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Title Oral Cancer and Its Diagnostic Measures-A Literature Review

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ABSTRACT
Oral cancer, which starts from the squamous cell epithelium of the lips or oral cavity, is the most prevalent type of cancer in the head and neck region. Oral cancer is a dangerous oral disease that typically affects individuals between the ages of 40 and 60, but it can affect anyone. However, in the previous decade, the percentage of young patients, particularly those with tongue cancer, has risen. While oral cancer isn't difficult to treat or identify, it's terrible that the majority of individuals are unaware they have it until it's too late. The high percentage of patients who come with advanced oral cancer is concerning. As a result, the mortality rate for this cancer is becoming extremely high. The only way to reduce this problem is early detection of disease. Early detection of oral cancer is seen to be the most effective way of lowering the disease's death, morbidity, and deformity rates. Early detection also helps to reduce individual disease burden and improve quality of life. Treatment includes radiation and chemotherapy, which can be used as a complement or as a palliative measure than surgery when it is identified in an early stage. This article describes all diagnostic procedures for detecting oral cancer in detail which can reduce the mortality rate of cancer.

Key words: Oral cancer, Oral cavity, Diagnostic measures, prevention of oral cancer

I. INTRODUCTION

Oral cancer is the world's 11th most common disease, with an estimated 300,000 new cases and 145,000 fatalities in 2012, and 702,000 new cases and 145,000 deaths over a five-year period [1]. Oral cancer is a serious health problem. Oral cancer is becoming more prevalent over the world, particularly in India. Mouth squamous cell carcinoma accounts for more than 95% of all oral cancers. Oral cancer has been linked to the use of tobacco, alcohol, and betel quid [2] . Tobacco usage, both smoking and chewing, both independently and in combination with betel-quid chewing; alcohol intake; and, less often, other risks such as poor oral hygiene, nutritional variables, and certain occupational exposures have all been linked to the development of mouth cancer. Oral cancer can also occur in regions like lips, tongue, gums, tonsils, and oropharynx. It spreads quickly, which is why early discovery and referral are critical. But early diagnosis of asymptomatic early-stage oral cancer leads to a satisfactory clinical outcome and cure [3]. Early diagnosis improves the survival rate, and early detection of tumours under 2cm is critical [4]. When compared to more advanced stage III and IV tumours, early identification within stages I and II corresponds to a dramatically enhanced 5-year survival rate [5]. Oral cancer can be considered a highly preventable disease because most risk factors can be removed.

Importantly, a better patient result can only be attained if the condition is identified and treated early on. Although many of the approaches have just lately been applied or adapted in dental settings, they provide scientists with highly sought-after early detection methods for oral cancer[6]. With rising prevalence of oral cancer in recent years, it is now more vital than ever to recognise the warning symptoms of mouth cancer as soon as possible and to make necessary referrals in a timely manner. The most significant lesson is that in most patients, early identification of asymptomatic early-stage oral cancer leads to a positive clinical outcome and cure. The relevance of early detection and treatment of PMOELs in terms of enhancing survival and lowering mortality is critical. The clinical oral examination, which includes visual

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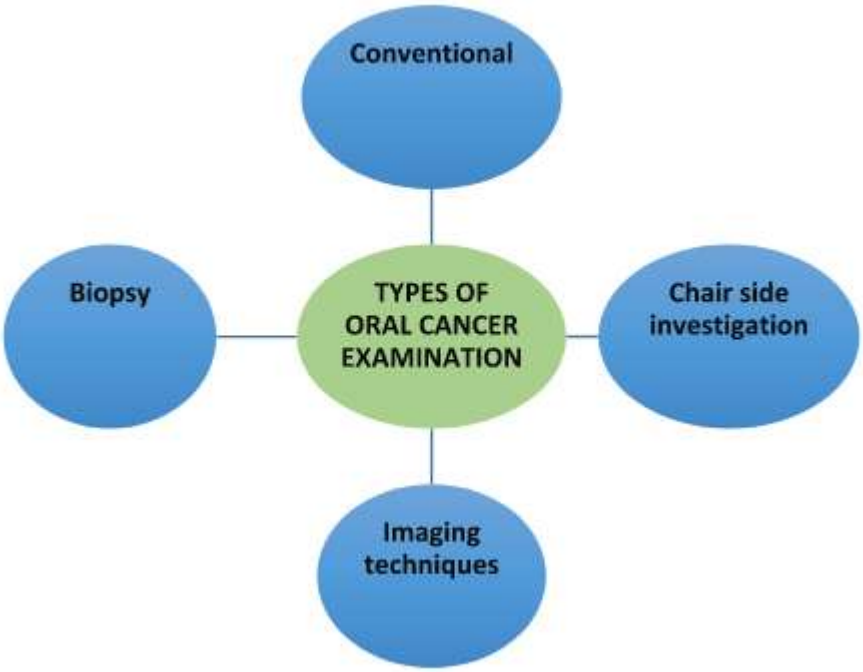
inspection and digital probing of the mouth cavity, is the first step in the diagnostic procedure[7]. Mouth malignancies can be detected in 99 percent of cases with a thorough clinical examination of the oral cavity.

