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Oral Cancer For Dental Students

A Project Submitted to

The College of Dentistry, University of Mosul,Oral Diagnosis Department

as a Partial Fulfillment for Bachelor degree in Dental Surgery

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Certification of the Supervisor

I certify that this project entitled "Oral Cancer for Students and General Practitioners Dentist" was prepared by the fifth-year student **Eman Ahmed Ali** under my supervision at the College of Dentistry/University of Mosul in partial fulfilment of the graduation requirements for the bachelor's degree in Dentistry.

Signature:

Dr. Ahmed salih khudhur

Date: / / 2025

Dedication

This study is wholeheartedly dedicated to my beloved parents, who have been my source of inspiration and gave me strength when I thought of giving up, who continually provide their moral, spiritual, emotional, and financial support.

To my brothers, sisters, friends who shared their words of advice and encouragement to finish this study.

Acknowledgments

I thank God first for his countless love and support always, I pray that I will live up to be a responsible Doctor.

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The completion of this project could not have been possible without the participation and help of so many people whose names may not all be enumerated. Their contributions are sincerely appreciated and gratefully acknowledged.

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Symbol	Abbreviations
(OSCC)	Oral squamous cell carcinoma
(OPVL)	Oral proliferative verrucous leukoplakia
CT Scan	Computed Tomography Scan
MRI	Magnetic Resonance Imaging
PET Scan	Positron Emission Scan
TNM System	Tumor Nodes Metastasis System
(SCC)	Squamous cell carcinoma
(VC)	Oral verrucous carcinoma
(BSCC)	Basaloid squamous cell carcinoma
(ASCC)	Acantholytic squamous cell carcinoma
(HPV)	human papillomavirus
(EBV)	Epstein-Barr Virus
(HSV)	Herpes Simplex Virus

Introduction

Oral cancer considered as one of the lists of head and neck cancer, it is the cancerous growth of tissue located in the oral cavity. New oral cancer cases were reported to increase annually over the world for this reason, this disease considered as a major health problem worldwide (Ferlay *et al*., 2008).

Oral squamous cell carcinoma (OSCC) is the sixth most common cancer and one of the main causes of cancer-related death around the world. Besides, oral cancer causes facial disfigurement and morbidity. The oral cancer stands in the range of the sixth most prevalent cancer reported internationally with a yearly incidence of over 300,000 cases, 62% of which exhibit in developing countries (Waranakulasuriya, 2009).

Clinical appearance of OSCC is variable, which could be presented as leukoplakia or erythroplakia, persistent ulcer, or as an exophytic mass, which had already become malignant. Indeed, early detection of oral malignancies, supported with prognostic markers to evaluate the prognosis, considerably aids in the determination of appropriate treatment, thereby increasing the long-term survival of patients with potential risk of recurrence. Interestingly, results from many surveys worldwide indicate that the majority of populations were not able to distinguish persistent ulcer or red patches as the early signs and symptoms of OSCC. For instance, at least 60% of OC cases in Ireland received the treatment at late stages associated with deficiency in awareness of this malignant condition**.** (Feller L, Lemmer J.2012)

The prevalence and incidence of oral cancer worldwide have been widely documented, incidence rate of oral cancer is widely different by geographic location, even within one location, the incidence varies among groups categorized by age, gender or race, and also incidence rate varies over time These variations in the prevalence of oral cancer indicate that the socio cultural lifestyle of a population plays an important role in the etiology of oral cancer,

in addition to the practices of tobacco smoking and drinking alcohol which are established cultural risk factors for oral cancer worldwide (Moore et al., 2000; Conway *et al*., 2006).

In the other word, variation in pattern and incidence of oral cancer can occur as a result of differences of risk factors, from regional point of view the oral cancer has well defined risk factors that may be modified the focus on the primary prevention which may give a hope to overcome this lethally disease, oral cancers are typically detected in their late stages in spite of the fact that oral cavity can accessible easily for visual examination. Oral cancer lesions have well defined clinical diagnostic criteria; hence the early detection of this disease may not improve the cure rate only but also may help in the decreasing the cost and morbidity rate associated with the treatment of this disease (Sankaranarayanan *et al*., 2005).

Aim of the study

This study aimed to provide a scientific background regarding oral cancer epidemiology, etiology, pathogenesis, diagnosis, and treatment for Dental students.

Chapter One

Review of Literature

1.1. Epidemiology of oral cancer

Incidence of oral cancer worldwide Epidemiology of oral cancer is based on the comparison of groups of people for ethical reasons using predominantly observational methods (nonexperimental) plays an important role in monitoring and measuring progress in control of cancer (Bland and Daly, 2001).

Mouth cancer is a major health problem in many parts of the world, while its incidence is relatively low in most western commoners there are some important exceptions to this trend : on the Indian subcontinent and the other parts of Asia of remains one of the most common forms of cancer and with high rates of incidence data. Significant geographic variation is noted in the incidence of oral cancer noted that the majority of population based data from the mouth cancer comes from the Western world with a paucity of reliable data the so called developing countries, mouth cancer remains a serious health problem in many parts of the world with many regions reporting increasing incidence rates particularly in males (Moore *et al*., 2000).

In 2011, close to 37,000 Americans are projected to be diagnosed with oral or pharyngeal cancer. 66% of the cases have been found as late stage, only slightly more than half will be alive in five years similar survival estimates are reported from other countries for example, five-year relative survival for oral cavity cancer in Germany is about 55 %. Iraqi National cancer registry (1976-1994) did not list oral cancer as the most common ten cancers for different periods depending on international coding system for malignancies in this registry, however, cancer of lip, tongue and other sites of the oral cavity are listed as separate entities , thus making each of them out of the range of ten most cancers however, even when considering these regions as part

of the oral cavity, oral cancer will not fall within or close to the common tenth cancers in Iraq (Listl *et al*., 2013; Al-Reyahi, 2004).

1.2. Etiology of oral cancer

There is no precise cause for oral cancer, There are many possible causes for oral cancer each one of them can cause oral cancer directly or indirectly.

