients.
- Minimally Invasive Techniques with Robotics: (32)
- Transoral Robotic Surgery (TORS) utilizes robotic arms for improved visualization and dexterity during surgery.
- Smaller incisions can be made through the mouth, minimizing external scarring and disruption of facial tissues.
- TORS may be suitable for early-stage or well-located tumors in the mouth and throat.
- Potential benefits include less blood loss, faster healing, and improved cosmetic outcomes.

## Transoral robotic surgery (TORS)

Transoral robotic surgery (TORS) offers two main advantages over open surgery: excellent three-dimensional visualization through double endoscopic cameras and a wider range of precise, tremor-free wristed movements. TORS was first developed in 2005 by Dr. Hockstein and was approved by the United States Food and

Drug Administration in 2009. In Poland, the first operation using the da Vinci system in the head and neck area was performed in March 2019 [33].

Open surgery with concurrent radiotherapy or definitive chemoradiotherapy remains the treatment of choice for most patients with HNSCC, but it has a high risk of severe functional morbidity and radiation-induced toxicity. Expanding the use of minimally invasive approaches such as TORS has become increasingly urgent due to the growing proportion of patients with HPV-positive HNSCC, as these patients are generally younger with a better long-term prognosis than HPV-negative patients. Patient selection involves considering comorbidities that could increase the risk of procedure-related complications and negatively impact outcomes [37]. Many comorbidities are considered relative or absolute contraindications, such as congestive heart failure, chronic obstructive lung disease, immunosuppression, rheumatological connective tissue diseases, and conditions such as poorly controlled diabetes and malnutrition. Some of these comorbidities can be resolved prior to surgery, thus allowing the patient to undergo TORS. Patient evaluation begins with a thorough medical history and physical examination, focusing on the presence and severity of trismus and the mobility of the cervical spine. Cross-sectional imaging is used for staging, determining resectability, and ruled out involvement of the internal carotid artery. Direct laryngoscopy is performed under general anesthesia to determine the size of the tumour and whether surgery is contraindicated. Patients are also presented to the multidisciplinary tumour board to determine the optimal therapeutic approach [38].

Contraindications for TORS can be identified by performing a comprehensive physical examination including a detailed review of the patient's medical history and pre-operative imaging. As robotic techniques and technologies advance, some anatomic characteristics may no longer be considered problematic [39].

Tumour-related considerations in patient selection include assessing the patient's suitability for TORS on an individualized basis and evaluating the tumor characteristics, particularly the location and involvement of surrounding anatomical structures. The number of current and emerging indications for TORS in head and neck surgery continues to grow, with the main tumour sites being the oropharynx, larynx, thyroid, and lymph nodes of the neck table 2 [32,33,39].

| Anatomic site | Indication |
|---|---|
| Oropharynx | Benign tumors Selected T1–T2, T3, T4a carcinomas |
| Larynx/hypopharynx | Benign tumors Selected T1, T2 and T3 carcinomas |
| Parapharyngeal space/infratemporal fossa | Benign tumors |
| Nasopharynx | Early recurrent T1–T2 carcinomas |

**Table 2:** Tumour sites for transoral robotic surgery.

Image-guided Surgery Techniques [38].

- Advanced imaging techniques like fluoroscopy, CT scans, and 3D reconstruction are used during surgery.
- Surgeons can visualize the tumor and surrounding structures in real-time, leading to more precise tumor removal and nerve preservation.
- This may be particularly helpful for complex cases or surgeries near critical structures.

- Personalized Surgical Planning with 3D Printing [40].
- 3D printing technology allows for creation of patient-specific models based on scans of the mouth and jaw.
- Surgeons can use these models to plan the surgery, including the extent of resection and reconstruction needs.
- This facilitates customized surgical procedures and potentially improves functional outcomes after surgery.

## Artificial intelligence in surgery and future direction

Medicine is entering a phase of digital innovation, with clinical evidence now accumulating behind advances in AI applications.

Surgery has evolved to thrive on world-class research and evidence, equaling other fields like cardiology in terms of randomized trials in AI applications. The values of privacy, data security, accuracy, reproducibility, mitigation of biases, enhancement of equity, widening access, and evidence-based care should guide technological advances in surgical AI [41].