FLOW CHART DEPICTING TYPES OF ORAL CANCER EXAMINATION:



CONVENTIONAL ORAL EXAMINATION

A traditional oral examination comprises both extraoral and intraoral examinations and is a standard aspect of dental evaluation[8]. Oral cancer screening has long been done using ordinary (incandescent) light. Conventional visual cancer screenings can be very effective to a certain extent. This could eventually help with early diagnosis of lesions, which is critical in the case of oral malignancies. Any new patient assessment should include an extraoral and intraoral soft tissue examination. To guarantee that no pieces are missing, this examination must be carried out completely and in a systematic manner. This reduces the chances of overlooking any areas of concern.

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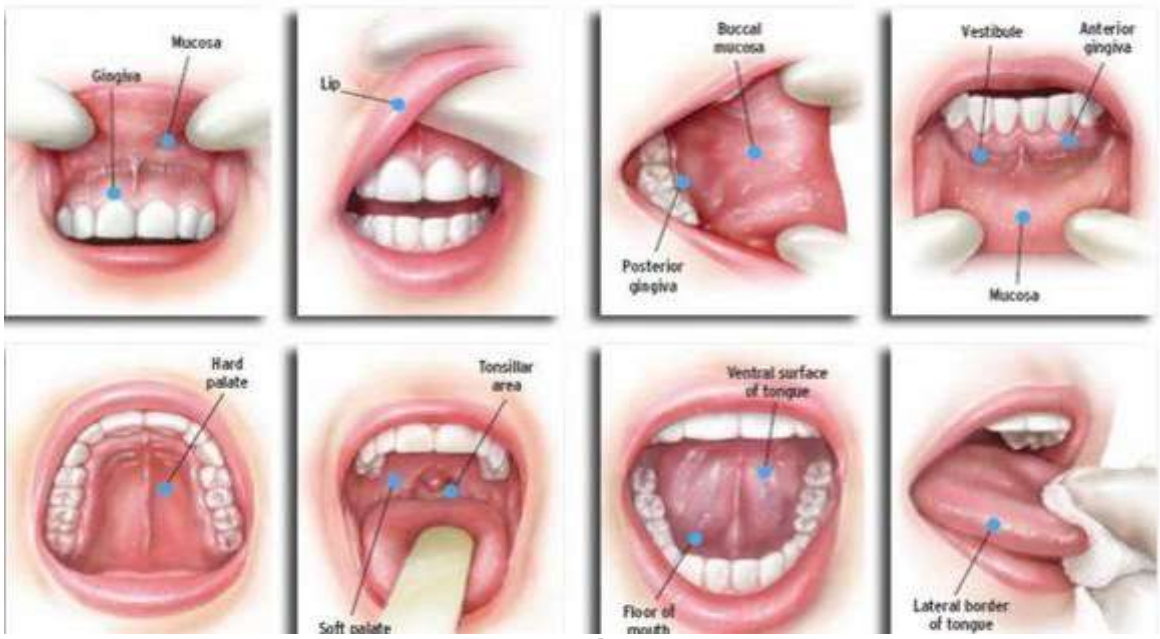

