

Review

Interdisciplinary Approaches to Managing Oral Cancer: Combining Dentistry, Oncology, and Surgery

Madhumitha¹, Ponmari K^{*2}, Aakash Kumar Jaiswal³, K. Arun Chand Roby⁴

¹Dentist, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai - 600077

²Professor, SGRRIM & HS, College of Nursing, Shri Guru Ram Rai University, Patel Nagar, Dehradun, Uttarakhand -248001

³Assistant Professor, School of Pharmaceutical Sciences, IIMT University, Meerut, Ganga Nagar, 250001

⁴Associate Professor, Vignan Pharmacy College, Vadlamudi, Guntur district, Andhra Pradesh, India 522213

Corresponding Author:

Dr. Ponmari K

Email:

ponmarikannan1986@gmail.com

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ABSTRACT

Oral cancer presents a significant global health challenge, necessitating a multidisciplinary approach for effective management. This paper explores the integration of dentistry, oncology, and surgery in the diagnosis, treatment, and post-treatment rehabilitation of oral cancer patients. Early detection by dental professionals plays a crucial role in improving prognosis, while oncologists contribute to targeted therapies such as chemotherapy, immunotherapy, and radiation therapy. Surgical interventions, including tumor resection and reconstructive procedures, restore functionality and aesthetics. The collaboration among these disciplines enhances patient outcomes by ensuring comprehensive care, minimizing recurrence rates, and improving the quality of life. Challenges such as treatment delays, accessibility to specialized care, and the need for personalized treatment strategies are also discussed. The study highlights the importance of a holistic, patient-centered approach that integrates advancements in medical research, technology, and clinical expertise to optimize oral cancer management.

KEYWORDS: Oral Cancer, Interdisciplinary Approach, Dentistry, Oncology, Surgery, Multidisciplinary Treatment, Patient-Centered Care

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1. Introduction

Oral cancer is a major public health concern, with an increasing global incidence and significant morbidity and mortality rates. It primarily affects the lips, tongue, gums, floor of the mouth, and oropharynx, with risk factors including tobacco use, excessive alcohol consumption, human papillomavirus (HPV) infection, and poor oral hygiene. The complexity of oral cancer requires a multidisciplinary approach, as early detection, precise diagnosis, and comprehensive treatment are critical for improving patient outcomes.(1)

Dentistry plays a pivotal role in early detection and prevention, as routine dental check-ups can help identify precancerous lesions and malignancies at an early stage. Oncologists contribute through targeted therapies, including chemotherapy, immunotherapy, and radiation therapy, which help manage cancer

progression. Meanwhile, surgical interventions, including tumor excision, maxillofacial reconstruction, and prosthetic rehabilitation, restore both function and aesthetics, improving patients' quality of life.

An interdisciplinary approach ensures holistic and patient-centered care, reducing recurrence rates and enhancing survival rates. However, challenges such as delayed diagnosis, limited access to specialized care, and treatment-related complications highlight the need for better integration of dentistry, oncology, and surgery. This paper explores the significance of collaboration among these disciplines in diagnosing, treating, and managing oral cancer while addressing existing challenges and opportunities for innovation in patient care.(2)

2. Overview of Oral Cancer

Oral cancer is a significant global health concern, affecting the lips, tongue, gums, floor of the mouth, and oropharynx. It is among the most common malignancies worldwide, with high morbidity and mortality rates, particularly in regions where tobacco use and alcohol consumption are prevalent. The primary risk factors for oral cancer include smoking, excessive alcohol intake, human papillomavirus (HPV) infection, prolonged exposure to ultraviolet (UV) radiation, and poor oral hygiene. Additionally, genetic predisposition and dietary deficiencies, such as a lack of vitamins A, C, and E, can contribute to disease development. The disease often remains asymptomatic in its early stages, leading to delayed diagnosis and a poor prognosis. When detected late, oral cancer requires extensive treatment, including surgery, chemotherapy, and radiation therapy, which can significantly impact the patient's overall quality of life. Therefore, early detection through routine screening and an interdisciplinary approach involving dentistry, oncology, and surgery is crucial for improving survival rates and treatment outcomes.(3)