The integration of AI-powered digital interventions in the intraoperative setting can improve three-dimensional views, annotations, and warning systems for aberrant anatomy. Traditional laparoscopic towers can be integrated with virtual or augmented reality, overlaying patient imaging with AI diagnostics for better oncological surgery. Existing diathermy towers can incorporate voice assistants and black box-type systems for audit and quality control figure 1. [42].

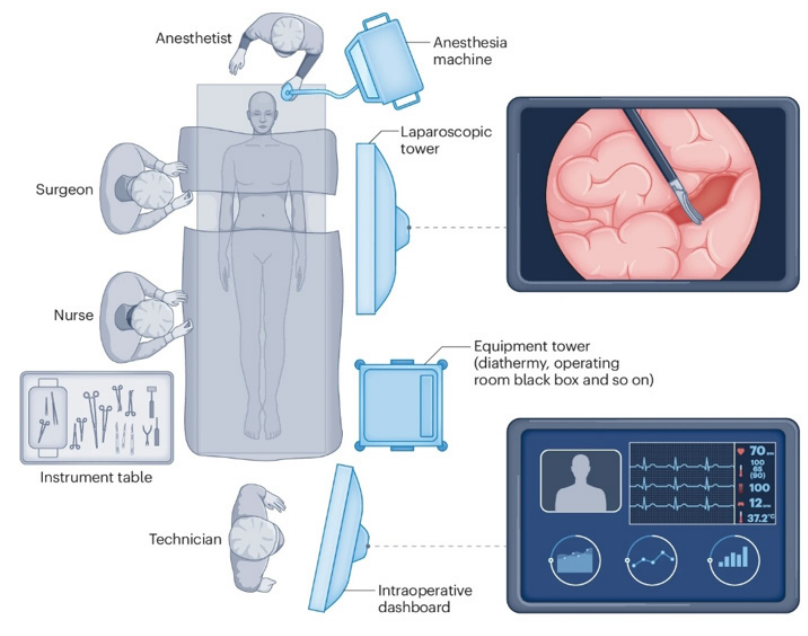


**Figure 1:** The integration of AI-powered digital interventions in the intraoperative setting.

Surgery poses specific challenges for AI integration, such as the paucity of digital infrastructure in most healthcare settings and procedural heterogeneity, acuity, and rapidly changing clinical parameters. However, targeted work in these areas, including growing priority toward digital infrastructure, data security and privacy, and unsupervised AI paradigms, demonstrates substantial promise.

Transformer models are poised to enable real-time analytics of multi-layered data, including patient anatomy, biomarkers of physiology, sensor inputs, -omics data, environmental data, and more. However, few examples exist for novel generative AI models in surgery. With the rapid development of AI in software, hardware, and logistics, these perceived limitations in scope will be continuously tested [43].

AI in surgery is a rapidly developing and promising avenue for innovation, with the realization of this potential underpinned by increased collaboration, robust randomized trial evidence, exploration of novel use cases, and the development of a digitally minded surgical infrastructure.

## Conclusion

In conclusion, oral cancer remains a significant global health issue, with lifestyle, habits, and genetic factors influencing its incidence. The primary etiologic agents, tobacco and alcohol, under-

score the importance of preventive measures. Among the various treatment options, surgery stands out as the most established and effective method, particularly for non-metastatic oral cancer. Surgery offers curative potential by allowing for the complete removal of the tumor and affected lymph nodes, thereby reducing the risk of recurrence and improving survival rates.

The advancements in surgical techniques, including tumor resection, neck dissection, and margin assessment, highlight the precision and effectiveness of modern surgical interventions. Techniques such as Mohs micrographic surgery, laser surgery, and minimally invasive methods like endoscopic and robotic surgeries, have revolutionized the field by minimizing tissue damage and preserving function. Moreover, innovations like sentinel lymph node biopsy, image-guided surgery, and personalized surgical planning with 3D printing, AI have enhanced the accuracy and outcomes of surgical treatments.

Early detection remains crucial for the successful surgical management of oral cancer. When diagnosed early, surgery can be less extensive, offering better preservation of oral structures and function. The integration of multidisciplinary care ensures comprehensive treatment planning and optimal patient outcomes. As research and technology continue to evolve, the role of surgery in the management of oral cancer will likely expand, offering new hope and improved quality of life for patients worldwide.