Fig.1. Intra oral Examination

The face, head, and neck are all part of the further oral examination. If an abnormality is found, more information is recorded, including the type of abnormality, its size, colour, position, surface roughness, and consistency. To assess if a structure is within normal bounds or abnormal, a thorough understanding of normal anatomy and typical deviations of normal is required. Asymmetries and lymph node examination should be performed on the patient. If an anomaly is discovered, the quantity, size, consistency, tenderness, movement, and location of the abnormality should be recorded. Swelling, discoloration, and asymmetry should all be checked on the face. Swellings from both dental and non-dental sources, such as infection, neoplastic growths, and hypertrophy, can produce asymmetry. The face, head, and neck are all part of the further oral examination. If an abnormality is found, more information is recorded, including the type of abnormality, its size, colour, position, surface roughness, and consistency. To prevent, a thorough understanding of normal anatomy and common variants of normal is required. The major lymph nodes should be palpated as part of the patient's head evaluation. Enlargement, fixation, and discomfort of the lymph nodes should all be observed. The major lymph nodes in the patient's neck should be palpated in the same way as the patient's head is. Any lymph node enlargement, fixation, or discomfort should be noticed once more. Any lumps, swelling, pain, or irregularities should be noticed as well.

Soft tissue and hard tissue examinations are two types of intraoral examinations. Lips, buccal and labial mucosa, floor of mouth, tongue, palate, and fauces are all included in the intraoral examination area. Figure 1 provides types of intra oral examination.

IMAGING TECHNIQUES

After an oral cancer diagnosis has been obtained, imaging tests are used to determine the tumour's stage. Magnetic resonance imaging, computed tomography, and positron emission tomography are the most prevalent imaging techniques utilised in diagnosis.

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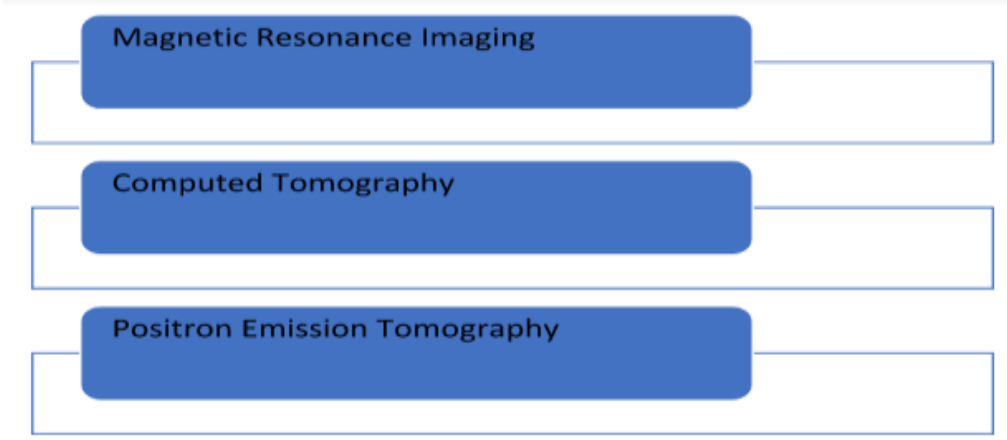

Magnetic Resonance Imaging:

Preoperative MRI gives acceptable accuracy for estimating tumour thickness and predicting occult cervical nodal metastases. In the examination and staging of oral cavity cancer, MRI is the preferable modality, which aids a clinician in treatment planning. The specifics of structures within the mouth cavity, as well as neighbouring structures, can be obtained using MRI. MRI's superior soft-tissue discrimination quickly identifies tumour invasion and dissemination to nearby structures [9]. The main benefit of MRI over computed tomography (CT) is that it offers superior soft tissue details and does not expose patients to any hazardous radiation. The primary advantage of MRI over computed tomography (CT) is that it offers superior soft tissue details and does not expose patients to hazardous radiation. MRI detects tumour infiltration of the bone marrow earlier than CT. Hence it can be used rather than CT is most cases.

Fig.2. Magnetic Resonance Imaging

In this investigation, clinical tests were used to determine the size of the primary tumour (T) and metastasis to regional lymph nodes (N) before MR imaging.

Computed Tomography:

Cone-beam computed tomography (CBCT) is now commonly employed in the diagnosis of oral and maxillofacial bone diseases because of its high spatial resolution and inexpensive cost. For craniofacial bone lesions, the most widely used resolution of CBCT is 0.25 mm, which is significantly lower than that of conventional 64-slice spiral CT (1 mm). The presence or absence of mandible invasion by OSCC can be determined with great accuracy using CBCT. However, no research has been done to see how accurate this method is at predicting invasion size.

