Adjunctive techniques for mouth cancer screening

Andrew Osafo reviews vital tissue staining, chemiluminescence and autofluorescence as aids to mouth cancer screening.

As dental professionals, we are in a prime position to educate the public about mouth cancer. Are you doing this? Mouth cancer is a serious and debilitating disease that can devastate lives – and prematurely end them.

The Mouth Cancer Foundation recommends dental professionals carry out a mouth cancer screening on every patient over the age of 16 at least once a year. Dr Ciro Gilveti and myself wrote an article about how to perform a comprehensive mouth cancer examination. This article appeared in the December 2019 edition of Dentistry; the article is also available online (dentistry.co.uk/2020/01/06/how-to-screen-mouth-cancer).

According to the Oral Health Foundation, early detection of mouth cancer results in a 90% survival rate, compared to 50% in late detection of mouth cancer.

Fortunately, approximately half of all mouth cancers are diagnosed at advanced stages (stages III or IV) (Gómez et al, 2002). By these stages, the treatment required is for a systemic disease process rather than a localised condition, as a result of lymphatic spread.

Detecting mouth cancer at the early stages can be difficult, because abnormal lesions may not be palpable and the colour of these lesions are not dissimilar from the surrounding mucosa. Techniques have been developed to be used in conjunction with a mouth cancer examination to improve the detection of early malignancy.

This article reviews the following adjunctive techniques: vital tissue staining, chemiluminescence and autofluorescence.

**Vital tissue staining**

Vital staining is the process of staining living cells or tissues. Toluidine blue (Toluidine blue) is an acidophilic vital dye that has been used for more than 40 years to aid the detection of mucosal abnormalities of the cervix.

Toluidine blue has a high affinity for acidic tissue components and selectively stains tissues that are rich in RNA and DNA (Sridharan and Shankar, 2012). Premalignant and malignant lesions contain significantly more RNA and DNA compared to normal cells. Areas that are stained dark blue (considered a positive stain) require further investigation.

The Orabla Oral Lesion Marking System (Addent Inc) contains three components:

1. Iodine chloride
2. Acetic acid
3. Applicator swabs.

Acetic acid is applied to the tissues by means of applicator swabs before and after applying iodine chloride. The acid helps to remove surface debris. The test is considered positive if the dye is retained after the application and de-staining with acetic acid.

**Chemiluminescence**

Chemiluminescence or tissue reflectance has been used in gynaecology and obstetrics to detect premalignant and malignant lesions. This technique has been adapted for use in the oral cavity.

Chemiluminescence light is used to assess the oral cavity after rinsing the mouth with acetic acid. Applying acetic acid results in surface condensation of cellular proteins and dehydration of the cells, this reduces the transparency of the epithelium.

Malignant cells have increased light reflectance compared to normal cells, because they have a higher nucleus to cytoplasmic ratio. Under blue-white illumination, abnormal cells appear white (acetowhite), while normal cells appear bluish because these cells absorb light (Figure 1).

The Microlux Transilluminator 2 (Addent Inc) is a multipurpose device that can be used to screen for caries, fractures and oral mucosal abnormalities. The unit consists of a high-intensity light emitting diode (LED) fibre optic source.

These tools do not replace or diminish the mouth cancer clinical examination, but rather should be used to complement and strengthen existing clinical protocols.

The transilluminator has various attachments that are designed for different applications. When a Microlux Diffused Light (DL) guide is attached to the transilluminator a blue-white light (6500 K) is generated, which helps to visualise mucosal abnormalities (Figure 2).

**Autofluorescence**

Cells and tissues contain molecules called fluorophores. When fluorophores are excited by light of a specific wavelength (blue/violet light, 400-450 nanometers) fluorophores will emit their own light at a longer wavelength (green light). This phenomenon is known as autofluorescence.

Loss of tissue autofluorescence has been associated with malignant and pre-malignant lesions. Cells and tissues are viewed through optical filters that allow the passage of long wavelength red and green autofluorescence. Typically, healthy tissue appears green (emits fluorescence) while abnormal tissue appears dark (Figure 3).

Autofluorescence devices are useful for detecting lesions that are not easily noticed by visual inspection and do not require the use of rinses or lesion-marking solutions (Figure 4). Many studies have looked at the use of autofluorescence devices to detect oral mucosal abnormalities (Tiwari L, Kujan O and Farnh C, 2019).

To effectively use these tools, it is important to know how normal phenomena appears when viewed through an optical filter. I would recommend anyone that is interested in autofluorescence devices review the education support material on the Apteryx imaging website (apteryx.com/velscopeinstallation/training-videos).

The Velscope (which stands for Visually Enhanced Lesion scope) was the first autofluorescence device for dentistry. The latest model is a cordless non-magnifying device called the Velscope Vx (LED Dental Inc). The Velscope Vx has a blue light source that is integrated...
into the handpiece and has an optical viewing filter. The Velscope Vx Imaging Adapter is an optional accessory available that can be used with an iPod Touch and the Velscope Vx to allow fluorescence and normal white light reflectance image acquisition (Figure 5).

The BioScreen Oral Examination Light (Addent Inc) is a biofluorescence screening device. Compared to the Velscope Vx, the BioScreen has a longer run time, is lighter and has a fan. The device can be used in full room light due to having five high-power violet LEDs (Figure 6).

SLR camera and phone adapters are available for the BioScreen Oral Examination Light to take clinical photographs.

The GOCCLES (which stands for Glasses for Oral Cancer – Curing Light Exposed – Screening) device (Pierrel Pharma SpA, Italy) is one of the latest autofluorescence systems.

The GOCCLES device was created to provide an easy and low-cost method to visualise oral mucosal abnormalities. The system consists of a pair of glasses that are equipped with filters that highlight autofluorescence when mucosa is illuminated by light from any dental curing light.

The GOCCLES device allows binocular vision and does not need any consumable products to function (Figure 7).

**Suspicious areas**

If any unusual findings are discovered during the examination, a review appointment should be made two weeks after the initial examination. The size, shape, colour, texture and position of the suspicious areas should be recorded. It is also a good idea to take clinical photographs of the area of concern.
The oral mucosa generally heals itself in two weeks, so if the suspicious areas are still present at the review appointment, the patient should be referred for further investigation. Highly suspicious lesions (Figure 8) should be referred urgently under the ‘two week wait’ referral pathway. A biopsy and a histopathological examination are necessary to diagnose a suspicious lesion.

**Conclusion**

Early detection and diagnosis of mouth cancer dramatically improves survival rates and also makes treatment and rehabilitation easier. Adjunctive techniques have been developed to assist healthcare professionals to detect oral mucosal abnormalities. These tools do not replace or diminish the mouth cancer clinical examination, but rather should be used to complement and strengthen existing clinical protocols. They are also not designed to provide a diagnosis. As with any new technique or technology, there is a learning curve and professionals need to invest the time to learn how to use them effectively. Systematic and regular screenings save lives. As healthcare professionals, are we doing our part to raise awareness of mouth cancer?

**References**


---

**FOR FURTHER INFORMATION** on how to screen for head and neck cancer, visit the Mouth Cancer Foundation’s website at www.mouthcancerfoundation.org/get-info/screening-head-and-neck-cancer.