

Title of the article: Chairside screening technique for Oral Potentially Malignant Disorders (OPMDs)

1. Dr B. Ishwariya

*Post graduate student, Department of Oral and Maxillofacial pathology
Sree Balaji Dental College and Hospital and Research
Bharath institute of Higher Education*

2. Dr. N. Aravindh Babu

*Professor, Department of Oral and Maxillofacial pathology
Sree Balaji Dental College and Hospital and Research
Bharath institute of Higher Education*

3. Dr. K. M. K. Masthan

*Professor and Head, Department of Oral and Maxillofacial pathology
Sree Balaji Dental College and Hospital and Research
Bharath institute of Higher Education*

4. Dr. E. Rajesh

*Reader, Department of Oral and Maxillofacial pathology
Sree Balaji Dental College and Hospital and Research
Bharath institute of Higher Education*

Corresponding Author:

1. Dr B. Ishwariya

*Post graduate student, Department of Oral and Maxillofacial pathology
Sree Balaji Dental College and Hospital and Research
Bharath institute of Higher Education*

Abstract: Oral cancer is the main leading cancer in India and 80% of Oral malignancy is analysed and diagnosed in the late stage. Oral Potentially Malignant Disorder (OPMDs) are the precursors of Oral malignancy. Delay in the diagnosis and screening is the main reason for the high death rate for oral cancer. Early Screening and treatment are an important role to prevent the progression of OPMDs into oral malignancy and also control the death rate. This Review article is to give the various clinical chairside screening methods using advanced techniques to detect the OPMDs.

Keywords: Chairside screening for OPMDs, Oral Potentially Malignant Disorders (OPMDs), non-invasive screening methods for OPMDs, Vizilite, Vizilite plus, Orascope DK, Microlux Diagnostic Light, Velscope, Photodynamic Therapy, IDENTAFI 3000 Ultra.

1. Introduction

OPMDs have the potential to slowly become oral cancers, such as leukoplakia, oral lichen planus, oral submucous fibrosis, etc. Screening is the first aspect that helps to prevent the further progression of OPMDs into malignancy. Recent non-invasive screening tools that have been used for earlier screening of OPMDs are Vizilite, Vizilite plus, Orascope DK, Microlux Diagnostic Light, Velscope, Photodynamic Therapy, IDENTAFI 3000 Ultra, etc are discussed in this article.

Screening technique for OPMDs (chairside)

- Vizilite
- Vizilite plus
- Orascoptic DK
- Microlux Diagnostic Light Velscope
- Velscope
- Photodynamic Therapy
- IDENTAFI 3000 Ultra.

VIZILITE:

Vizilite is a screening device that helps the clinician to visualize the suspicious lesion in the oral cavity. ViziLite (Zila Pharmaceuticals, Phoenix, AZ, the United States in 2001) works on the principle of chemiluminescence-based detection devices used to detect the early identification of OPMDs and OSCC.¹

Patients were instructed to flush with a 1% acetic acid solution for a minute to eliminate the glycoprotein barrier and slightly remove the moisture from oral mucosa. A hand-held, single-use, disposable chemiluminescent light with an average wavelength of 430, 540, and 580 nm is then activated which is used to examine the oral mucosa². Normal cells absorb the light and which appears blue, though dysplasia cells should reflect the light which appears white. The colour difference relates to the altered epithelial thickness, or to the higher density of nuclear content and mitochondrial matrix which mainly reflect light in the pathological tissues.

Vizilite plus

Vizilite Plus is a combination of both TB (toluidine blue) and ViziLite systems (ViziLite Plus with TBlue System; Zila, Batesville, AR, USA), received FDA which detects any abnormalities in the tissues inside the mouth and throat. Toluidine blue is an acidophilic metachromatic dye in the Vizilite Plus which stains the acidic components of mucosa selectively such as sulfates, carboxylates, and phosphate radicals, thus staining the cells of nucleic acid (DNA and RNA). So, the hyperplastic or dysplastic lesions appear white against the blue appearance of the normal tissue, hence it is termed as “acetowhite lesion”. The difference between the Plus and the earlier version is that the latter contains a TB staining solution thus improving the specificity of positive lesions.³

Advantage

Easily portable devices and low-cost method which helps in the screening of OPMDs

Disadvantage

The limitations in Vizilite methods are low specificity and not differentiating benign or malignant lesions.

VELscope (Visually Enhanced Lesion Scope)

The VELscope (LED Dental, Inc., White Rock, BC, Canada) is a commercially available handheld device that has been approved by the US FDA which works on the principle of direct tissue autofluorescence as an adjunct to examine the oral mucosal abnormalities. The most relevant fluorophores in the oral epithelium are nicotinamide adenine dinucleotide and flavin adenine dinucleotide and collagen cross-links in the stroma. The wavelength of 400 to 460 nm is used where the mucosal abnormalities can alter the absorption and scattering properties of light as a result of changes in tissue architecture and concentrations of fluorophores.⁴ So, the dysplastic tissue appears dark colour due to decreased levels of autofluorescence and the healthy tissue appears pale green autofluorescence. Based on different studies, it is found that VELscope has a sensitivity of 98% and specificity of 100% using biopsy as “gold standard” while differentiating the normal mucosa from severe dysplasia and carcinoma in situ.

