



Enhanced Oral Assessment

## Oral Surgeons and the VELscope System: Partners in Early Detection & Diagnosis

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There is a growing trend within general dentistry stressing the importance of total oral health – that is, not only health of the teeth and gums but all the soft tissues in the oral cavity and oropharynx. This has led to increasing pressure on clinical practitioners to incorporate routine intra and extra oral head and neck exams into their hygiene appointments to screen for dysplasia, oral cancer and other oral diseases.

In addition the changing face of oral cancer in particular has led us to rethink some of the traditional high-risk groups for this deadly disease. An increasing body of evidence points to a strong link between particular strains of the human papilloma virus, HPV, (most notably strain 16) and a certain type of oral cancer that occurs in the oropharynx (tonsils, base of tongue, etc...). HPV 16 is the same strain associated with almost all cervical cancer. Many experts now recommend that all adult patients over the age of 18 receive a thorough intra and extra oral head and neck exam annually.

Increased emphasis on soft tissue examination at the primary care level inevitably leads to an increased number of referrals for lesion assessment, biopsy and/or surgical management as appropriate. As specialists in particular, oral surgeons need to be sure that they have the best tools available to assist them with this responsibility.

Along with the increased awareness of the importance of oral lesion discovery, diagnosis and management has been the development of adjunctive visualization tools such as VELscope. When it was first introduced in 2006, VELscope was unique in that it used natural tissue fluorescence as an alternative way to visualize oral mucosal tissue to complement and enhance the examination under

white light. In fact, the **VELscope system** is the first adjunctive device cleared by the FDA and Health Canada to help clinicians **detect cancerous and precancerous lesions and other lesions that might not be apparent to the naked eye.** Furthermore, the VELscope is also cleared to help surgeons determine the **appropriate surgical margin** when excision is indicated. The fact is that fluorescence allows you to see mucosal changes that may be very hard to see based on conventional visualization.

The tissue fluorescence visualization science that is the foundation of VELscope's technology is backed by over **\$50 million in research** funded by the NIH and other prestigious organizations. The VELscope device is used for more oral exams than any adjunctive device in the world, with over **3 million such exams** occurring in 2009 alone. Over **4,500 GPs, oral surgeons, periodontists and other specialists** are using the VELscope system, and an impressive 92% say they would recommend it to a colleague.

A number of papers have appeared in the literature to support that VELscope is an invaluable tool to help specialists in the management of oral lesions.

The landmark paper, "Fluorescence visualization detection of field alterations in tumor margins of oral cancer patients" (Poh et al, 2006) laid the groundwork for the surgical margin claim for VELscope that was cleared by the FDA. In this paper, 20 primary cancers were assessed with a stepwise protocol that first included an assessment of the lesion under normal surgical lighting with the apparent clinical extent of the tumor was marked with a surgical pen. Then the VELscope was used to map out the area of abnormal fluo-

rescence visualization loss (FVL) around the tumor. This almost invariably larger area was similarly marked with a surgical pen. Then the lesion was excised with a clear margin where the fluorescence had returned to normal or FVR (fluorescence visualization retention). To evaluate the performance of the fluorescence technique, multiple histological tissue samples were acquired from the excised specimens: from the clinically apparent tumor, the areas around the clinically apparent tumor which appeared normal but which demonstrated an abnormal loss of fluorescence (FVL), and finally the normal margins which looked normal both under white and with through the VELscope (FVR). The results of this histological assessment were as follows:

- 122 biopsies were acquired in total – 20 from the tumors, 36 from the FVL margins and 66 from the FVR margins
- 32 out of 36 FVL biopsies showed histological changes:
  - 7 squamous cell carcinoma
  - 10 severe dysplasia
  - 15 mild/moderate dysplasia
- 65 out of 66 FVR biopsies were normal
  - 1 abnormal biopsy: mild/moderate dysplasia
- In the 10 tumors showing > 10mm FVL extension, 6 tumors showed severe dysplasia or cancer in biopsies taken > 10 mm from the clinical boundary.

