Oral cancer screening – its place in the general practice

With incidences of mouth cancer on the rise, Dr David Bloom and Dr Jay Padayachay from Senova Dental Studios look at how using the Velscope can help in its detection

There is a lot of media coverage at the moment regarding what might be defined as a ‘commonly recognised cancer’. We can all identify with those cancers that figure in the public media. Breast cancer and cervical cancer have a relatively high incidence and are well known, but just how aware is the general public of mouth cancers?

Many dental journals highlight the issue of the general dental practitioners’ involvement in the detection of mouth cancer, as part of a routine dental examination. It is clear that the majority of practitioners do carry out basic patient screening to detect suspicious soft tissue areas, but just how easy is it to spot the initial signs or symptoms of oral cancer?

So what is oral cancer?

Oral cancer cannot always be readily or easily identified, and it can prove difficult for clinicians to determine exactly which abnormal tissues should cause the most concern. Let’s first remind ourselves of some basic facts.

The oral mucosa consists primarily of two layers: the epithelium and the stroma.

The epithelium – referred to more completely as stratified squamous epithelium – consists of basal, intermediate and superficial squamous cells. The stroma is separated from the epithelium by the basement membrane. The stroma consists primarily of connective tissue - mostly collagen. It also contains capillaries (Fig. 1). Note that a surface layer of keratin of varying thickness can also be present although it is not shown in this picture. Certain types of oral mucosa are naturally keratinized while others can become keratinised as a result of chronic irritation or because of other disease processes.

Squamous cell carcinoma is the most common of all oral cancers (usually accounting for approximately 90 per cent of all cases), and can form within the soft tissues of the mouth, lips and tongue. Pre-cancerous epithelial lesions usually initiate from below the surface of the tissue at the basement membrane, and can remain hidden from view until they reach the surface (Fig. 2). It is essential that discovery and intervention be made during the very earliest of dysplastic progression.

Oral squamous cell carcinoma can progress from oral pre-malignant lesions, and can involve hyperplasia, and dysplasia and may ultimately evolve into what is termed as carcinoma in situ. To overlook the initial signs or symptoms of any suspect lesions can allow these to develop into more advanced stages.
Spotting the signs

Patients who present with suspect oral lesions should be carefully managed in an attempt to determine whether any suspicious mucosal changes have undergone a transformation into a malignancy. In some instances it is possible to see signs of oral disease, as in some forms of leukoplakia (exhibiting as white spots or lesions), or as a form of erythroplakia (red spots or patches).

Recent surveys have shown that the incidence of mouth cancers is on the increase and that it is not only those most susceptible groups such as older male smokers, or those who drink heavily that are at risk, but that young females and individuals that are sexually active, and who may contract the Human Papilloma Virus Type 16 (HPV-16) are also susceptible. It is therefore imperative that oral cancers be detected early, as dental professionals have a significant role to play in the detection of mouth cancers and they can in many instances be instrumental in identifying the early signs of any pre-cancerous conditions.

Statistics show that the five-year survival rate when detected in late stages of development can be as low as 22 per cent, but when detected early can leap to over 80 per cent. Figures issued by the British Dental Health Foundation (November 2006) show that 4,500 new cases of mouth cancer are diagnosed annually, and that around 1,700 are likely to die of mouth cancer each year.

Screening can help

A very basic screening process, carried out in the dental practice, can therefore assist in the initial discovery of soft tissue lesions, and then having established that there are areas of the soft tissue that may require further and more detailed investigation, the appropriate referral actions can then be undertaken. This may then involve some form of invasive biopsy, which could then lead to surgical intervention, and the removal of any obvious malignant tissue. We are all aware that no innocent oral ulceration generally persists for more than two weeks.

Dentists continually strive to offer the best possible treatment options for their patients, and dental practitioners are the only professionals that are in the unique position of being able to detect oral disease. Being aware of at least some of these facts has prompted dental professionals to look seriously at just how they could play a part in combating this disease.

Veloscope success

At Senova Dental Studios we became aware of a product called the Veloscope in 2007, and were introduced to Optident Ltd who act as UK distributors for this innovative instrument.

The Veloscope was developed in North America with themajority of research costs being funded by the National Institute of Health. Much supportive research was also conducted by the British Columbia Cancer Agency (BCCA). It has also received FDA approval for its ability to help identify pre-cancerous and cancerous tissue that may not be apparent to the naked eye. FDA approval also covers the use of Veloscope to help determine appropriate surgical margins when surgery is warranted.