## Bibliography

1. Moore SR., *et al.* "The epidemiology of mouth cancer: a review of global incidence". *Oral Diseases* 6 (2000): 65-74.

2. Sankaranarayanan R. "Oral cancer in India: a clinical and epidemiological review". *Journal of Oral Medicine, Oral Surgery, Oral Pathology* 69 (1990): 325-330.

3. Tahir A., *et al.* "The role of mast cells and angiogenesis in well-differentiated oral squamous cell carcinoma". *Journal of Cancer Research and Therapeutics* 9.3 (2013): 387-391.

4. Chi AC., *et al.* "Oral cavity and oropharyngeal squamous cell carcinoma: an update". *CA: A Cancer Journal for Clinicians* 65.5 (2015): 401-421.

5. Shah JP and Gil Z. "Current concepts in management of oral cancer-surgery". *Oral Oncology* 45.4-5 (2009): 394-401.

6. Endicott N., *et al.* "Adjuvant chemotherapy for advanced head and neck squamous carcinoma". *Cancer* 60 (1987): 301-311.

7. Carreras-Torras C and Gay-Escoda C. "Techniques for early diagnosis of oral squamous cell carcinoma: systematic review". *Medicina Oral, Patologia Oral, Cirugia Bucal* 20.3 (2015): e305-315.

8. Omar E. "Current concepts and future of noninvasive procedures for diagnosing oral squamous cell carcinoma: a systematic review". *Head and Face Medicine* 11 (2015): 6.

9. S Mehta and MA Kuriakose. "Principles of Surgical Management of Oral Cancer" (2021).

10. Weiss MH., *et al.* "Use of decision tree analysis in planning a management strategy for the stage N0 neck". *Archives of Otorhinolaryngology-Head and Neck Surgery* 120.7 (1994): 699-702.

11. Shah JP and Patel SG. "Head and Neck Surgery and Oncology". 3rd Edition. Edinburgh, London, New York: Mosby (2003).

12. Jun MY., *et al.* "Head and neck cancer in the elderly". *Head and Neck Surgery* 5.5 (1983): 376-382.

13. Friedlander PL., *et al.* "Squamous cell carcinoma of the tongue in young patients: a matched-pair analysis". *Head Neck* 20.5 (1998): 363-368.

14. Bernier J., *et al.* "Defining risk levels in locally advanced head and neck cancers: a comparative analysis of concurrent postoperative radiation plus chemotherapy trials of the EORTC (#22931) and RTOG (# 9501)". *Head Neck* 27.10 (2005): 843-850.

15. Song M., *et al.* "Mandibular lingual release approach: an appropriate approach for total or subtotal glossectomy". *Head Neck Oncology* 5.2 (2013): 11.

16. Devine JC., *et al.* "A comparison of aesthetic, functional and patient subjective outcomes following lip-split mandibulotomy and mandibular lingual releasing access procedures". *International Journal of Oral and Maxillofacial Surgery* 30.3 (2001): 199-204.

17. Na HY., *et al.* "Modified mandibulotomy technique to reduce postoperative complications: 5-year results". *Yonsei Medical Journal* 54.5 (2013): 1248-1252.

18. Satpathy S., *et al.* "Double mandibular osteotomy with segmental mandibular swing approach to parapharyngeal space". *National Journal of Maxillofacial Surgery* 5.2 (2014): 213-216.

19. Shah JP., *et al.* "Comparative evaluation of fixation methods after mandibulotomy for oropharyngeal tumors". *The American Journal of Surgery* 166.4 (1993): 431-434.

20. Dziegielewski PT., *et al.* "The mandibulotomy: friend or foe? Safety outcomes and literature review". *Laryngoscope* 119.12 (2009): 2369-2375.

21. Dziegielewski PT., *et al.* "The lip-splitting mandibulotomy: aesthetic and functional outcomes". *Oral Oncology* 46.8 (2010): 612-617.

22. Marchetta FC. "Function and appearance following surgery for intraoral cancer". *Clinics in Plastic Surgery* 3.3 (1976): 471-479.

23. Al-Saleh MA., *et al.* "Morphologic and functional changes in the temporomandibular joint and stomatognathic system after transmandibular surgery in oral and oropharyngeal cancers: systematic review". *Journal of Otolaryngology - Head and Neck Surgery* 41.5 (2012): 345-360.