In total, 19 out of 20 tumors had FVL boundaries extending beyond the clinically apparent lesion. Moreover, if a conventional 10mm clearance of the clinical tumor had been used, 50% of the tumors in this study would have had cancer or dysplasia at the clinical margin, 30% (6) showing severe dysplasia or CIS. These six tumors would have had a high chance of tumor recurrence because of inadequate tissue removal.

In 2007, a paper entitled “Direct fluorescence visualization of clinically occult high-risk oral premalignant disease using a simple hand-held device” was published in Head & Neck (Poh et al) that provided case studies with full color photographs of premalignant lesions that were essentially invisible to the naked eye but readily apparent using the VELscope. In addition to the above this work, this paper helped substantiate the indication cleared by the FDA that the VELscope can “enhance the visualization of oral mucosal abnormalities that may be

or may lead to oral cancer and that may not be apparent or visible to the naked eye.”

Exciting new research has recently appeared in the literature describing a retrospective analysis comparing patients at the British Columbia Cancer Agency who had undergone surgical excision of cancerous lesions with and without the use of fluorescence visualization guidance using the VELscope. Since it is well documented that that oral cancer recurs in a significant percentage of patients following oral cancer surgery, the key endpoint considered was the percentage of patients with high risk lesions at the treated site when examined at follow-up. The results were published recently in Cancer Prevention Research (Poh et al) and tracked 60 oral cancer patients who were treated with surgical excision only during 2004-2008. Thirty-eight patients had VELscope-guided surgery (i.e., the surgical margin was 10 mm beyond the tumor edge defined by the VELscope exam), while 22 patients—the control group—did not have VELscope-guided surgery (i.e., the surgical margin was 10 mm beyond the tumor edge defined by the standard white-light exam). All 60 patients had a follow-up time of at least 12 months. The follow-up revealed that 7 of the 22 control group patients had experienced a recurrence of severe dysplasia or more serious tumors, **while none of the patients who had VELscope-guided surgery experienced a recurrence of severe dysplasia or cancer.**

This dataset is in fact a subset taken from of a larger group of patients who were treated at the British Columbia Cancer Agency from 2004 to 2008. This group included not just patients with cancerous lesions but with all “high-risk lesions” (HRLs) including severe dysplasia and carcinoma-in-situ. An analysis of this larger group is still unpublished but was presented as an abstract/poster at the University of British Columbia Dentistry Research Day 2009 on January 29<sup>th</sup> 2009. From 2004-2008, 163 patients at the British Columbia Cancer Agency with high-risk lesions (HRLs) had surgical excision with minimum 6-month follow-up:

1. 87 under FV guidance (FV Group)
2. 76 conventional surgery (Control Group)

The results were just as striking as the ones described above with only 2% of the FV Group presenting with severe dysplasia or worse compared to 41% for the control group.

## What Does All This Mean for Oral Surgeons & Other Specialists

The VELscope system can assist you in a number of areas:

1. Common ground for discussions with referring GP who has used VELscope in their practice as a discovery tool.
2. Biopsy site guidance
3. Better appreciation of the full scope of mucosal involvement of particular lesions
4. Use of abnormal fluorescence patterns and loss of fluorescence as an aid to lesion risk assessment.
5. A supplementary discovery tool helping you find difficult to detect or clinically occult satellite lesions whether they be dysplastic or outright cancer.
6. Determination of appropriate surgical margins around lesions to help ensure that all diseased tissue is removed.
7. Some illustrative examples of these uses should help to provide a sense of the power of VELscope's fluorescence visualization technology as a tool to help the specialist in the management of oral lesions.