1.2.1.Classification of causes:

I. Exposure to chemicals and curtains substance: (IARC, 2012; Gupta *et al*., 2020; Shield *et al*., 2017; Lachenmeier & Sohnius, 2009)

1. Tobacco (Smoking & Smokeless): Contains carcinogens like nitrosamines that damage DNA and promote cancer.

2. Alcohol: Converts to acetaldehyde, a toxic compound that increases oral cancer risk.

3. Betel Nut (Areca Nut) & Gutkha: Contains arecoline, which promotes pre-cancerous changes.

4. Heavy Metals (Arsenic, Nickel, Cadmium): Occupational exposure linked to oral cancer.

5. Formaldehyde & Asbestos: Found in industrial workplaces, increasing cancer risk.

6. Pesticides & Industrial Chemicals: Exposure to toxic compounds may contribute to oral cancer.

II. Exposure to Radiation:

A. Ultraviolet (UV) Radiation

• Farmers, fishermen, and outdoor workers are at higher risk due to prolonged sun exposure. (Krutmann *et al*., 2017)

B. Ionizing Radiation (X-rays, Gamma Rays, Radiotherapy: (Little *et al*., 2019)

• Ionizing radiation (e.g., X-rays, gamma rays, and CT scans) can cause DNA double-strand breaks, leading to mutations and chromosomal instability.

• Head and neck radiotherapy for other cancers (e.g., lymphoma) increases the risk of secondary oral malignancies.

• Radon exposure, a naturally occurring radioactive gas, has been linked to increased oral and lung cancer risks.

III. Infections:

1. **Viral Causes of Oral Cancer:** (Gillison *et al*., 2012; D'Souza *et al*., 2007)

a) Human Papillomavirus (HPV-16, HPV-18): Disrupts tumor suppressor genes (p53, pRb), increasing oral cancer risk.

b) Epstein-Barr Virus (EBV): Produces oncogenic proteins (LMP1) linked to nasopharyngeal and some oral cancers.

c) Herpes Simplex Virus (HSV-1): May contribute to DNA damage and chronic inflammation in oral tissues.

2. Fungal Causes of Oral Cancer: (Samaranayake & Samaranayake, 2001; O'Grady *et al*., 2020; San-Millán *et al*., 2021)

1. Candida albicans: Produces carcinogenic nitrosamines and promotes chronic inflammation, leading to epithelial dysplasia and malignant transformation.

2. Candida tropicalis: Induces DNA damage and inflammation, increasing the risk of oral squamous cell carcinoma.

1.2.2. Risk Factors for Oral Cancer: (Gupta *et al*., 2021; Shield *et al*., 2018; Gillison *et al*., 2019)

Oral cancer, primarily oral squamous cell carcinoma (OSCC), is influenced by several environmental, behavioral, and genetic factors. Below are the major risk factors associated with the development of oral cancer.

1. **Tobacco Use**

- Smoking (Cigarettes, Cigars, Pipes)

Smoking is the most significant risk factor for oral cancer, contributing to 75–85% of cases.

- Smokeless Tobacco (Chewing Tobacco, Betel Quid)

Smokeless tobacco, including products like betel quid and gutkha, is linked to oral cancer, especially in South Asia.

2. **Alcohol Consumption:**

- Chronic alcohol consumption is a major risk factor for oral cancer, particularly when combined with tobacco use.
- The combined effect of alcohol and tobacco is synergistic, meaning the combined risk is much higher than either alone.

3. **Human Papillomavirus (HPV) Infection:**

- HPV, especially HPV-16 and HPV-18, is a significant risk factor for oropharyngeal cancer, but its role in oral cavity cancers is still under investigation.
- HPV infection leads to persistent mucosal infection, resulting in epithelial dysplasia and later progression to malignant transformation.

4. **Poor Oral Hygiene and Chronic Irritation:**

- Chronic irritation caused by poor oral hygiene, ill-fitting dentures, or sharp teeth can lead to mucosal changes that increase cancer risk.

- Conditions such as leukoplakia and erythroplakia (precancerous lesions) are linked to chronic local irritation, and these lesions may eventually develop into oral cancer.

5. **Diet and Nutritional Deficiencies:**

- Deficiency in fruits and vegetables, particularly vitamin A, C, and E, is associated with an increased risk of oral cancer.
- Antioxidants found in fruits and vegetables can protect against DNA damage, whereas low dietary intake increases susceptibility.
- Excessive salt consumption has also been linked to oral cancer, particularly in areas with high consumption of salted fish and foods.

6. **Sun Exposure:**

- UV radiation from the sun is a significant risk factor for lip cancer, especially the lower lip.

7. **Radiation Exposure:**

- Exposure to ionizing radiation (X-rays, gamma rays) can increase the risk of oral cancer, particularly in patients who have undergone radiotherapy for head and neck cancers.

8. **Genetic and Family History:**

- A family history of oral cancer or other cancers (such as head and neck cancer) increases the likelihood of developing oral cancer.
- Genetic mutations.
- Hereditary syndromes, such as Fanconi anemia and dyskeratosis congenital, increase the risk of developing oral malignancies at an early age.

9. **Age and Gender:**

- Oral cancer risk increases with age, particularly in individuals over 50 years old.
- Males are at higher risk than females, with the male-to-female ratio being approximately 2:1 for oral squamous cell carcinoma.

10. **Location:** Oral cancer can develop in various parts of the oral cavity and oropharynx. The most common locations include:

- **Lower Lip**

The lower lip is more prone to cancer due to its exposure to UV radiation from the sun, which can cause DNA damage over time.

- **Tongue (Lateral Borders & Ventral Surface)**

The lateral borders and ventral surface of the tongue are more commonly affected by oral cancers because they are in direct contact with smoked tobacco, alcohol, and HPV, which can increase the likelihood of malignancy.

- **Floor of the Mouth**

The floor of the mouth is particularly vulnerable to smoking and alcohol consumption and is more likely to develop cancer in people with poor oral hygiene or long-term irritation from things like ill-fitting dentures.

