

chair side diagnostic aids in early detection of oral cancer

For general dental practitioners

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ABSTRACT

The incidence of oral cancer is increasing worldwide. Patients with oral cancer have low survival rate compared with other cancer in the body. This is mainly because of the delay in the diagnosis, spread of tumor-metastasis, and thereby leading to secondary tumors. For the dental profession, it is really challenging and highly important to diagnose oral precancer or oral cancer, particularly in its early stage of the disease. Early screening and advanced diagnostic tool play an important role in the early diagnosis and treatment planning of patients suffering from oral cancer. This article reviews the chair side diagnostic aids as a tool for early detection of oral cancer. The article also emphasis on the role of general dentist and their importance in the early detection of oral cancer. Therefore every general dental practitioner should be aware of recent advances in diagnosis, in order to provide a high level of care among patients suspected with cancerous or pre-cancerous lesions .

KEY WORDS: cancer diagnosis, oral pathology, oral screening, oral cancer, advanced aids

INTRODUCTION:

Oral Cancer Incidence is the 6TH most common cancer World wide with an annual incidence - 36.2 million and with approximately 8.2 million death per year all over the world.

INDIA is the 3rd most common cancer where 20 in 100000 population are affected by oral cancer which accounts for about 30% of all types of cancer comparatively. The common etiological factors are tobacco, alcohol consumption, positive family history of cancer, Viral infections like HPV, traumatic tooth and poor oral hygiene . Oral cancer are usually neglected by the common population when compared to other systemic cancers such as the lung cancer, colon, breast cancer etc. However, they also may be extremely fatal if left untreated even at a very initial stage of the lesion. Based upon the National Cancer Institute's SEER program, which collects data on oral cancer, there has been little or no change in the past twenty years in the detection of oral cancers at early stages. Unfortunately, most patients are diagnosed during advanced stage of the disease. Early detection is therefore necessary in raising awareness among the general public and improving access to oral health services for all group of population. Oral squamous cell carcinoma is almost always preceded by a visible precancerous lesion-dysplasia. Dentists are one among the first in detecting benign and potentially malignant oral lesions during routine screenings. By the use of newer diagnostic modalities that detect the disease in its early stage there can definitely be an increase in the survival rate .

EARLY DIAGNOSIS:

During a routine screening or any dental procedures, oral cavity and area around the oral cavity are most frequently examined by the dentist. Here as Dentist we play an important role in detecting oral signs and symptoms of any disorder. Sometimes oral mucosal lesion which are present are not noticed or said as a complaint by the patients to the dentist as some of lesion or changes remain without any alarming symptom even for a long period of time. Dental examination should be done thoroughly which includes dental and soft tissue structures. Many a times patients during their early stage of the disease do not show up with any forms of signs and symptoms, in such cases the primary goal to diagnose the lesion properly is of utmost important. Diagnostic delay is an important factor that should be prevented by offering required investigation and questioning as a prompt care to the patient with oral cancer, thereby reducing the morbidity and mortality. This also helps to offer a favorable prognosis of the disease to increase the quality of life by decreasing the morbidity of the disease and its treatment, which is associated with a severe loss of function, disfigurement, sufferings from pain and discomfort, depression and poor quality of life¹.

According to the American Dental Association - ADA, “Identifying white and red the spots that show dysplasia and removing them before they become cancer has proved to be one of the most effective methods for reducing the incidence and mortality of cancer”². Oral malignant transformation of dysplasia, which is mostly unpredictable, occurs over years, during this period of time the lesion can be treated, potentially preventing oral cancer from developing.

CHAIR SIDE METHODS AND ADVANCEMENTS IN THE DIAGNOSIS OF ORAL CANCER:

Clinical Methods	<ul style="list-style-type: none"> • Vital tissue staining • Vizilite
Cytopathology Examination	<ul style="list-style-type: none"> • Exfoliative cytology • Brush Cytology/ Oral CDx
Visualization Adjuncts Tissue Auto fluorescence	<ul style="list-style-type: none"> • VELscope • In Vivo Confocal Microscopy • Chemiluminescence
Photo diagnosis	<ul style="list-style-type: none"> • Auto fluorescence Spectroscopy • Fluorescence Photography

CLINICAL METHODS

VITAL STAINING:

Among all diagnostic aids, vital staining is the most simple, inexpensive and sensitive tool for identifying oral epithelial dysplasia and early squamous cell carcinoma. Vital staining is a procedure in which the living cells take up certain dyes, which selectively stains some elements like the mitochondria, lipid vesicles, lysosomes in the cells³.