Advantage

Easy and quick to use which gives thorough soft tissue examination which easily differentiates normal and abnormal cells.

Disadvantage

Inability in differentiating high and low-risk lesions.

IDENTAFI 3000 Ultra:

The Identafi 3000 technology uses the Multi-Spectral Fluorescence and Reflectance technology which helps in the screening of oral mucosal abnormalities such as OPMDs and oral carcinomas. Compared to other fluorescence technologies and dye systems, the Identafi 3000 is multi-spectral with three distinct color wavelengths such as white, violet, and amber green light making it easier to distinguish the morphology and vasculature of the lesion. The White light is used to begin the conventional oral examination, followed by violet light of wavelength 405nm enhances normal tissue's natural fluorescence and the abnormal or dysplastic tissue appears dark due to loss of fluorescence. Finally, the green-amber light of 545 nm wavelength enhances normal tissue's reflectance properties which help to distinguish and observe the differences between the normal and dysplastic tissue's vasculature. This imaging technology helps to evaluate the status of tumour angiogenesis.⁵⁻⁷

Advantage

Helps in the visualisation of deeper neovascularization and lesion progression. To determine the surgical margins for the excision of the abnormal tissues.

Disadvantage

Inability in differentiating benign and malignant lesions

Microlux/DLTM

Microlux/DLTM (AdDent Inc., Danbury, CT, United States) is a chemiluminescence-based device that was approved by the FDA in 2005. This device has a diffused blue-white LED light source and a fiber optic light guide and follows the same principles of ViziLite after 1-

min rinse with 1% acetic acid, the oral examination is performed with 460–555 nm wavelength light. The abnormal epithelial cells cause the appearance of “aceto-white” lesions and the LED light source makes the lesion more easily recognizable⁸. Additionally, the use of TB can be used along with Microlux/DLTM, to enhance the visualization of dysplastic areas.

Advantage

Helps in the visualization of dysplastic areas more accurate than Vizilite system

Disadvantage

This method does not help to differentiate benign and malignant lesions.

Orascope DKTm system

Orascope DKTm system (Orascope, Middleton, WI, United States) is a chemiluminescence-based device, which is designed to improve the visualization of OPMDs. It is a battery-operated hand-held LED attached light instrument with an oral lesion screening attachment, and is used along with a 1% acetic acid solution. The examination process is similar to that used with ViziLite and MicroLux.⁸

Advantage

Helps in the visualization of dysplastic areas more accurate than Vizilite system

Disadvantage

This method does not help to differentiate benign and malignant lesions.

Photodynamic Therapy:

Photodynamic treatment (PDT) is an effective screening and treatment methodology for oral potentially malignant lesions. The PDT utilizes a photosensitizer (photoactive dye), enacted by the light of an accurate wavelength in the presence of oxygen. The activated photosensitizer transfers energy to the oxygen bringing about the arrangement of toxic oxygen species like singlet oxygen and free radicals, which are cytotoxic and vascular toxic harming proteins, lipids, nucleic acids, and other cell segments. The Route of administration of photosensitizers might be infused intravenously, ingested orally, or applied topically depending on the type of agent. PDT is the treatment of decision for localized infected or affected cells and tissue. In oral lesions the PDT emits light with 585 nm wavelength of 1.5 milliseconds in sections of 5 mm diameter to target the lesion and surrounding tissue along with that 5-Aminolevulinic Acid is topically administered with an incubation time of 60-180 minutes; single dose (345 mg of active 5-ALA in 1.5 ml solution) and soaked onto white gauze and applied to the targeted lesion, covered with sterile Xeroform gauze. To increase the indicative specificity, a 5-ALA facilitated fluorescence endoscopic imaging technique (digitally) has been introduced.⁹ So, the ratio between red-to-green and red-to-blue fixation in cells which are going through dysplastic changes are more prominent than seen in benign lesions when a measurement of PPIX fluorescence endoscopic images is finished.

Advantage

Low cost compared to other treatment options and helps in the detection and treatment of oral cancers.

Disadvantage

This system cannot be used to treat the malignant tumours.

2. Conclusion

OPMDs have the potential to turn into oral malignancies. So early screening and treatment protocols can help to prevent the progression of OPMDs into oral cancer. In this reviewed article currently available chairside screening non-invasive techniques along with advantages and drawbacks are discussed to provide an outline in the screening process of OPMDs and to prevent the mortality rate of oral cancer globally.

3. References

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