Early Detection of Oral, Head, and Neck Cancers

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482 Oral Diseases: Prevention & Management
**Background**

Oral cancer is a disfiguring disease that is ranked sixth in the most common malignancies affecting people worldwide. More than 30,000 Americans are diagnosed with various oral cancers annually. These cancers occur in various locations of the oral cavity, which include: lips, tongue, floor of the mouth, tonsils, soft palate, salivary glands, and back of the throat. The tongue and floor of the mouth are the most common sites.

Oral health care professionals need to be well educated on the topic of oral, head, and neck cancers in order for early detection to occur, which in turn will increase the survival rate of these patients. Out of numerous major cancer locations throughout the body, oral cancer has a mean survival rate of five years, which is much lower than other cancers. Oral cancer can be detectable in its early stages with proper screening, which therefore can be preventable. This screening process is immensely vital in order to diagnose oral cancer early, even on patients who appear to be healthy or have no associated risk factors. Early detection will allow oral cancer to be 90% curable and much more cost effective for treatment.

Decreasing the morbidity and mortality rate of these cancers and prolonging the lives of the patients with this disease can be achieved. This involves being knowledgeable in oral cancer’s etiology, importance of early detection, significance of continual education for the clinician as well as the patient, and being aware of methods that are available for early detection. Competent, well educated oral health care providers are needed to provide proper oral cancer screening examinations, escalating the chances for early oral, head, and neck cancer detection.

**Etiology**

Knowing the etiology of how these cancers develop is important for early detection and diagnosis. Evidence has been conclusive that an accumulation of genetic and epigenetic alterations of a normal cell progresses to a cancer cell, which is referred to as a multistep carcinogenesis. Various
abnormal lesions, which include those difficult to identify in the upper respiratory and digestive tracts, along with lesions that are clearly visible to the naked eye, become carcinomas 2-3% of the time. Visual examination may identify erythroplakia, leukoplakia, and erythroleukoplakia, which are known to have the possibility of being precancerous. Oral cancer, however, is thought to have evolved from alterations in molecular pathways that accumulate and then become complex. This complexity is characterized by histologic and genetic heterogeneity. Therefore, oral cancer often gets overlooked in its most early and curable stages because clinical signs are not shown. The latter stages (stages III or IV), which may present ulceration, induration, tumor development and bleeding, can spread to the lymph nodes or other areas of the body, resulting in a 50% five-year survival rate. Consequently, identifying oral cancer with conventional oral exam’s (COE) is vital.

**Patient Assessment**

How many lives could be saved if clinicians utilized both the clinical and technological screenings? The earlier these cancers are detected with proper screenings, the greater chance of recovery, function, and quality of life for our patients. Screening involves checking for the presence of disease in a person who is symptom-free. Since many cases of early oral cancer do not present with apparent signs and symptoms, they aren’t diagnosed until stages III or even IV. This screening process is extremely important in order to diagnose early, even on those who present healthy or with no associated risk factors. With early detection, oral cancer is 90% curable and less expensive to treat.

Healthy People 2000 contains thirteen objectives that relate to oral cancer prevention, detection, and control. This national health promotion and disease prevention information states how early detection is possible because often oral cancers are in an accessible areas for oral health care providers. Cancers in accessible areas are usually well defined and the patient usually does have some signs or symptoms (such as pain and infection) of an abnormality. Also, careful examinations done by the oral health care provider has shown evidence that persons with early-stage oral cancer have a better
prognosis than those diagnosed with a more advanced disease.\textsuperscript{11} If performing careful, thorough oral, head, and neck cancer screening examinations, oral health care providers can assist Healthy People 2000 in achieving their goal of reducing health disparities among Americans.

With advancing clinical and technological screening methods, health care professionals should significantly eliminate or decrease oral cancer occurrences. Clinical screenings and the utilization of new technologies help detect oral cancer early. Clinicians should thoroughly examine the patient’s health history and ask proper questions. This allows the clinician to recognize risk factors, both non-modifiable genetic and modifiable lifestyle, that the patient has associated with oral cancer and educate the patient accordingly. By making the patient aware, they can adjust modifiable risk factors, such as smoking and alcohol intake, which highly increase their susceptibility to developing oral cancer.