3. Common risk factors (tobacco use, alcohol consumption, HPV infection, poor oral hygiene)

Several factors contribute to the development of oral cancer, with some being preventable through lifestyle modifications and early intervention. The most prominent risk factors include:

Tobacco Use

Tobacco consumption, in the form of smoking cigarettes, cigars, pipes, or chewing smokeless tobacco (gutka, betel quid, snuff), is the leading cause of oral cancer. The carcinogenic compounds in tobacco damage the oral mucosa, leading to DNA mutations that increase the risk of malignant cell growth. Studies show that long-term tobacco users have a significantly higher likelihood of developing oral squamous cell carcinoma (OSCC), the most common form of oral cancer.(4)

Alcohol Consumption

Chronic alcohol consumption is another major risk factor, particularly when combined with tobacco use. Alcohol acts as a solvent, allowing carcinogens from tobacco and other environmental sources to penetrate the oral tissues more easily. It also weakens the immune system and disrupts cellular repair mechanisms, increasing susceptibility to malignant transformations. Individuals who consume excessive alcohol are at a higher risk of developing oral and oropharyngeal cancers.

Human Papillomavirus (HPV) Infection

Infection with high-risk HPV strains, particularly HPV-16 and HPV-18, has been linked to the development of oropharyngeal cancer. HPV is transmitted through oral-genital contact and can lead to cellular changes in the mucosal lining of the mouth and throat. Unlike tobacco and alcohol-related oral cancers, HPV-associated oral cancer tends to affect younger individuals and often appears at the base of the tongue, tonsils, and oropharynx.(5)

Poor Oral Hygiene and Chronic Irritation

Inadequate oral hygiene, lack of regular dental check-ups, and untreated oral infections contribute to an increased risk of oral cancer. Chronic inflammation caused by persistent gum disease, ill-fitting dentures, or rough teeth can lead to continuous irritation of the oral mucosa, making it more vulnerable to malignant transformation. Nutritional deficiencies, particularly in vitamins A, C, and E, further weaken the body's ability to repair damaged tissues, increasing the likelihood of oral cancer development.

Additional risk factors include prolonged exposure to ultraviolet (UV) radiation, particularly for lip cancer, a diet low in fruits and vegetables, genetic predisposition, and exposure to carcinogenic chemicals in occupational settings. Understanding these risk factors is essential for prevention, early diagnosis, and effective management of oral cancer.(6)

4. Need for an Interdisciplinary Approach

Oral cancer is a complex disease that requires a comprehensive, multidisciplinary approach for effective diagnosis, treatment, and rehabilitation. The integration of dentistry, oncology, and surgery plays a crucial role in improving patient outcomes by ensuring early detection, precise treatment planning, and holistic post-treatment care. Dentists are often the first to identify precancerous lesions or suspicious abnormalities during routine examinations, facilitating early diagnosis and timely intervention. Oncologists contribute by designing personalized treatment strategies, including chemotherapy, radiation therapy, and immunotherapy, to target malignant cells while minimizing damage to healthy tissues. Surgical interventions are necessary for tumor resection, maxillofacial reconstruction, and functional restoration, ensuring both aesthetic and physiological rehabilitation. A collaborative approach helps in reducing treatment delays, improving survival rates, and enhancing the quality

of life for patients. By bridging the gap between these specialties, an interdisciplinary framework provides a patient-centered strategy that addresses not only cancer eradication but also the long-term well-being and psychological support of individuals affected by oral cancer.(7)

5. Complexity of Oral Cancer Treatment

The treatment of oral cancer is highly complex due to the anatomical, functional, and aesthetic challenges associated with the disease. The oral cavity plays a vital role in essential functions such as speech, chewing, swallowing, and facial expressions, making treatment decisions intricate and multidisciplinary. The complexity arises from tumor location, stage of cancer, metastasis, and patient-specific factors, which influence the choice of therapeutic strategies.