24. Pang P., *et al.* "A comparison of mandible preservation method and mandibulotomy approach in oral and oropharyngeal cancer: a meta-analysis". *Oral Oncology* 63 (2016): 52-60.

25. Li H., *et al.* "Mandibular lingual release versus mandibular lip-split approach for expanded resection of middle-late tongue cancer: a case-control study". *Journal of Cranio-Maxillofacial Surgery* 43.7 (2015): 1054-1058.

26. Masuda M., *et al.* "Mandible preserving pull-through oropharyngectomy for advanced oropharyngeal cancer: a pilot study". *Auris Nasus Larynx* 38.3 (2011): 392-397.

27. Johnson DE., *et al.* "Head and neck squamous cell carcinoma" [published correction appears". *Nature Reviews Disease Primers* 6.1 (2020): 92.

28. Lodi G., *et al.* "Interventions for treating oral leukoplakia to prevent oral cancer". *Cochrane Database Systematic Review* 7.7 (2016): CD001829.

29. Suter VG., *et al.* "Erythroplakie und Erythroleukoplakie: Rote und rot-weisse Risikoläsionen der Mundhöhlenschleimhaut. Teil 2: Aktuelle Aspekte zur Zytodiagnostik, Pathogenese, Therapie und Prognose [Oral erythroplakia and erythroleukoplakia: red and red-white dysplastic lesions of the oral mucosa--part 2: cytodiagnosis, pathogenesis, therapy, and prognostic aspects]". *Schweiz Monatsschr Zahnmed* 118.6 (2008): 510-518.

30. Al-Lami A., *et al.* "Reducing the unknowns: A systematic review and meta-analysis of the effectiveness of trans-oral surgical techniques in identifying head and neck primary cancer in carcinoma unknown primary". *Oral Oncology* 126 (2022): 105748.

31. Tabrizi R., *et al.* "Feeding in Oral Cancer Patients After Massive Ablative Surgery: Percutaneous Endoscopic Gastrostomy or Nasogastric Tube". *Journal of Craniofacial Surgery* 27.4 (2016): 1010-1011.

32. Lin TS., *et al.* "Transoral Robotic Surgery for Oral Cancer: Evaluating Surgical Outcomes in the Presence of Trismus". *Cancers (Basel)* 16.6 (2024): 1111.

33. Weinstein GS., *et al.* "Transoral robotic surgery: radical tonsillectomy". *Archives of Otorhinolaryngology-Head and Neck Surgery* 133 (2007): 1220-1226.

34. Urken ML., *et al.* "Frozen Section Analysis in Head and Neck Surgical Pathology: A Narrative Review of the Past, Present, and Future of Intraoperative Pathologic Consultation". *Oral Oncology* 143 (2023): 106445.

35. Reddy CR., *et al.* "Toluidine blue staining of oral cancer and precancerous lesions". *Indian Journal of Medical Research* 61.8 (1973): 1161-1164.

36. H Alsarraf A., *et al.* "The utility of oral brush cytology in the early detection of oral cancer and oral potentially malignant disorders: A systematic review". *Journal of Oral Pathology and Medicine* 47.2 (2018): 104-116.

37. de Bree R., *et al.* "What is the role of sentinel lymph node biopsy in the management of oral cancer in 2020?". *European Archives of Oto-Rhino-Laryngology* 278.9 (2021): 3181-3191.

38. Iqbal H and Pan Q. "Image guided surgery in the management of head and neck cancer". *Oral Oncology* 57 (2016): 32-39.

39. Nyirjesy SC., *et al.* "The role of computer aided design/computer assisted manufacturing (CAD/CAM) and 3- dimensional printing in head and neck oncologic surgery: A review and future directions". *Oral Oncology* 132 (2022): 105976.

40. Segaran N., *et al.* "Application of 3D Printing in Preoperative Planning". *Journal of Clinical Medicine* 10.5 (2021): 917.

41. Garrow CR., *et al.* "Machine learning for surgical phase recognition". *Annals of Surgery* 273 (2021): 684-693 (2021).

42. Varghese C., *et al.* "Artificial intelligence in surgery". *Nature Medicine* (2024).

43. Janssen BV., *et al.* "The use of ChatGPT and other large language models in surgical science". *BJS Open* 7 (2023): zrad032.