Few of the vital stains which can be used as clinical tool in the diagnosis of oral dysplasia or malignancy are:

- Toluidine blue
- Lugol’s iodine
- Methylene blue
- Rose bengal dye
- Acetic acid

Among all the above mentioned stains, the most commonly used stains are Toluidine blue and Lugol's iodine.

TOLUIDINE BLUE:

Toluidine blue is also known as tolonium chloride, methylaniline, aminotoluene. Basically Toluidine blue is an acidophilic metachromatic dye which has the ability to bind to acidic tissue components, thereby it binds to the nuclear material of the tissues having high DNA and RNA content⁴. As the toluidine blue has the characteristic ability to bind to the acidic components of the tissue, it is based on the known fact that usually the dysplastic and neoplastic cells contain more nucleic acid quantitatively when compared to that of the normal cells. Also the intercellular canals appears to be wider in malignant epithelium than the normal epithelium, and due to which the penetration of dye is enhanced. For intraoral use, 1% of toluidine blue is commonly used.

LUGOL'S IODINE STAINING:

Lugol's iodine was named after the French physician Lugol (1786–1851). Until the end of 19th century, it was used as an antiseptic and disinfectant⁵. The principle is based on the concept of glycogen content of the cytoplasm of the cell and the reaction is known as the iodine– starch reaction, which is visualized by a colour change. As there is enhanced glycolysis in the dysplastic and cancer cells, they do not promote the iodine–starch reaction. Hence there is no color change in dysplastic epithelium, whereas due to high glycogen content of normal epithelial cells, brown color change can be noticed when applied on the normal epithelium. The vital dye with Lugol's solution is also called Schiller's test^{6,7}.

ADVANTAGES OF VITAL STAINING IN COMMON DENTAL PRACTICE⁸:

It is inexpensive and simple procedure

- Can be used for screening high- risk patients who may have asymptomatic malignant lesions of oral cavity.
- Very helpful for surgeon in operating room to evaluate free surgical margins.
- Though Toluidine blue staining when used on the oral epithelium they will not interfere with histologic staining or interpretation.

CYTOPATHOLOGY EXAMINATION:

ORAL EXFOLIATIVE CYTOLOGY:

Oral exfoliative cytology was first introduced by Navone et al, it is one of the common, easiest, and reliable procedure used in every day dental practice in detecting oral pre-malignant or malignant lesion. In this, a collecting device used may be swab, wooden spatula, or brush and is placed on the surface and rotated against the mucosal surface, by doing this the cells are collected. These cells should be spread on a glass slide to prepare a smear. These slides are examined under a microscope after fixing and staining. It can detect epithelial dysplasia, carcinoma, and atypical changes even during the early stages of cancer.

BRUSH CYTOLOGY/ ORAL CDx:

Brush cytology, was first developed in 1999 and has become common in day to day dental practice. Oral CDx is a highly specialized computer-assisted analysis of oral brush biopsy performed in a dental clinics or dental

hospitals⁹. It is a rapidly chair side procedure that results in minimal bleeding, requires no topical or local anesthetic, and results in a collection of a complete transepithelial tissue sample. Oral CDx kits supplied to investigators consist of an oral brush biopsy instrument, a precoded glass slide and matching coded test requisition form, an alcohol/ polyethylene glycol fixative pouch, and a preaddressed container to submit the contents. In addition to precancer and cancer detection, it can provide morphologic evidence of a variety of benign oral processes like candidiasis, herpes infection, pernicious anemia, radiation effects, and pemphigus. However, oral CDx does not substitute for a. As majority of oral cancers are squamous cell carcinomas, Cytological study of oral cells is a relatively less expensive, simple, noninvasive and also risk-free technique which is well accepted by the patient and also by the dentists. The oral cells can be obtained by the use of a cytobrush. Detecting the sensitivity of epithelial dysplasia or oral squamous cell carcinoma with brush cytology is relatively high¹⁰.

VISUALIZATION ADJUNCTS TISSUE AUTO FLUORESCENCE

Optical spectroscopy provides tissue diagnosis in real time and noninvasively. This relies on the fact that the optical spectrum derived from any tissue will contain information about the histological and biochemical makeup of that tissue. Light based oral cancer screening aids are used for the detection of dysplasia and malignancy, in performing guided biopsies, monitoring of hemoglobin tissue perforation in free flap and therapeutic drug levels during chemotherapy and photodynamic therapy, assessment of the surgical margins, and plays a role in sentinel node biopsy¹¹. Specifically, these aids are intended to be used as adjuncts to the conventional oral cavity examination to help visualize lesions.