Positron Emission Tomography:

Unlike CT and MRI, positron emission tomography gives precise anatomical information as well as physiological and metabolic data[10]. Detectors positioned around the patient measure the distribution of a radioactive chemical agent

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given intravenously with a biological substance feature in the body.

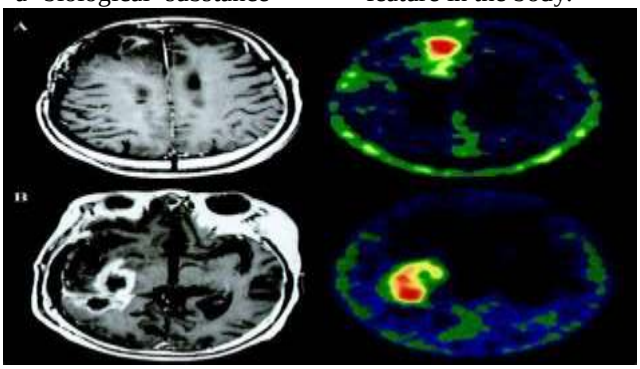


Fig.3. Positron Emission Tomography

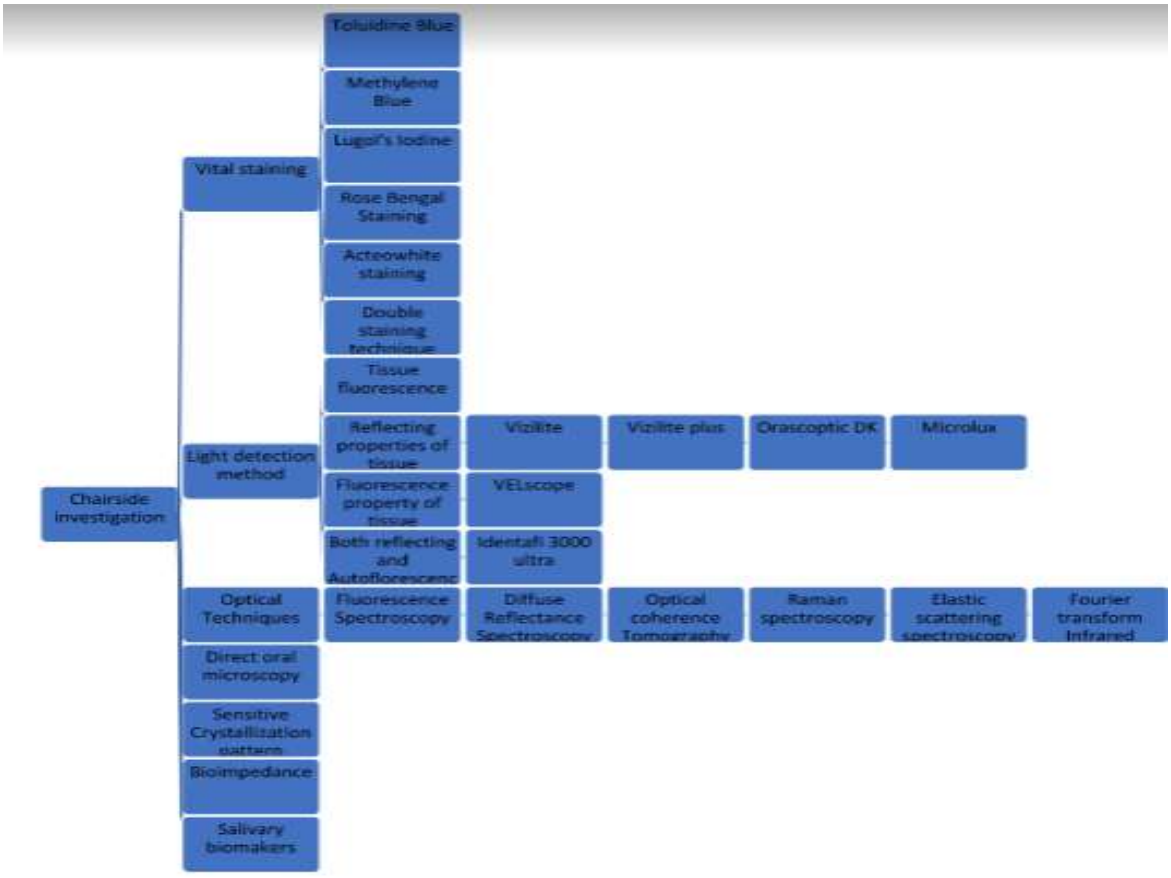
In other words, a PET-CT result that is negative may not require additional investigation, whereas a positive result may require the use of other imaging technologies or histological confirmation. When compared to other imaging modalities, PET can provide additional staging information.