- **Buccal Mucosa (Cheeks)**

Buccal mucosa cancer is common in individuals who use betel nut or chewing tobacco (e.g., gutkha), as these products contain carcinogenic substances that directly affect the mucosa.

- **Gingiva (Gums)**

• The gingiva is commonly affected by tobacco use, particularly in individuals who smoke or use smokeless tobacco. It is also more susceptible to chronic irritation from poorly fitting dentures or rough teeth.

- **Oropharynx (Tonsils, Soft Palate, Posterior Pharyngeal Wall)**

The oropharyngeal region (which includes tonsils, soft palate, and posterior pharyngeal wall) has a higher incidence of HPV-related cancers, especially in non-smokers, and is also vulnerable to tobacco and alcohol exposure.

- **Hard Palate**

The hard palate is more prone to oral cancer due to chronic irritation from dentures or other mechanical causes.

- **Salivary Glands**

Salivary gland cancers are less common but can occur due to radiation exposure, which increases the cancer risk in the parotid and submandibular glands.

11.Immunologic Diseases (Bower *et al*., 2013; Gillison *et al*., 2008; Chan *et al*., 2005)

A. Immunosuppression:

- Individuals with compromised immune systems, such as those with HIV/AIDS or organ transplant recipients on immunosuppressive therapy, are at an increased risk of developing oral cancers.

B. Human Papillomavirus (HPV):

- This virus is a major risk factor for oral cancer, especially in patients with weakened immune systems.

C. Epstein-Barr Virus (EBV):

- EBV infection is associated with nasopharyngeal carcinoma, a type of cancer found in the oral cavity and other regions of the head and neck. In regions with higher prevalence rates, such as Southeast Asia, screening for EBV antibodies is used to identify high-risk individuals.

12.Premalignant Oral Lesions:

Premalignant oral lesions, also referred to as potentially malignant disorders, are a significant risk factor for the development of oral cancer. These lesions can progress to malignant oral cancers if left untreated or if risk factors continue to be present.

A. **Leukoplakia**:

Leukoplakia is one of the most common premalignant lesions in the oral cavity. It is characterized by a white patch or plaque that cannot be scraped off. Studies have shown that a significant percentage of leukoplakia cases may progress to oral squamous cell carcinoma (OSCC), particularly those that exhibit dysplasia (Lodi *et al*., 2006).

B. **Erythroplakia**:

Erythroplakia, characterized by a red, velvety lesion, is considered to be more likely to progress to oral cancer than leukoplakia. It is highly associated with dysplastic changes and has a higher potential for malignancy. (Pindborg *et al*., 1972)

C. **Oral Submucous Fibrosis (OSF)**:

OSF is a chronic condition that causes fibrosis of the oral mucosa and is strongly associated with the chewing of betel nut and areca nut, common habits in parts of Asia. OSF is known to increase the risk of developing oral cancer, with some studies estimating that a large proportion of OSF cases may progress to malignancy. (Pindborg *et al*., 1966)

D. **Lichen Planus**:

Oral lichen planus is an inflammatory condition that has been associated with an increased risk of oral cancer. Although not all cases of oral lichen planus will progress to malignancy, lesions that exhibit dysplastic features have a higher risk. (Khurana *et al*., 2015)

1.3. Pathogenesis of Oral Cancer:

The pathogenesis of oral cancer is a complex, multistep process involving genetic, molecular, and environmental factors that lead to malignant transformation of oral epithelial cells. It typically begins with chronic exposure to carcinogenic agents such as tobacco, alcohol, human papillomavirus (HPV) infection, and prolonged irritation from ill-fitting dentures or sharp teeth. These factors induce genetic mutations and epigenetic alterations, disrupting normal cellular homeostasis and promoting uncontrolled cell proliferation.

At the molecular level, oral carcinogenesis is characterized by the accumulation of genetic mutations affecting key regulatory genes, including tumor suppressor genes such as *TP53* and oncogenes like *cyclin D1*. These mutations result in dysregulation of cell cycle control, evasion of apoptosis, and increased cellular proliferation. Additionally, sustained inflammation and oxidative stress contribute to DNA damage and further genetic instability, facilitating malignant progression (Warnakulasuriya *et al*., 2020).

The process of malignant transformation typically follows a sequence of histopathological changes, starting with epithelial dysplasia, progressing to carcinoma in situ, and eventually leading to invasive squamous cell carcinoma (SCC), the most common type of oral cancer. Angiogenesis, mediated by vascular endothelial growth factor (VEGF), plays a crucial role in tumor progression by supplying oxygen and nutrients to the growing mass. Furthermore, epithelial-mesenchymal transition (EMT) enables cancer cells to acquire invasive properties, facilitating metastasis to regional lymph nodes and distant sites. (Gupta *et al*., 2017)

Understanding the pathogenesis of oral cancer is essential for early detection and prevention.

1.3.1.Oral cancer stages: (Warnakulasuriya *et al*., 2020)

Oral cancers are staged using the TNM system. T stands for the size and location of the primary tumor. N indicates if the tumor has spread to your lymph nodes. M indicates if the tumor has metastasized, or spread to other areas of your body.

The stages for oral cavity cancer are:

T: Tumor Size and Extent

- T0: No evidence of a primary tumor.
- T1: Tumor ≤ 2 cm in greatest dimension.
- T2: Tumor > 2 cm but ≤ 4 cm.
- T3: Tumor > 4 cm.
- T4a: Tumor invades nearby structures (e.g., bone, deep tongue muscles, skin).
- T4b: Tumor invades deeper areas (e.g., skull base, encases major arteries).

N: Lymph Node Involvement

- N0: No lymph node involvement.
- N1: Cancer in one lymph node (≤ 3 cm, same side as the tumor).
- N2: Cancer in one or more lymph nodes on either side of the neck:
- N2a: One node (3–6 cm).
- N2b: Multiple nodes (≤ 6 cm).
- N2c: Nodes on both sides of the neck (≤ 6 cm).