Early-stage oral cancer may be treated with localized surgery or radiation therapy, whereas advanced stages require a combination of surgery, chemotherapy, and radiation therapy. In cases where tumors invade critical structures such as the jawbone, tongue, or lymph nodes, extensive surgical resection is required, often leading to functional impairments that necessitate reconstructive surgery and rehabilitation. Maxillofacial reconstruction, prosthetic rehabilitation, and speech therapy become essential post-treatment to restore functionality and improve the patient's quality of life.(8)

Additionally, the side effects of treatment, such as mucositis, xerostomia (dry mouth), dysphagia (difficulty swallowing), and loss of taste, pose further challenges. Chemotherapy and radiation therapy may also lead to systemic complications, including weakened immunity, making patients susceptible to infections. Psychological distress, nutritional deficiencies, and socioeconomic barriers further complicate treatment adherence and long-term care.

Given these complexities, an interdisciplinary approach involving dentists, oncologists, surgeons, nutritionists, speech therapists, and psychologists is necessary to provide comprehensive, patient-centered care. Collaboration among these specialists ensures early diagnosis, precise treatment planning, post-operative rehabilitation, and psychosocial support, ultimately enhancing survival rates and quality of life for oral cancer patients.(9)

6. Role of Dentistry in Oral Cancer Management

Dentistry plays a crucial role in the management of oral cancer, encompassing prevention, early detection, treatment support, and rehabilitation.

According to research, dental professionals are often the first to identify precancerous and malignant lesions during routine check-ups, making early diagnosis a key factor in improving patient outcomes. Regular oral screenings help detect abnormal tissue changes, facilitating timely referrals for biopsy and further oncological assessment. Dentists also contribute significantly to the prevention of oral cancer by educating patients about risk factors such as tobacco use, alcohol consumption, and HPV infections, as well as promoting good oral hygiene.

Moreover, during cancer treatment, dentists help manage oral complications arising from chemotherapy and radiotherapy, such as mucositis, xerostomia, and infections, ensuring better patient comfort and adherence to therapy. Post-treatment, dental professionals assist in the rehabilitation of patients through prosthodontic solutions, speech therapy referrals, and reconstructive procedures to restore oral function and aesthetics. Research highlights the importance of interdisciplinary collaboration between dentists, oncologists, and surgeons in providing holistic cancer care. By integrating dental expertise into oral cancer management, patient survival rates and quality of life can be significantly improved.(10)

Early detection and prevention

Early detection and prevention play a critical role in reducing the burden of oral cancer, with dentists being at the forefront of identifying precancerous and malignant lesions. Regular dental check-ups provide an opportunity for oral cancer screenings, where dentists examine the soft tissues, gums, tongue, and other oral structures for abnormalities such as leukoplakia, erythroplakia, or persistent ulcers. Studies suggest that early diagnosis significantly improves treatment outcomes and survival rates, as oral cancer detected in its initial stages is more responsive to therapeutic interventions.

Screening during routine dental visits

Screening during routine dental visits is an effective strategy for the early identification of oral cancer. Dentists use visual examinations, palpation, and, in some cases, adjunctive diagnostic tools such as toluidine blue staining, fluorescence imaging, and biopsy referrals to detect suspicious lesions. Research emphasizes that high-risk individuals, including smokers, alcohol users, and those with HPV infections, should undergo regular screenings to facilitate early intervention. Additionally, patient

education on lifestyle modifications, such as quitting tobacco and maintaining oral hygiene, forms a crucial part of preventive strategies. By integrating routine screenings into dental practice, oral health professionals contribute significantly to reducing oral cancer mortality and improving overall patient prognosis.(11)

7. Contribution of Oncology in Treatment

Oncology plays a vital role in the treatment of oral cancer by providing a multidisciplinary approach that includes surgery, radiation therapy, chemotherapy, and targeted therapies. Oncologists work closely with dentists, surgeons, and other healthcare professionals to develop personalized treatment plans based on the cancer stage, location, and patient health status. Surgical interventions, often the first line of treatment, involve the removal of cancerous tissues, sometimes followed by reconstructive procedures to restore oral function and aesthetics. Radiation therapy and chemotherapy are commonly used either as primary treatments or in combination with surgery to eliminate residual cancer cells and prevent recurrence.