### 1. Common Ground with Referring GP Who Has Used VELscope

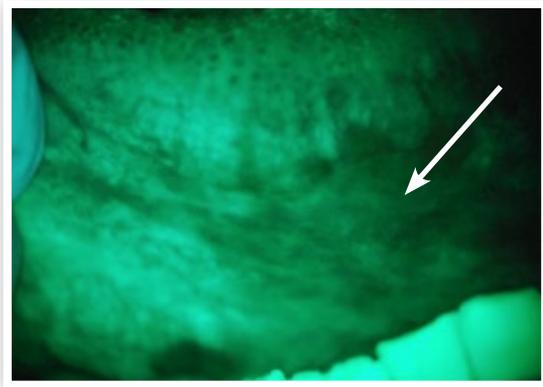
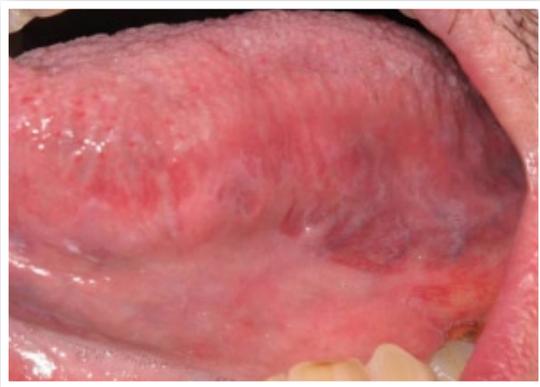


Figure 1. Dysplastic lesion demonstrating visual enhancement with VELscope compared to white light alone.

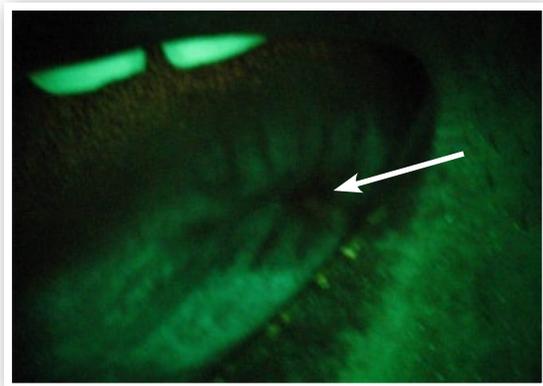


Figure 2. Another dysplastic lesion demonstrating visual enhancement with VELscope.

Figure 1 and Figure 2 are examples of dysplastic lesions whose visual appearance is markedly enhanced with the use of the VELscope system compared to white light alone. Upon referral from a GP using VELscope to a specialist in such cases, it is highly advantageous for the specialist to have a VELscope system available so as to properly understand the reason for the referral and the particular areas that might have been of concern for the GP.

## 2. Biopsy Site Guidance

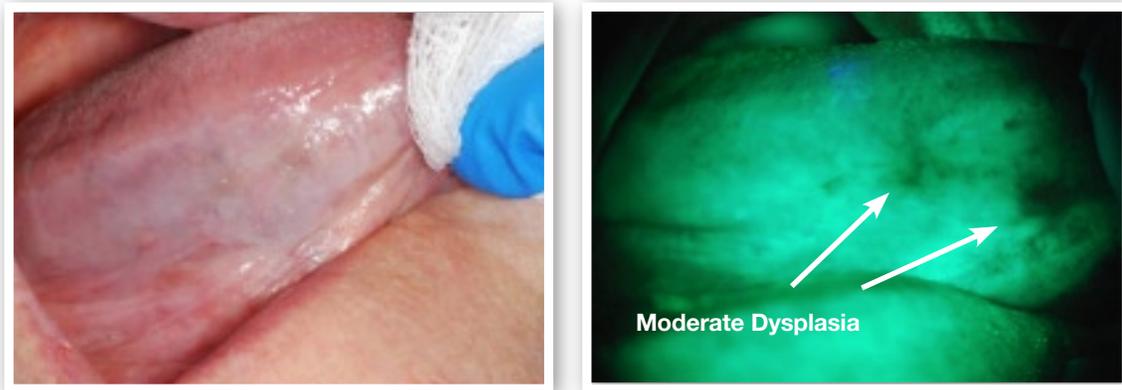


Figure 3. Broad area of leukoplakia under white light – fluorescence suggests particular areas of concern.

Figure 3 suggests the usefulness of fluorescence visualization in to help in identifying appropriate sites for biopsy. In this case, what presents as a broad area of leukoplakia under white light, shows two distinct dark areas under fluorescence using VELscope. Both of these areas were found to contain moderate dysplasia upon biopsy.

