COMMENTARY

Oral Cancer Screening: New Analytic Technique for Autofluorescence Interpretation

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Oral Cancer Screening Techniques

Oral cancer screening techniques have expanded beyond the conventional physical examination over the last several decades. The conventional oral cancer screening, with head and neck examination, encompasses multiple checkpoints extra- and intraorally[1] and is the first step in physically screening patients for oral pathology, including oral cancer. Scalpel biopsy is the definitive procedure to establish the diagnosis and the only way to histologically rule out dysplasia and neoplasia.[2] Oral cavity cancers are also amenable to direct visualization and palpation under incandescent white light.

After an oral cancer screening examination has been performed, adjunctive screening devices may be used to help clinicians clarify and further characterize clinical findings. One such technique is referred to as tissue fluorescence or autofluorescence.

VELscope® (visually enhanced lesion scope), from LED Medical Diagnostics, White Rock, British Columbia, Canada, is one brand-name device that provides soft tissue autofluorescence using a bright blue light with a wavelength between 400 nm and 460 nm. Areas of normal oral mucosa visually appear green ("increased intensity") when the VELscope® light is directed onto the mucosa. The increase in green color intensity is due to the excitation of cellular elements known as fluorophores.

When there is a change in the normal soft tissue architecture (due to a lesion, ulcer, thickening, etc), the excitation of fluorophores is decreased, resulting in a tissue appearance that is dark ("decreased intensity"). Clinicians who have experience using tissue autofluorescence are familiar with the change from a green to a dark appearance, referred to as "loss of fluorescence." However, clinicians new to this adjunctive technique are more likely prone to human bias and error with interpretation during the early usage/adoption of this screening device.

Improving Discrimination in Oral Cancer Screening

In this recently published study, the authors[3] developed a quantitative and quadratic discriminant analysis method for clinical VELscope autofluorescence images. The goal was to eliminate human bias/error and provide an analytic technique that helps to discriminate between oral cancer/precancerous lesions and normal oral mucosa.

The normal oral mucosa (n=39), precancer (n=54), and oral cancer (n=47) groups rinsed with normal saline for 2 minutes, three separate times, and then had a digital photo white light image taken of the lesion or normal mucosa. Next, a VELscope autofluorescence digital photo image of the lesion (or normal mucosa) was taken. The principal investigator (who was also the patients' attending physician) then chose a "region of interest" (ROI) on each of the photo images.

The authors analyzed the selected ROIs for average intensity and image heterogeneity and used a simplified version of a pattern recognition analysis that is frequently used in medical pathologic imaging —called "quadratic discriminant analysis." The oral cancer and precancer lesion patients all had incisional biopsy after the autofluorescence images were captured.

Using the authors' novel data analysis algorithm, the sensitivity and specificity of differentiating oral cancer lesions from normal mucosa were 0.923 and 0.979, respectively. The sensitivity and specificity of differentiating oral cancer and precancerous lesions from normal mucosa were 0.923 and 0.970, respectively. The authors suggested that without a quantitative analysis of autofluorescence intensity and heterogeneity, the accuracy of clinical interpretation of autofluorescence relies heavily on a provider's previous experience with the tool.

On the basis of other clinical findings in this study, the authors also noted that clinical interpretation of autofluorescence from precancerous lesions and normal attached gingiva can have more variation in the amount of visually apparent color intensity and heterogeneity.

Viewpoint

Much discussion and, at times, controversy arise among colleagues related to the use of adjunctive oral lesion screening devices. A crucial point to keep in mind when considering the use of adjunctive screening devices is that a thorough medical/dental history and conventional oral cancer screening examination[1] should be performed *before* using any adjunctive device(s).

Additionally, providers must keep in mind that scalpel biopsy is the only way to confirm the presence or lack of dysplasia and/or neoplasia.[2] There are other limitations of scalpel biopsy, not the least of which includes sampling error, which providers must keep in mind when making clinical decisions regarding oral lesions found during oral cancer screening examinations.

As the adjunctive use of autofluorescence increases in conjunction with oral cancer/lesion screening, a novel analytic method, as demonstrated in this study, could be helpful to early adopters who have little experience in interpreting normal and pathologic oral mucosal autofluorescence intensity and heterogeneity.

The new analytic method could perhaps be applied in some other way (as a software application) so as to standardize autofluorescence image interpretation among providers and those performing research on such technologies. More detailed research over a longer period of time is needed to help replicate this group's algorithm and to provide feedback regarding the analytic method's clinical utility in helping to screen for oral cancer, precancer, and lesions.

References

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