Recent advancements in oncology have introduced targeted therapies and immunotherapy, which enhance treatment efficacy while minimizing side effects. Targeted drugs such as epidermal growth factor receptor (EGFR) inhibitors specifically attack cancerous cells, improving survival rates. Immunotherapy, which strengthens the body's immune response against cancer, has shown promising results in advanced oral cancer cases. Furthermore, oncology contributes to palliative care by managing pain, infection, and other complications associated with oral cancer treatment. Through continuous research and innovation, oncology continues to refine treatment protocols, ultimately improving patient survival rates and quality of life.(12)

Chemotherapy, immunotherapy, and radiation therapy

Chemotherapy, immunotherapy, and radiation therapy are essential components of oral cancer treatment, often used alone or in combination with surgery to improve patient outcomes. Chemotherapy involves the use of cytotoxic drugs to destroy rapidly dividing cancer cells, either as a primary treatment or as an adjunct to surgery and radiation. It is particularly effective in advanced-stage oral cancer or when cancer has metastasized. However, chemotherapy can cause side effects such as nausea, hair loss, and immunosuppression, requiring careful

patient monitoring and supportive care. Radiation therapy, on the other hand, utilizes high-energy radiation to target and eliminate cancerous tissues. It is often recommended after surgery to reduce the risk of recurrence or as a palliative measure in cases where surgery is not an option. Recent research has also highlighted the role of immunotherapy in enhancing the body's natural immune response against cancer. Immunotherapeutic agents such as checkpoint inhibitors help the immune system recognize and attack cancer cells, showing promising results in cases resistant to conventional treatments.(13)

Targeted therapy and precision medicine

Targeted therapy and precision medicine represent significant advancements in oral cancer management, offering more specific and effective treatment options with fewer side effects. Targeted therapy involves the use of drugs that interfere with specific molecular pathways involved in cancer growth, such as epidermal growth factor receptor (EGFR) inhibitors, which prevent tumor cells from multiplying. Unlike traditional chemotherapy, targeted therapy minimizes damage to healthy cells, reducing toxicity. Precision medicine, a more personalized approach, utilizes genetic and molecular profiling of tumors to tailor treatments to individual patients. This method ensures that therapy is more effective by targeting the unique characteristics of a patient's cancer, leading to improved survival rates and reduced side effects. As research continues to evolve, targeted therapy and precision medicine are expected to revolutionize oral cancer treatment, making it more efficient and patient-specific.(14)

8. Surgical Interventions for Oral Cancer

Surgical interventions play a fundamental role in the treatment of oral cancer, especially in cases where the tumor is localized and operable. The primary goal of surgery is to remove cancerous tissues while preserving as much normal function as possible. Depending on the tumor's size, location, and stage, different surgical techniques may be employed. Wide local excision is a common procedure that involves removing the tumor along with a margin of healthy tissue to prevent recurrence. In more advanced cases, neck dissection may be performed to remove lymph nodes that may have been affected by cancerous cells, reducing the risk of metastasis.(15)

For extensive tumors, more complex procedures such as mandibulectomy (removal of part of the

jawbone) or maxillectomy (removal of part of the upper jaw) may be required, which can significantly impact speech, chewing, and facial aesthetics. Reconstructive surgery, including bone grafts, skin flaps, and prosthetic rehabilitation, is often necessary to restore oral function and appearance. Advancements in microsurgical techniques and 3D printing have improved post-surgical outcomes, enhancing both functional and cosmetic rehabilitation. Surgical interventions, when combined with radiation or chemotherapy as part of a multidisciplinary approach, offer the best chance for long-term survival and improved quality of life for oral cancer patients.(16)