## 3. Full Scope of Mucosal Involvement

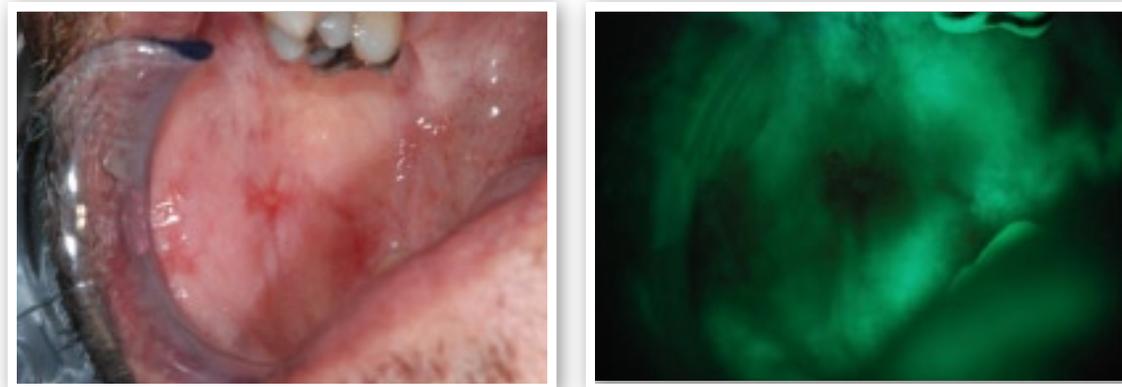


Figure 4. Erosive Lichen Planus under white light and through the VELscope.

Figure 4 is an example of erosive lichen planus demonstrating the ability of fluorescence visualization using VELscope to provide an enhanced appreciation for the full extent of mucosal involvement of a particular lesion or lesions. While useful for relatively common conditions such as lichen planus it can be critical for precancerous and cancerous lesions. Such an example is provided next in Figure 5.

## 4. Lesion Risk Assessment



Figure 5. VELscope can help raise suspicion about seemingly innocuous lesions.

Figure 5 is a lesion that when initially assessed without the use of VELscope was thought likely to be the result of trauma. However, the presentation under VELscope does not fit this picture. Not only is the white, non-inflamed-looking area under white light dark through the VELscope but there is an