• N3: Lymph node(s) > 6 cm or extensive spread.

M: Metastasis (Spread to Distant Organs)

• M0: No distant metastasis.

• M1: Cancer has spread to distant organs (e.g., lungs, liver, bones).

1.3.2.Histologic changes in oral cancer

Oral cancer, primarily oral squamous cell carcinoma (OSCC), progresses through distinct histopathological stages, Understanding these stages is crucial for early detection and treatment.

Epithelial Dysplasia (Precancerous Stage)

Before invasion, squamous cells undergo dysplastic changes, classified as mild, moderate, or severe dysplasia based on how much of the epithelium is affected.

Histopathological Features: (Warnakulasuriya *et al*., 2020)

• Cellular atypia: Enlarged, hyper chromatic nuclei with irregular shapes.

• Loss of cell polarity and disordered epithelial maturation.

• Increased and abnormal mitotic figures, sometimes in upper epithelial layers.

• Loss of normal stratification, leading to a crowded basal layer.

• Carcinoma in situ: Full-thickness dysplasia without invasion beyond the basement membrane.

Micro invasive Carcinoma: (El-Naggar *et al*., 2017)

• The cancer breaches the basement membrane, but invasion is still limited.

Invasive Squamous Cell Carcinoma (OSCC): (Neville *et al*., 2015)

• Tumor extends deep into connective tissue, muscle, or even bone.

Metastatic Oral Cancer: (El-Naggar *et al*., 2017)

• Tumor cells spread to regional lymph nodes (e.g., cervical lymph nodes).

• Hematogenous spread can lead to distant metastases (lungs, liver).

• Lymph nodes show tumor emboli within sinuses and possible extranodal extension.

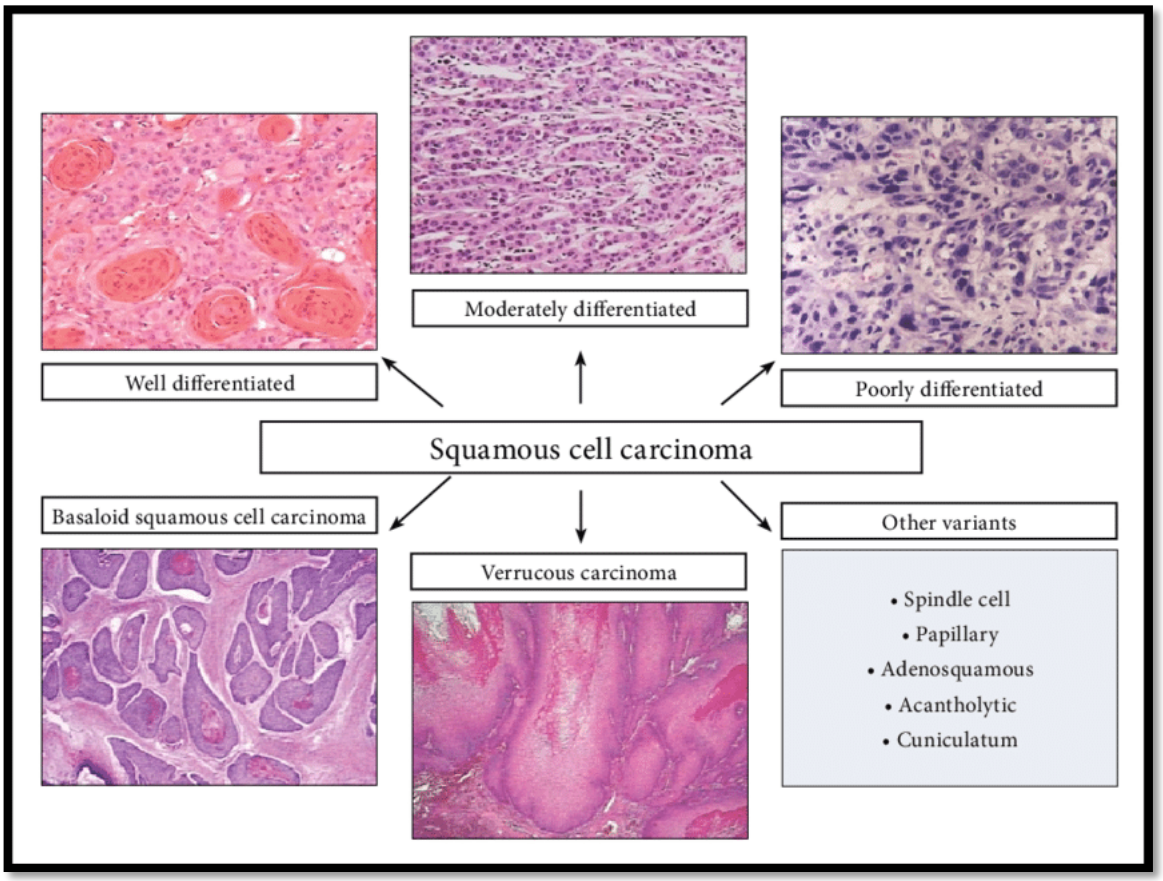

Figure (1-1): Histologic subtypes of oral squamous cell carcinoma.

1.3.3. Most Common Types of Oral Cancer (Fletcher *et al*., 2002; Radhi, 2012; Kerawala, 2009)

The most frequent types of oral cancer include:

1. **Squamous Cell Carcinoma (SCC):** Squamous Cell Carcinoma (SCC) is the most common type of oral cancer, accounting for 90% of cases. It originates from squamous epithelial cells that line the mouth and is strongly associated with smoking, alcohol consumption, HPV infection, and chronic irritation. This type of cancer can appear as non-healing ulcers, white patches known as leukoplakia, red patches called erythroplakia, or as growing masses. It is most frequently found on the tongue, floor of the mouth, buccal mucosa, and lips, Figure (A).