The Veloscope looks very much like a curing light and it emits a safe blue light that excites natural fluorescence in the oral mucosa, both in the epithelium and underlying connective tissue. By looking through the handpiece, changes within the soft tissue can be seen as actuations within the fluorescence pattern, and this exhibits itself by showing any suspicious soft tissue as dark areas, whilst healthy soft tissue will be seen as ‘apple green’. Figure 5 shows a graphic representation of how dysplastic cells in the epithelium, and the disruption or breakdown of the stratum collagen, gives rise to a decrease in fluorescence intensity compared to the surrounding tissue, when viewed with Veloscope.

Figure 4 shows the mechanism of visual reflectance, or what happens when we see things under white light with our naked eye. The type of reflection that mainly contributes to how we perceive an object is a so-called diffuse reflectance. This is where photons of light actually enter an object, get scattered or bounced around inside, and then come back out again to our eye— that is, if they don’t get absorbed first.

White light is a mixture of all wavelengths of visible light—blue, green, yellow and red. Short wavelength light like blue light, is absorbed very strongly by mucosal tissue. Not many blue photons make it back outside the tissue without getting absorbed first.

Red light on the other hand is much less strongly absorbed by mucosal tissue—a lot of red photons manage to re-emerge from the tissue and make it to our eye. This is why mucosal tissue seems to us to be predominantly red or pink in appearance. See Figure 5.

Notice that no new photons are generated in the tissue— what comes back to our eye is a subset of what illuminated the tissue in the first place.

When we illuminate the tissue with light of an appropriate wavelength such as blue light, it enters the tissue just as it does for reflectance, but now it can get absorbed by special, naturally occurring molecules in the tissue called fluorophores. These fluorophores absorb the blue excitation light and then re-emit light at a longer wavelength — that is, green, yellow or red—a fraction of a second later. Blue light excites fluorophores in both the epithelium and the stroma.

The natural fluorescence from the tissue is relatively dim—much less bright than the blue reflected light. The VELscope Handpiece allows us to see the natural fluorescence by blocking the much brighter blue light reflected back from the tissue. Also, proprietary filtering of the fluorescence light is performed to optimize the contrast between normal and abnormal tissue. See Figure 6.

Detection with fluorescence

So, why is fluorescence a useful tool in finding diseases such as dysplasia and oral cancer?

The biochemical, morphologic and environmental changes that accompany disease processes affect: Natural fluorophores in the tissue; and the Absorption & Scattering properties of the tissue. The net result is a change in the fluorescence observed (See Figure 7).

The Veloscope concept allows general dental practitioners to carry out a quick and straightforward examination of the soft tissues that can highlight any suspicious signs or symptoms that may then require further more detailed investigation, and it is not intended that the device be used in place of a visual exam and not meant to replace it (See Figures 8 to 11).

The decision to incorporate the Veloscope into our practice routine was prompted by our desire to offer the best possible patient care and to include a simple screening method that could be easily integrated with routine examination procedures (see Figure 12). The practice does not charge patients for the oral cancer screening, but incorporates its costs into our regular fee structures. We do however offer an oral cancer screening for non-registered patients with a view to encourage new patients to our practice.

Overall the Veloscope has proved to be a useful addition to our diagnostic instrumentation, and by virtue of its ability to indicate any suspect soft tissue areas, enables us as practice professionals to promote increased standards of dental care for our patients.
Dr David Bloom, a graduate of the Newcastle-upon-Tyne Dental School, has been a principle at Senova Dental Studios since 1990, focusing on comprehensive restorative and cosmetic dentistry. A full member of the British Academy of Cosmetic Dentistry, David is also President of the BACD and began his appointment in November 2007. He is a member of The British Society of Occusal Studies, The British Society of Restorative Dentistry, The British Dental Association and is a sustaining member of The American Academy of Cosmetic Dentistry (AACD). He is also a fellow of The International Academy of Dental Facial Aesthetics. David is on the editorial board of The Journal of Cosmetic Dentistry – the official journal of the American Academy of Cosmetic Dentistry, and clinical director of CO-OP.R8 seminars and instructs and lectures on all aspects of cosmetic dentistry in the UK and the US.

Dr Jay Padayachay, a graduate of the Newcastle-upon-Tyne Dental school, has been a principle at Senova Dental Studios since 1998 focusing on comprehensive restorative and cosmetic dentistry. He’s a full member of the British Academy of Cosmetic Dentistry and is on the board of directors. He is a member of The British Society for Occusal Studies, The British Society of Restorative Dentistry, The Pankey Association, The British Society of Periodontology and the American Academy of Cosmetic Dentistry of which he is a sustained member. He is also a director of CO-OP.R8 seminars and lectures in all aspects of cosmetic dentistry in the UK.

Oral cancer doesn’t care... ...we do

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Visible Leukoplakia
Loss of fluorescence visualisation
No Apparent Lesion
Loss of fluorescence visualisation confirmed through biopsy to be carcinoma in situ (cis)

VELscope®
The Mucosal Examination System