CHAIR SIDE INVESTIGATION:

Chairside investigations are straightforward, requiring only basic equipment and quick execution of processes. They don't necessitate any special training. It can be done in the comfort of a clinic or dental office.

As a result, chairside investigations are a useful tool for supporting the oral physician in confirming the diagnosis and evaluating alternative treatment options based on the patient's needs.

FLOW CHART DEPICTING CHAIR SIDE INVESTIGATIONS



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Vital staining (toluidine blue)

Since its discovery by William Henry Perkin in 1856, toluidine Blue (TB) has been utilised primarily by the dye industry for a variety of medicinal uses. Toluidine blue, also known as methylanaline or aminotoluene, was previously used to detect mucosal abnormalities in the oral cavity[12]. TB is an acidophilic metachromatic dye that prefers to stain acidic tissue components, as well as sulphate, carboxylate, and phosphate radicals like DNA and RNA, but not normal mucosa. It is a simple, quick, low-cost, and less technique-sensitive tool for mass screening of oral cancer, particularly in large populations. Toluidine Blue may reveal information about the edges of a lesion.

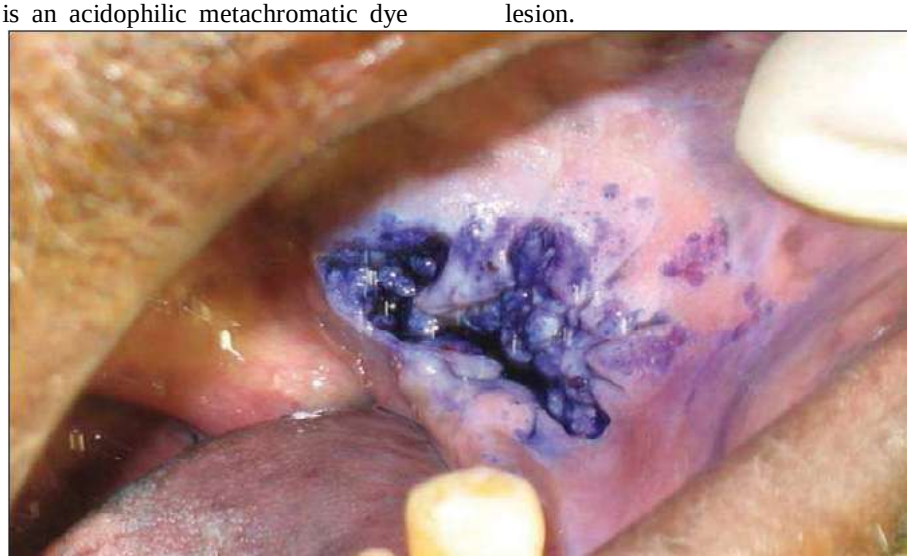

Fig.4. Vital staining

Methylene Blue

Methylene Blue has also been used to detect oral cancer as a diagnostic test. Methylene blue has a chemical structure and physical properties that are similar to toluidine blue[13]. When compared to toluidine blue, it is less harmful to the human body and is less expensive.

Light detection method

It is based on acetic acid's capacity to promote thickened surface keratin areas. It makes the keratin whiter and thus more noticeable to the naked eye in the oral environment. After a minute of contact with acetic acid, a thin leukoplakia that may have gone unnoticed could be spotted. The ViziLite device takes use of this by combining it with intense blue light to improve keratin detection even more[14].

Toluidine blue has recently been introduced to the kit (ViziLite Plus) for the detection of superficial nuclear abnormalities. The light comes from either chemical tubes (chemiluminescence) or a laser. The advantage of the light detection method is that it is useful for detecting hyperkeratotic regions that would otherwise be missed by ordinary visual inspection[15].