2. Verrucous Carcinoma: which is considered a low-grade variant of SCC. It is slow-growing and locally invasive but rarely spreads to other areas. This type of cancer is commonly found in individuals who use smokeless tobacco. It typically appears as a thick, wart-like lesion that is painless. Verrucous Carcinoma is most often located on the buccal mucosa, gingiva, and tongue, Figure (B).

Figure (1-2): (A) Squamous cell carcinoma (SCC), (B) Oral verrucous carcinoma (VC)

3. Mucoepidermoid Carcinoma: Is one of the most common salivary gland malignancies. It originates from minor salivary glands, primarily affecting the palate. This type of cancer can

present as either low-grade, which is slow-growing, or high-grade, which is more aggressive. Symptoms often include swelling, pain, and, in some cases, nerve involvement.

4. Adenoid Cystic Carcinoma: Is an aggressive type of salivary gland cancer. It has a tendency to invade nerves, leading to pain and numbness. Although it grows slowly, it has a high recurrence rate and a significant potential for distant metastasis, making it a serious and challenging condition to manage.

5. Lymphomas: Is affecting the oral cavity involve immune cells and commonly include non-Hodgkin's lymphoma. These cancers are typically found in the tonsils and the base of the tongue. Symptoms may include persistent swelling, difficulty swallowing, and painless lumps, which can sometimes go unnoticed until they progress further.

6. Basaloid squamous cell carcinoma (BSCC): As defined by the World Health Organization is an aggressive, high-grade, variant of squamous cell carcinoma (SCC) composed of both basaloid and squamous components. The tumor arises most frequently in the head and neck region, the most common sites being epiglottis, piriform sinus and base of the tongue, Figure (C).

7. Acantholytic squamous cell carcinoma (ASCC): is commonly seen in the sun exposed areas of adults. Their occurrence in the oral cavity is rare and confers bad prognosis, Figure (D).

Figure (1-3): (C) Basaloid squamous cell carcinoma, (D) Acantholytic squamous cell carcinoma

1.4. Management:

To correctly address the diagnosis of oral cancer, it is important to first consider the patient's medical history, as it plays a crucial role in identifying risk factors and guiding the diagnostic process.

1.4.1.Medical History in the Diagnosis of Oral Cancer:

1. Patient History:

The first step in diagnosing oral cancer is obtaining a detailed medical history from the patient. Key components include:

- **Risk Factors**: History of tobacco use (smoking or smokeless), alcohol consumption, betel nut chewing, or a history of HPV infection, which are significant risk factors for oral cancer (Vigneswaran & Williams, 2014).
- **Symptoms**: The patient should be asked about any symptoms such as persistent oral lesions, ulcers, pain, difficulty swallowing (dysphagia), changes in voice, or unexplained weight loss. (Kurose *et al*., 2019)
- **Previous Conditions**: A history of premalignant lesions (e.g., leukoplakia, erythroplakia, oral submucous fibrosis) or previous oral cancers may suggest a higher risk of recurrence or development of new malignancies (Pindborg *et al*., 1966).

2. Family History:

A family history of head and neck cancers can provide important clues to a potential genetic predisposition to oral cancer. Patients with a first-degree relative diagnosed with oral cancer may have an increased risk, which can influence both the diagnostic and surveillance approach (Roth *et al*., 2016).

3. **Past Cancer History:**

A history of other cancers, particularly those related to the head and neck region or those that may metastasize to the oral cavity, is important. (Vigneswaran & Williams, 2014)

1.4.2.Dental History in the Diagnosis of Oral Cancer:

1. **Previous Oral Lesions or Sores:**

It is important to inquire about any past oral lesions, ulcers, or non-healing sores. Persistent sores that do not heal within 2 weeks should raise suspicion for oral cancer (Scully & Bagan, 2009). Lesions such as leukoplakia or erythroplakia, which are known precursors, should also be noted.

2. **Oral Symptoms:**

- Pain and Discomfort: A history of unexplained oral pain, swelling, or discomfort should be assessed. Painful areas that have not improved over time could be indicative of malignancy (Lodi & Sardella, 2006).
- Changes in Mucosal appearance: Any noticeable changes in the appearance of the oral mucosa, such as discoloration, texture changes, or non-healing lesions, should be recorded as these are potential indicators of oral cancer (Scully & Bagan, 2009).

3. **History of Tobacco and Alcohol Use:**

• A detailed history should be taken to assess the patient's exposure to these substances, as they substantially increase the risk of developing oral cancers (Scully & Bagan, 2009).

4. **Previous Oral Cancer Diagnosis or Treatment:**

If the patient has previously been diagnosed with oral cancer or undergone treatments such as radiation therapy, this should be documented. These individuals are at an increased risk for recurrence or secondary malignancies (González *et al*., 2018).

5. **Carcinogenic Materials:**

Metals in Dental Restorations: Certain materials used in dental fillings, such as amalgam and gold, have been discussed in research in relation to their potential to contribute to the development of oral cancer, though evidence remains inconclusive. However, nickel, used in some crowns and bridges, has been considered a potential carcinogen (O'Regan & McCabe, 2008).

- Formaldehyde: It is used as a preservative in certain dental products and has been linked to an increased risk of oral cancers in workers who are frequently exposed (Scully, 2014).

1.4.3. Extraoral Examination:

1. Head and Neck Inspection:

• Examine for asymmetry, swelling, or any masses around the face, neck, and oral cavity. Focus on the submandibular and submental areas for potential lymphatic involvement (Mouth & Jaw Surgery, 2020).

2. Lymph Node Palpation:

• Palpate cervical lymph nodes (submandibular, jugulodigastric, supraclavicular). Enlarged, hard, or fixed nodes may indicate metastatic oral cancer (Kademani, 2007).

3. TMJ Examination:

• Look for TMJ tenderness or limited jaw mobility, which can be a sign of tumor spread to the mandible or surrounding structures (Gillespie *et al*., 2004).

4. Facial Asymmetry:

• Check for deformities or changes in the contour of the face, which could point to underlying cancer involvement in the bone or soft tissues (Shiboski *et al*., 2007).