VELSCOPE:

VELscope is a handheld, portable device based on narrow-emission tissue fluorescence which provides light in the range of 400- 460 nm. Under the intense blue light, normal mucosa emits a pale green autofluorescence while the suspicious tissue appears dark¹²

IN VIVO CONFOCAL MICROSCOPY:

Another light based diagnostic aid is the Confocal microscopy which is an imaging technique for various researches in cell biology with an advantage of optical sectioning and high resolution imaging. In vivo confocal images from the oral cavity show the characteristic features such as nuclear atypia which is used to differentiate OSCC from normal oral mucosa. However, to rate it as a promising non-invasive tool for the early detection of cancer further optimization of the instrument is still needed.¹³

CHEMILUMINESCENCE:

It means emission light by chemical reaction. Vizilite is most commonly used under chemiluminescence, which emits bluish white light with a wavelength of 430 to 580nm. In this technique, patient is asked to rinse with 1% acetic acid, which is done to remove the debris and to increase the visibility of nuclei due to mild cellular dehydration. The normal mucosa absorbs the light and appears blue, whereas abnormal mucosa appears aceto-white with brighter, sharper, more distant margins as it reflects the light. The reported sensitivity is 100% and specificity range from 0 to 14.2%¹⁴. Recently, Vizilite system was modified to use along with toluidine blue.

PHOTO DIAGNOSIS :

AUTO FLUORESCENCE SPECTROSCOPY

Auto fluorescence spectroscopy falls under the category of photo diagnostic methods used in the detection of oral dysplasia. It has emerged as a promising tool for oral cancer diagnosis in general clinical practice. The system consists of a small optical fiber which produces various excitation of wavelengths and a spectrograph which receives and records on a computer and analyzes the spectra of reflected fluorescence from the tissue with the help of software. The disadvantage of this auto fluorescence spectroscopy is that the optical fibers are small, so only a small mucosal area can be scanned and therefore, not suitable for large mucosal lesion. But overall, it seems to be very accurate for distinguishing lesions especially malignant tumors from healthy oral mucosa, with a high specificity and sensitivity¹⁵. It is a non-invasive aid in the detection of various alterations in the structural alterations and chemical compositions of cells indicating the presence of a diseased tissue. It can be useful in guiding the clinician in identifying the optimal location needed for biopsy¹⁶. According to many studies, on using violet excitation light, camera-based autofluorescence photodetection technique has presented as a highly promising tool for the diagnosis of oral malignancies .

FLUORESCENCE PHOTOGRAPHY:

In this technique the oral mucosa is illuminated with intense blue light with the wave length range from 400 to 460nm. When illuminated with the blue light the normal mucosa appears pale green compared with abnormal mucosa, which appears darker due to altered structure and cellular metabolism of epithelium and subepithelial stroma. Sensitivity range from 97 to 98% and specificity range from 94-100%. Microlux, Orasoptic are few commercially available manufactures in tissue fluorescence imaging. Fluorescence photography is simple non-invasive, rapid, and reproducible method in detection of oral cancer. Fluorescence positivity can show enlargement of carcinomas and progression of the disease. The system is usually used in the diagnosis of squamous cell carcinoma. However, biopsies are still necessary. Fluorescence photography is an useful tool for the diagnosis of oral cancer, especially in patients with squamous cell carcinoma¹⁷.

CONCLUSION:

Early diagnosis of oral cancer is a priority health objective, in which general dental practitioner in every day practice play a very important role. Early detection should lead to less damage from cancer treatments and to a better prognosis. There are numerous advanced techniques that may variously help in the diagnosis of oral malignancy. Recently, light-based detection systems have been claimed to improve sensitivity and specificity, but so far, controlled studies have failed to justify their application. Brush biopsy and conventional scalpel biopsy are effective diagnostic tests for evaluating suspicious precancerous or cancerous oral lesions. Light based screening aids should only be employed as an adjunct to the clinical examination for identifying oral lesions that may have been overlooked with a conventional oral examination and not for determining the biologic nature of a lesion. There has been a dramatic increase in the development of many potential oral cancer screening techniques in last few years and still many researchers are on the look for any better and faster aids of diagnosing these life threatening cancers. So it is highly important to have clear knowledge about the usage of various diagnostic aids that can be used during chair side diagnosis mentioned here. Which on proper usage can decrease the risk of morbidity and mortality associated with oral cancer.

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