Optical techniques

The VELscope is a commercially available instrument for detecting tissue autofluorescence loss in the oral cavity, which is linked to precancer and cancer. Wide-field autofluorescence photos can be digitally processed to indicate worrisome zones in real time. Optical techniques include, Fluorescence Spectroscopy, Diffuse Reflectance spectroscopy, Optical coherence tomography, Raman spectroscopy, Elastic Scattering Spectroscopy (ESS) and Fourier transform Infrared spectroscopy,

These techniques are cost-effective, reliable and is the fastest diagnostic tool which can be used to diagnose cancer in its early stage. It can be used instead of biopsy to assess the surgical margin after treatment

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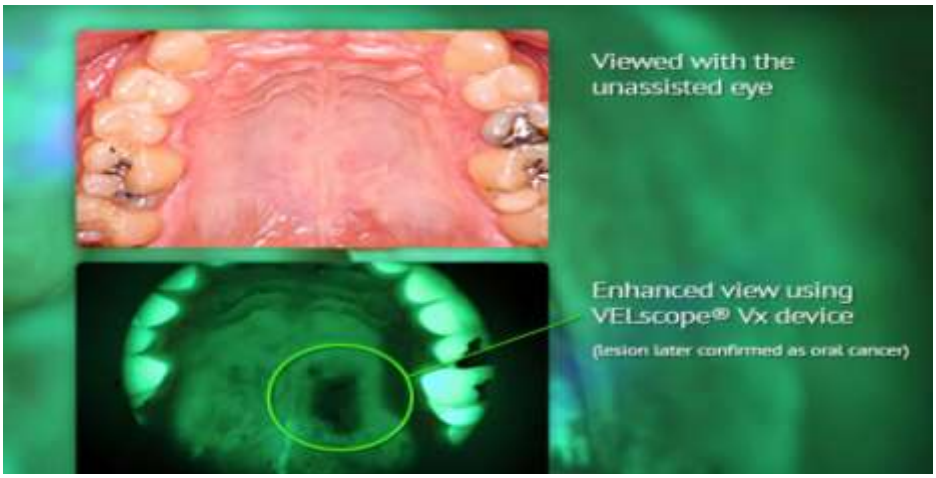


Fig.5. VELscope

Direct oral microscopy

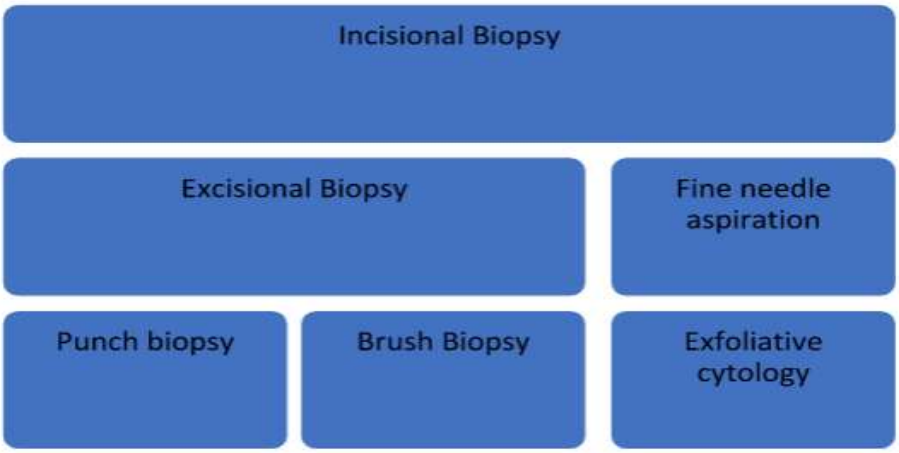
Direct oral microscopy is a unique, yet occasional, non-invasive diagnostic approach that assists in clinical assessment of the mouth cavity. Microscopically, the oral mucosa is studied at several magnifications to assess aspects such as sub-epithelial mucosal vessels, surface patterns, colour tone, and transparency, as well as the exact demarcation boundaries of mucosal lesions[16]. The use of a green filter on the light source makes it easier to examine sub-epithelial mucosal vessels because the contrast between these vessels and the surrounding tissues is enhanced. Direct oral microscopy allows for the discovery of dysplasia within clinically unaffected mucosal margins around OSCC, allowing for more precise resection boundary establishment and improved resection totality.