5. Lip Abnormalities:

• Inspect for ulcers, lesions, or actinic cheilitis (cracking) in patients with sun exposure, as these conditions can progress to oral cancer (Mouth & Jaw Surgery, 2020**)**.

6. Jaw Deformities:

• Look for mandibular or maxillary swelling, which can indicate cancer invasion into the bone or soft tissues (Kademani, 2007).

7. Neurologic Examination:

• Evaluate for numbness or paresthesia in areas like the lower lip, tongue, or chin, suggesting nerve involvement by the tumor (Gillespie *et al*., 2004).

1.4.4. Intraoral Examination:

1. Inspection of the Oral Mucosa:

- Examine the buccal mucosa, tongue, palate, and floor of the mouth for white lesions (leukoplakia), red patches (erythroplakia), ulcerations, or any irregularities that could indicate malignancy. These areas are particularly important as they are frequent sites of oral cancer (Kurose *et al*., 2019).

2. Palpation of the Oral Soft Tissues:

- Palpate the buccal mucosa, floor of the mouth, tongue, and palate to identify indurations, thickening, or lumps, which can be indicative of oral cancer. Tumors may not always be visible but can be palpated as hardened areas. (Roberts *et al*., 2020)

3. Examination of the Tongue:

- specially the lateral borders and ventral surface of the tongue. Early signs of oral cancer may include non-healing ulcers, painful areas, or indurated tissue. (Reis *et al*., 2020)

4- Examination of the Gingiva:

- Inspect the gingiva for signs of bleeding, swelling, or ulcerations, which could be associated with oral cancer. (Della Vella *et al*., 2019)

5-Examination of Tooth Mobility:

- Tooth mobility can be a key indicator of oral cancer, especially when it is unexplained or progressive. In cases of oral cancer, especially those involving jawbone invasion, loose teeth without any apparent trauma or periodontal disease should raise suspicion of malignant involvement. (Hirai *et al*., 2020)

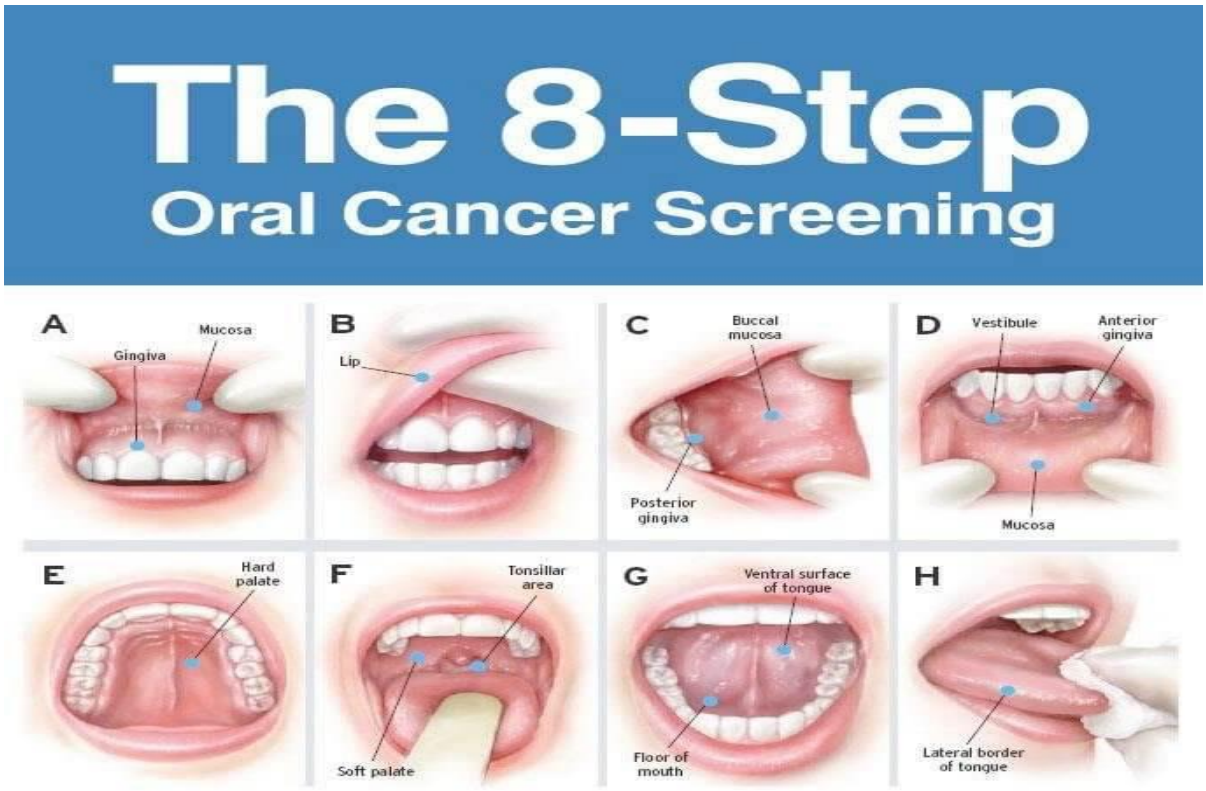

Figure (1-4): oral cancer screening

1.4.5. ***<u>In conclusion Common signs and symptoms of oral cancer include:</u>*** (Kurose *et al*., 2019).

1) Sores on your lip or inside your mouth that bleed easily and don't heal within two weeks.
2) Rough spots or crusty areas on your lips, gums or inside of your mouth.
3) Areas in your mouth that bleed for no obvious reason.
4) Numbness, pain or tenderness on your face and neck or in your mouth that occur without apparent cause.
5) Difficulty chewing or swallowing, speaking or moving your jaw or tongue.
6) Unintentional weight loss.
7) Earache.
8) Chronic bad breath.

