Adjunctive techniques for mouth cancer screening

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

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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 Gilvetti 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.

Unfortunately, approximately half of all mouth cancers are diagnosed at advanced stages (stages III or IV) (Gómez et al, 2009). 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.

Figure 2: The Microlux DL Diagnostic system

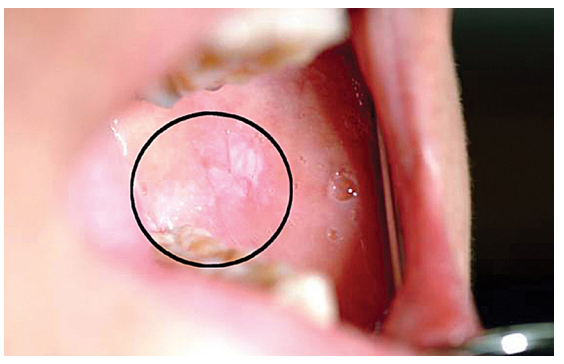

Figure 1a: An indistinct white area on the left buccal mucosa

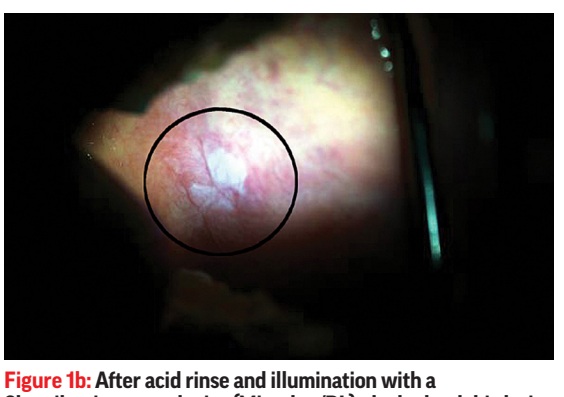

Figure 1b: After acid rinse and illumination with a Chemiluminescent device (Microlux/DL), the leukoplakic lesion become more visible. A diagnostic biopsy was recommended. Excisional biopsy revealed a benign hyperkeratosis with chronic inflammation and no evidence of epithelial dysplasia (images courtesy of Susan Zunt DDS MS)

Vital tissue staining

Vital staining is the process of staining living cells or tissues. Tolonium chloride (Toluidine blue) is a metachromatic 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). Pre-malignant and malignant cells contain significantly more RNA and DNA compared to normal cells. Areas that are stained dark blue (considered a positive stain) require further investigation.

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

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

Acetic acid is applied to the tissues by means of applicator swabs before and after applying tolonium chloride. The acetic acid helps to remove surface debris. The test is considered positive if the dye is retained following 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.

Chemiluminescent light is used to assess the oral cavity after rinsing the mouth with acetic acid. Applying acetic acid results in surface coagulation 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 (65000K) 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 nanometres) 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 Farah CS, 2019).

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

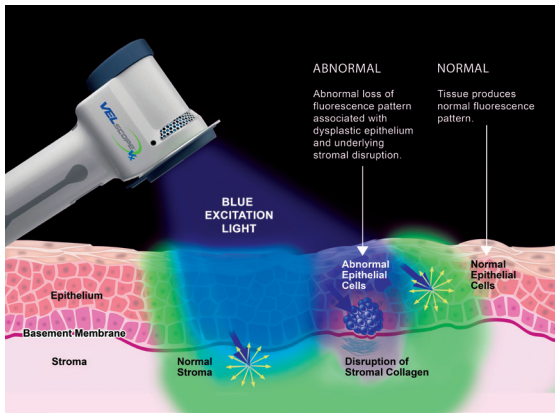

Figure 3: Interaction of blue/violet excitation light with normal and abnormal mucosa (image courtesy of Apteryx Imaging)

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 Bio/Screen Oral Examination Light (Addent Inc) is a biofluorescence screening device. Compared to the Velscope Vx, the Bio/Screen has a longer run time, is lighter and has no 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 Bio/Screen Oral Examination Light to take clinical photographs.

The GOCCLES (which stands for Glasses for Oral Cancer – Curing Light Exposed – Screening) device (Pierrel Pharma Srl, 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.

Figure 4: Autofluorescence screening device reveals a loss of autofluorescence (dark area), which is not apparent under white light (images courtesy of Addent Inc)

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

Figure 5: Velscope Vx with iPod-based camera system attached

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.

Figure 6: The Bio/Screen Oral Examination Light

Figure 7: GOCCLES mouth cancer screening device

Figure 8: Ulceration of tongue (left side) with raised and rolled borders

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 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? D

References

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Sridharan G, Shankar A (2012) Toluidine blue: A review of its chemistry and clinical utility. *J Oral Maxillofac Pathol* 16(2): 251-255

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Addent products and the Velscope, contact Panadent.
01689 881788 **www.panadent.co.uk**

The GOCCLES device, contact Dental Sky.
01233 502605 **www.dentalsky.com**

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.**