Salivary biomarkers

The oral cancer lesion is in direct touch with saliva, an aqueous biological fluid. As a result, saliva can simply be used to collect aberrant DNA, RNA, and protein molecules generated by cancer cells. Saliva has been discovered to include elements that reflect the pathological or physiological state of the human body, making it potentially useful for diagnostic purposes.

BIOPSY:

A tissue sample is surgically extracted from the suspicious area and sent to a pathology laboratory for microscopic analysis[17]. This is the only way to tell if you have oral cancer or oropharyngeal cancer. Biopsies such as exfoliative cytology and incisional biopsy are performed depending on the specific requirement. Incisional biopsy, excisional biopsy, fine needle aspiration, punch, brush biopsy, and exfoliative cytology are the six forms of biopsy[18].



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Incisional biopsy:

Incisional biopsy, which involves removing a representative sample of the lesion and normal surrounding tissue in order to provide a definitive diagnosis before treatment, has been considered the gold standard for the detection of oral premalignant and malignant lesions[19]. Because it does not cover the full lesion, the incisional biopsy is relatively accurate. When it is not possible to remove the entire lesion, an incisional biopsy is used.

Excisional biopsy:

The entire area of concern is eliminated using this procedure[20]. If the diagnosis is unknown, doctors would typically do an incisional biopsy to confirm the diagnosis before removing the entire tumour. In rare cases, however, the lesion is tiny and an excisional biopsy is required[21]. Oral malignancies can be diagnosed and treated by excisional biopsy with margin control.

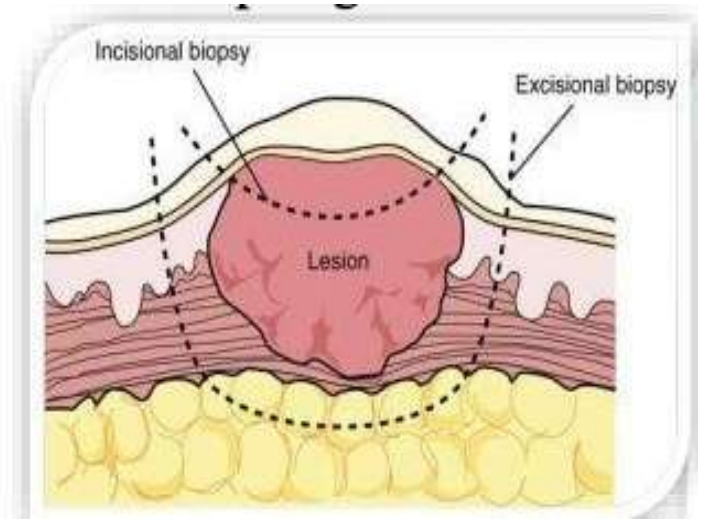

Fig.6. Incisional and Excisional Biopsy

Fine needle aspiration:

Fine-needle aspiration cytology is a non-invasive diagnostic technique that has acquired widespread acceptance in a variety of medical and surgical disciplines in recent years. Fine needle aspiration biopsy is a method in which a tiny needle is inserted into the tumour and a syringe is used to extract certain cells[22]. Despite the fact that the procedure has been around for 150 years, its effectiveness, safety, and diagnostic accuracy have only been proven in the last 20 years. Here the lesion is extracted using syringe and it been tested for cancer.

Punch biopsy:

A punch biopsy is used to diagnose cancers such as non-melanoma and melanoma skin cancers, oral, throat, inflammatory breast cancer, vaginal, and vulvar23 cancers. It's also utilised to detect precancerous and noncancerous skin tumours and disorders. Large tumours on the skin or a thin, wet layer of tissue that lines some organs and cavities are frequently the subject of a punch biopsy. It is one of the most straightforward methods in which the equipment is inserted in the lesion region and then removed by punching the affected area into the tube. This can be taken to a lab to be investigated further.