1.4.6. Diagnostic Investigations: (Mayo Clinic, 2024)

A. Biopsy (Excisional or Incisional Biopsy) : To assess cellular changes and differentiate between dysplasia and cancer.

B. Imaging Studies:

- ❖ X-ray: To evaluate bone involvement.
- ❖ CT Scan: To determine tumor size and spread.
- ❖ MRI: To assess soft tissue involvement.
- ❖ PET Scan: To detect metastatic spread.

C. Serological Tests: To evaluate tumor markers and organ function before treatment.

Early diagnosis improves treatment outcomes, so any suspicious symptoms should be evaluated.

1.5. Treatment:

The three main treatment options for oral (mouth) are **surgery**, **radiation therapy** and **chemotherapy**. (Patel V, Leethanakul C,2001)

1.5.1. The most common surgeries for oral cancer are:

A. **Primary tumor surgery:** Healthcare providers remove tumors through your mouth or an incision in your neck.

B. **Glossectomy:** This is the partial or total removal of your tongue. Glossectomy is the surgical removal of part or all of the tongue. This may be used to remove cancer. Some healthy tissue around the edge of the tumor will also need to be removed. This is to help reduce the risk of any cancer cells being left behind. How much of the tongue is removed depends on the size of the cancer and where it is.

- If the cancer is small when it is removed, the hole will be either stitched or left to close naturally

- If the cancer is larger, the hole will be filled by a piece of skin and/or muscle known as a 'flap' A flap is a piece of tissue that is transferred from one part of your body, such as your forearm or thigh, to the tongue.(Ries LAG,2002)

Figure (1-5): Partial Glossectomy for Tongue Cancer

Your plastic and reconstructive surgeon will tell you more about how this is done. We will send tissue samples of your cancer removed during the operation to the laboratory so they can be examined under a microscope. Depending on the results, you may need further treatment. Your individual treatment will be carefully planned and the medical team will explain this to you.

(Funk GF, Karnell LH,2002)

C. **Mandibulectomy:** This is surgery for oral cancer in your jawbone. Dividing the mandible following a midline lip-split affords excellent access to the oral cavity with minimal attendant morbidity. The mandible is divided with a Gigli saw or a powered saw. The osteotomy may be made either vertically or alternatively in a stepor V-shaped fashion so as achieve a more stable repair. The author places the osteotomy just anterior to the mental foramen in lateral tongue cancers. Gigli saws make wider cuts than powered saws; hence it is advisable to extract a tooth and make the osteotomy through the dental socket so as avoid devitalizing both adjacent teeth. In dentate patients the mandible is preplated to ensure perfect dental alignment. When plating sets are not available, the mandible is wired together at conclusion of surgery with stainless steel

wiring by drilling opposing holes on either side of the osteotomy. Visor flap This is achieved by cutting along the gingivolabial and gingivobuccal sulci about 0.5 cm from the bone to permit placement of sutures when closing the wound, and then stripping the soft tissues from the outer aspect of the mandible. Take care not to transect the mental nerves if they can be saved. The skin flap is then retracted superiorly to expose the mandible (Figure).

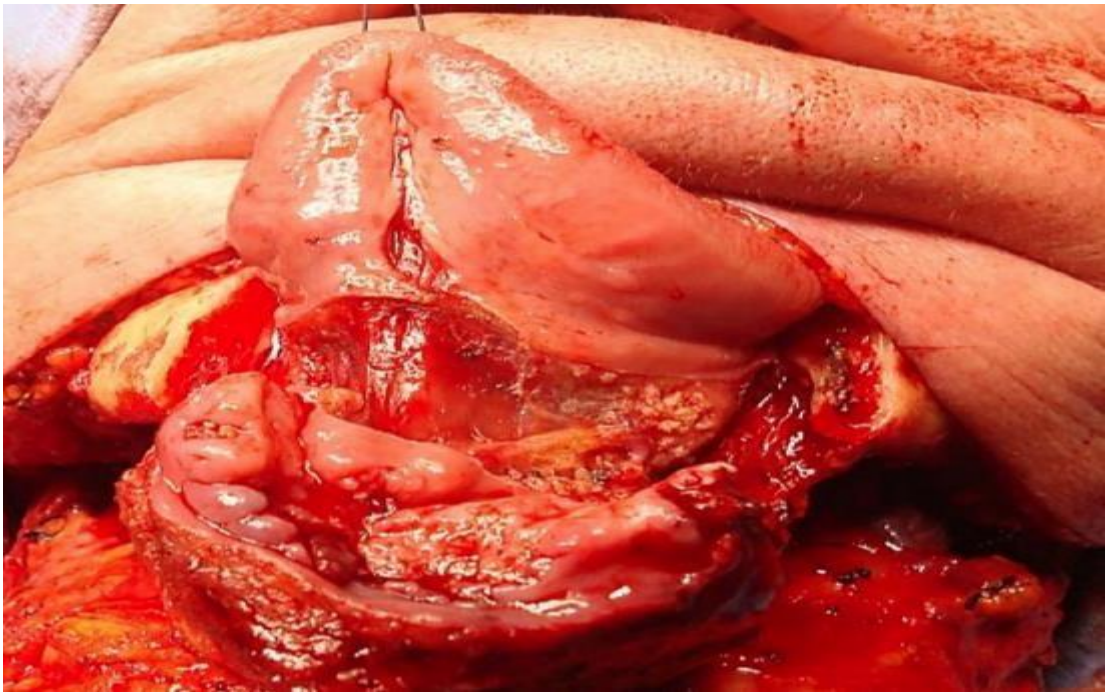

Figure (1-6): Visor flap and segmental mandibulectomy

D. **<u>maxillectomy</u>:** Tumors of the maxilla and adjacent anatomic sites are generally treated surgically by means of a maxillectomy, a generic term used to describe a variety of surgical procedures. Depending on the extent of the maxillary defect, impairment and disability may range from none at all to hypernasal and unintelligible speech, difficulty swallowing due to communication of the oral cavity with the nasal cavity and

paranasal sinuses, altered mastication due to loss of teeth and alveolus, alteration or loss of vision, and altered facial appearance due to loss of mid-facial support, with consequent deleterious effects on patient self-image and social acceptability.