9. Tumor Resection and Maxillofacial Reconstruction

Tumor resection is a crucial surgical procedure in oral cancer treatment, aimed at removing malignant tissues while minimizing damage to surrounding healthy structures. Depending on the tumor's size and location, resection may involve partial or total removal of affected oral structures, such as the tongue, jawbone (mandible), or maxilla. In cases where extensive tissue loss occurs, maxillofacial reconstruction becomes necessary to restore facial integrity, function, and aesthetics. Reconstruction techniques include the use of free flaps, such as fibular or radial forearm flaps, which provide both soft tissue and bone grafts to rebuild the affected areas. Advances in microsurgery and computer-aided design (CAD) technology have significantly improved reconstructive outcomes, allowing for precise restoration of the oral and facial structures. Maxillofacial reconstruction not only enhances the physical appearance of patients but also improves essential functions such as speech, swallowing, and chewing, thereby contributing to a better quality of life post-surgery.(17)

10. Prosthetic Rehabilitation and Functional Restoration

Prosthetic rehabilitation plays a crucial role in restoring oral function and aesthetics after surgical interventions for oral cancer. Patients who undergo extensive tumor resection often experience difficulties in speaking, chewing, and maintaining facial symmetry, making prosthetic devices essential for rehabilitation. Dental prostheses, such as obturators for maxillary defects and implant-supported dentures, help restore oral cavity function and improve the patient's overall comfort. Additionally, advancements in 3D printing and maxillofacial prosthetics have enabled the creation

of highly customized solutions that closely resemble natural tissues. Functional restoration is further supported by speech therapy, physiotherapy, and dietary modifications to help patients regain normal oral functions. A multidisciplinary approach, involving maxillofacial surgeons, prosthodontists, and speech therapists, ensures comprehensive rehabilitation, allowing patients to reintegrate into their daily lives with improved confidence and functionality.(18)

11. Delayed Diagnosis and Treatment Gaps in Oral Cancer Management

Delayed diagnosis remains a significant challenge in oral cancer management, often leading to poor prognosis and reduced survival rates. Many patients seek medical attention only when symptoms become severe, such as persistent ulcers, difficulty swallowing, or unexplained oral bleeding. Lack of awareness, socio-economic barriers, and limited access to specialized healthcare contribute to delays in diagnosis. Additionally, oral cancer symptoms are sometimes misinterpreted as benign conditions like mouth ulcers or infections, further postponing proper evaluation. Research suggests that early detection through regular dental check-ups significantly improves treatment outcomes, yet many high-risk individuals, such as tobacco users and alcohol consumers, do not undergo routine screenings.(19)

Treatment gaps also pose major obstacles in oral cancer care, particularly in developing regions where advanced medical facilities may not be easily accessible. Long waiting times for biopsies, imaging, and treatment initiation can allow cancer to progress to advanced stages, reducing treatment efficacy. Financial constraints and disparities in healthcare infrastructure further limit access to timely interventions such as surgery, radiation, and chemotherapy. Moreover, a lack of interdisciplinary coordination between dentists, oncologists, and surgeons can delay comprehensive care planning. Addressing these challenges requires increased awareness campaigns, better integration of primary healthcare with oncology services, and improved accessibility to diagnostic and treatment facilities to ensure early intervention and enhanced survival rates for oral cancer patients.(20)

12. Conclusion

The role of dentistry in oral cancer management is indispensable, encompassing early detection, prevention, treatment support, and post-treatment rehabilitation. Regular screenings during routine

dental visits significantly improve early diagnosis, allowing for timely intervention and better patient outcomes. Oncology plays a crucial role in treatment through surgical interventions, chemotherapy, radiation therapy, immunotherapy, and emerging targeted therapies that enhance precision and effectiveness. Advances in tumor resection, maxillofacial reconstruction, and prosthetic rehabilitation further contribute to restoring oral function and aesthetics, improving patients' quality of life. However, challenges such as delayed diagnosis, treatment gaps, and limited access to specialized care hinder effective cancer management. Addressing these barriers through increased awareness, multidisciplinary collaboration, and improved healthcare infrastructure is essential to enhancing early detection rates and ensuring comprehensive treatment. A proactive approach integrating dentistry, oncology, and rehabilitation services will lead to better survival rates and improved overall well-being for oral cancer patients.

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