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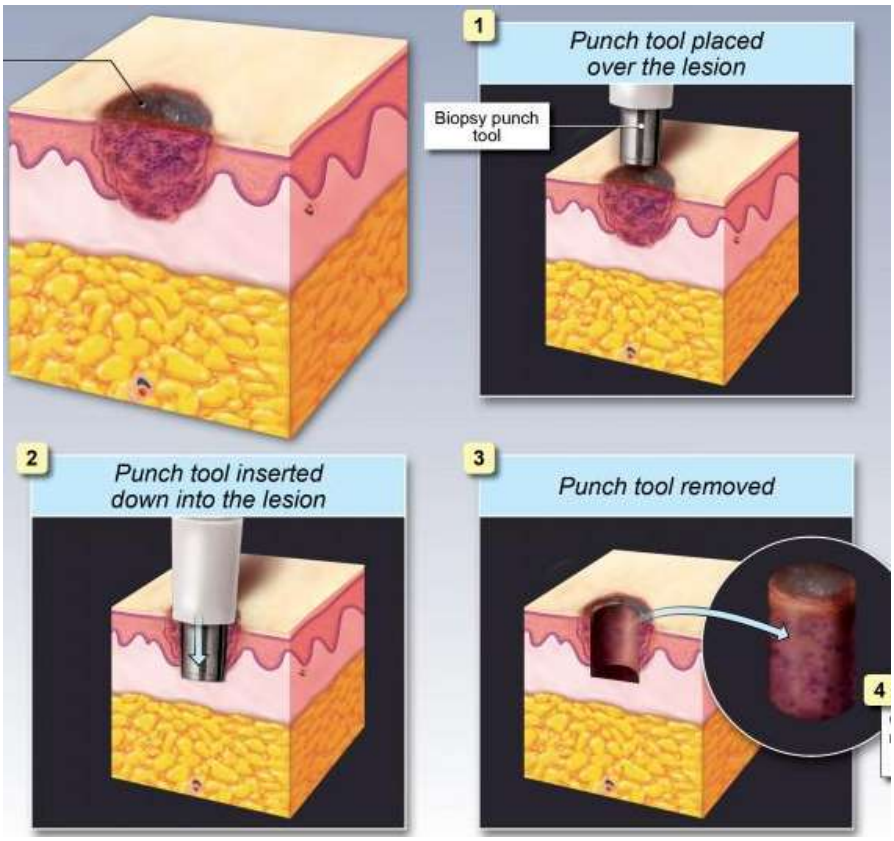

Fig.7. Punch Biopsy

Brush biopsy:

Brush biopsy involves scraping the surface mucosa to extract transepithelial cells from the oral lesion. Oral cancer screening with a brush biopsy is a straightforward, painless, chair-side, low-cost, highly sensitive, and risk-free procedure[24]. It can be used to rule out any dysplastic features in any suspicious lesion, such as little red and white oral lesions. Brush biopsy is an additional diagnostic technique that removes epithelial cells for evaluation using a proprietary spiral-shaped stiff brush (Fig.8).

Fig.8. Brush Biopsy

The brush is rubbed over the lesion repeatedly until bleeding spots appear, indicating that the epithelial tissues have been pierced. The cells trapped in the brush are wiped off on a glass slide and transported to the lab, where pathologists examine the sample for abnormal cells using both computer assisted and traditional methods[25]. The brush biopsy will not provide a final diagnosis, but it will provide the practitioner with more conclusive evidence of any other abnormalities discovered, such as abnormal cells.

Exfoliative cytology:

Exfoliated cytology is a simple and non-invasive diagnostic procedure for early diagnosis of oral cancer. It is based on epithelium physiology[26]. Mouth exfoliative cytology (OEC) is a simple, non-invasive method that is comfortable for the patient and can be used to detect oral cancer early. It is one of the best method to diagnose oral cancer at its early stage.

II. CONCLUSION

Treatment for oral cancer is mostly determined by the tumor's location and size, as well as the patient's ability to preserve organs. In the early stages of oral cancer, radiotherapy and surgery are recommended treatment options. To combat the incidence of oral cancer in India, prevention, early diagnosis, and quick treatment are crucial. It is necessary to raise public knowledge about the causes and consequences of oral cancer, as well as the significance of quitting smoking, drinking alcohol, and keeping good oral hygiene. In many respects, the diagnostic stage of treatment influences everything that follows, thus it's critical to determine the cancer's aggressiveness and stage precisely and effectively. This complete diagnostic provides specific insight to those prescribing treatment, allowing for more precise treatment.

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