The main goals of maxillary rehabilitation for maxillectomy patients are separation of the oral and nasal cavities to allow restoration of oral function and facial aesthetics. There is ongoing debate about the most appropriate method of maxillary rehabilitation, with advocates of both surgical and prosthodontics reconstruction. (Brown JS, Jones DC,2002)

1.5.2.Radiotherapy:

Radiotherapy is a primary treatment option for oral cancer, particularly for tumors that are not amenable to surgery or in cases of advanced-stage cancer (Mendenhall *et al*., 2015). It is used either alone or in combination with surgery and chemotherapy to improve survival rates (Vokes *et al*., 2017).

Radiotherapy Types:

1) External Beam Radiation Therapy (EBRT):
   EBRT is the most common type of radiation therapy for oral cancer. (Mendenhall *et al*., 2015)
2) Intensity-Modulated Radiation Therapy (IMRT):
   IMRT is a form of EBRT that uses computerized technology. (Snyderman *et al*., 2018)

1.5.3.Chemoradiotherapy:

• A combination of radiotherapy and chemotherapy, chemoradiotherapy is used for advanced oral cancers. (Vokes *et al*., 2017)

1.6. Reconstructive Surgery for Mouth Cancer

For many mouth tumors, your head and neck surgeon will close the wound with dissolvable sutures, or in some cases allow the wound to heal naturally. Other methods your surgeon may use include a skin graft, which uses your own skin (usually from the upper thigh) to repair the site, or an allograft, in which tissue from a donor is used. For larger tumors, a plastic surgeon may repair the affected area using reconstructive techniques.

Reconstructive surgery for mouth cancer often involves the transplantation of tissue from one area of your body to the affected area of your mouth. MSK's plastic and reconstructive surgeons have extensive experience in caring for people with mouth cancer. Their goal is to preserve the form and functions of your mouth by using the latest techniques available.

(Brown JS, Rogers SN,2000)

Reconstruction for mouth cancer typically involves a microsurgical approach called free tissue transfer. This is when a plastic surgeon transfers a piece of your own tissue, along with the blood vessels, to the area where the cancer was removed in order to repair the surgical site. Tiny sutures (stitches) are used to connect the small blood vessels of the tissue to the blood vessels in the neck. That allows the transferred tissue to thrive and heal properly.

The type of tissue transfer you have depended on the size and location of your primary tumor. Areas we commonly transfer tissue from include the forearm, the fibula (the smaller of the two bones in the lower leg), the thigh, and the abdomen. (Shah JP, Patel SG,2019)

Chapter Two
Disscusion

Oral cancer is a serious and potentially life-threatening disease, but its prognosis significantly improves with early detection. Dentists play a crucial role in the early diagnosis of oral cancer, as they are often the first healthcare professionals to examine a patient's oral cavity. Routine dental examinations provide an opportunity to detect suspicious lesions at an early stage, allowing for timely intervention and improved patient outcomes (Warnakulasuriya *et al*., 2018).

During routine dental check-ups, dentists should carefully examine all areas of the oral cavity, including the tongue, floor of the mouth, buccal mucosa, gingiva, palate, and oropharynx. Any abnormal findings, such as persistent ulcers, red or white patches, unexplained swelling, or lumps, should raise suspicion. Special attention should be given to the size of the tongue, any asymmetry, or changes in texture, as well as abnormalities in the floor of the mouth.

If a suspicious lesion is identified, further investigation is necessary. This includes conducting a thorough clinical examination, documenting the lesion's size, color, and texture, and determining whether the lesion has persisted for more than two weeks. If the abnormality does not resolve or continues to raise concern, the patient should be referred to an oral medicine specialist or an oncologist for further evaluation, including biopsy and histopathological analysis. (Kurose *et al*., 2019)

Early diagnosis of oral cancer has a direct impact on prognosis. The earlier the cancer is detected, the better the chances of successful treatment with less invasive procedures and lower costs. Patients diagnosed at an early stage often require less aggressive treatment, leading to faster recovery and a better quality of life. Conversely, late-stage diagnosis is associated with more extensive surgical procedures, higher morbidity, and lower survival rates. (Sharma, D., *et al*. 2016)

One of the biggest challenges in oral cancer treatment is late-stage diagnosis. Most cases are detected at an advanced stage, reducing the chances of successful intervention. Reasons for delayed diagnosis include: (Miller *et al*., 2023).

1. Lack of public awareness about early symptoms.

2. Limited access to oral healthcare services in low-resource areas.

3. Difficulty in differentiating early cancerous lesions from benign oral conditions.

Current treatment options include surgery, radiation therapy, chemotherapy, and targeted therapy. However, these approaches have limitations, such as:

1.Surgical challenges: Removing tumors while preserving oral function.

2.Toxicity of radiation and chemotherapy: Affecting the quality of life.

3. Drug resistance: Reducing treatment effectiveness.

To improve oral cancer outcomes, the following areas need attention: (Anderson *et al*., 2023).

1. Early detection programs: Implementing regular oral screenings.

2. Public awareness campaigns: Educating communities about risk factors and early signs.

3. Development of novel therapies: Enhancing treatment efficacy while minimizing side effects.

Chapter Three
Conclusions

Oral cancer is a serious condition that requires early detection for better treatment outcomes. It can present in various forms, including squamous cell carcinoma, verrucous carcinoma, and minor salivary gland carcinomas.

1) Role of Dentists:

• Conduct routine examinations to detect abnormalities.

• Refer suspicious cases for early diagnosis.

• Raise awareness about the importance of regular screenings.

E. **Diagnosis:** Involves clinical examination, biopsy, and imaging techniques such as X-ray, CT, MRI, and PET scans.

F. **Treatment:** Depends on the stage and type of cancer; may include surgery, radiation therapy, chemotherapy, and targeted therapy.

G. **Prevention and Awareness:** Regular check-ups and education on risk factors like smoking and alcohol consumption play a crucial role in prevention and early detection.

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