## 5. Satellite Lesions

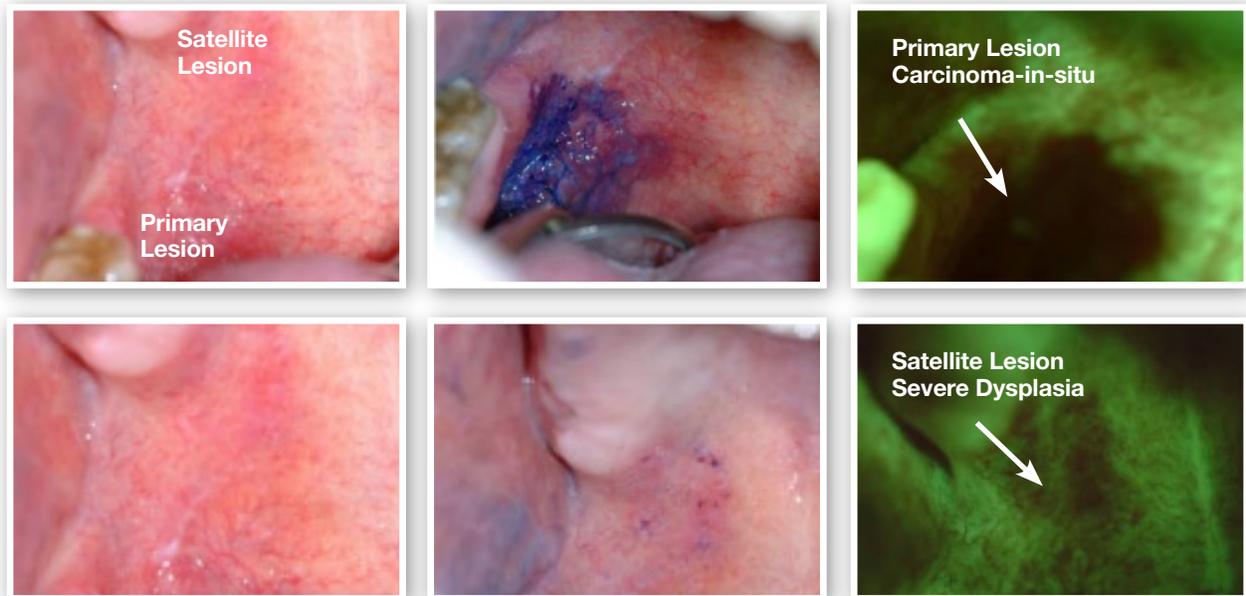


Figure 6. A satellite lesion found to be severe dysplasia whose discovery was facilitated through the use of VELscope.

Figure 6 is a classic example, not only of a clinically occult lesion, carcinoma-in-situ, that presents with a dramatic loss of fluorescence through the VELscope, but also of how the VELscope can facilitate discovery of satellite lesions that might easily be overlooked. In this case, there is lesion containing severe dysplasia quite close to but distinct from the primary lesion. Note that for the primary lesion, the Toluidine blue positive area is distinctly smaller than the area demonstrating loss of fluorescence. For the satellite lesion, very little Toluidine blue stain is retained despite the distinct loss of fluorescence and presence of severe dysplasia.

## 6. Surgical Margins

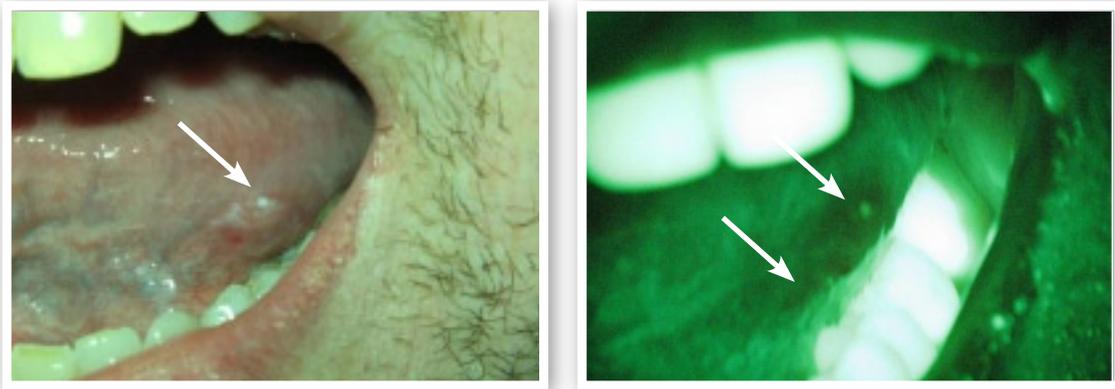


Figure 7. Dysplastic lesion showing a loss of fluorescence suggesting a larger area for surgical excision.

Figure 7 shows an example of a dysplastic lesion which based on its suspicious appearance under white light alone was appropriately referred for biopsy. The loss of fluorescence through VELscope confirms the suspicious nature of the lesion but also shows a distinct abnormal lack of fluorescence away from, and anterior to, the clinically obvious lesion. Cytology and biopsy confirmed the presence of dysplasia in this area as well. The extension of mucosal change anterior to the clinically obvious area under white light suggests an area for surgical excision larger than what otherwise might have been considered. In particular, note the asymmetrical pattern of loss of fluorescence around the area obvious area under white light. This is a characteristic that was noted in the surgical margin research papers discussed above.

We encourage you to explore the information provided on the VELscope website to learn more about how the VELscope system can support your efforts.

Your expertise and the VELscope's technology can  
form a powerful combination that will truly make  
earlier detection and diagnosis of oral disease a reality.



*Enhanced Oral Assessment*