**Intervention & Management**

Without any extra diagnostic aids or office expenditures, any clinician can perform a standard oral, head, and neck exam with specialized education in proper screening methods and knowledge of what to look for. At each maintenance visit, dental hygienists should perform a COE, as it is both effective at detecting suspicious lesions and a standard of the dental hygiene profession. A COE using normal (incandescent) light has been highly successful in detecting cancer in some anatomical locations.\textsuperscript{3} While COEs have traditionally been the norm for oral cancer screenings, its efficacy remains controversial, especially since many early stages of oral cancer show few signs and symptoms.\textsuperscript{3} Even with the implementation of COEs, many continue to be diagnosed in the later stages of oral cancer. New detection methods, to be used by trained oral health care providers, are being researched to assist in the early detection of oral cancer with diagnostic aids that should be used in conjunction with COEs.

One such diagnostic aid clinicians may use to help detect oral cancer earlier, to be used in conjunction with COEs, is tolonium chloride, more commonly known as toluidine blue or TB. For over 40 years, this metachromatic dye (with application either by cotton swab or used as a rinse) has been used
to detect mucosal abnormalities by preferentially binding to tissues undergoing rapid cell division, such as sites associated with oral pre-malignant and malignant lesions (OPML). Specifically, in the oral cavity TB has been shown to identify cells with genetic changes, such as allelic loss or loss of heterozygosity, which are associated with progression of OPMLs to cancer. Overall, this adjunct has been researched to show a sensitivity (which measures the proportion of those with the disease who test positive) ranging from 38 to 98%, with a median of 85%, and a specificity (which measures the proportion of those without the disease who test negative) ranging from 9 to 92.9%, with a median of 67%. To be considered reputable, diagnostic aids aim at having both high sensitivity and high specificity, this in turn reduces the number of false negatives and false positives. While the efficacy of this technique has varied greatly, TB has assisted in detecting oral cancer. A positive aspect in using TB in early oral cancer detection has shown its application has been associated with a decrease in the number of false positive diagnoses. One study specifically shows a 52.6% reduction in the number of false positive cases.

Another diagnostic aid that can be used to help detect oral cancer earlier is the ViziLite system, a chemiluminescent diagnostic aid. Currently, the ViziLite system is only used in conjunction with TB (ViziLite Plus with TBlue system) and should also be used in conjunction with COEs. The ViziLite Plus works after application, or rinse, of acetic acid comes in contact with the mucosal tissues which causes a change in light reflectance, therefore, allowing clinicians to identify areas of oral cancer easier. While normal cells absorb the blue light, those with a higher nucleus:cytoplasm ratios, keratinized epithelium, or tissues with inflammatory infiltrate will reflect the light and appear “acetowhite” with brighter, marked borders. Patton et al assessed the efficacy of ViziLite Plus on those already diagnosed with oral cancer. Because the sample population used in the studies were confirmed cancer cases the sensitivity of ViziLite Plus was 100%. However, the specificity of its use ranged from zero to 14.2%.
Since ViziLite cannot accurately distinguish between malignant, benign, and inflammatory lesions, the drawback of its use results from a high rate of false negative lesion detections.\(^9\)

The VELscope (Visually Enhanced Lesion) system, another chemiluminescent diagnostic aid, is used to detect high-risk oral lesions by examining fluorophore alterations.\(^9,10\) The oral cavity’s tissue fluorescence varies from structural changes, such as metabolic activity, presence of hemoglobin in the tissue, vessel dilation, and possibly inflammation, all of which will decrease the tissue’s fluorescent visualization.\(^10\) Patton et al looked at the efficacy of VELscope in several studies, which also only utilized participants that had confirmed high-grade dysplastic lesions and squamous cell carcinomas (SCC); these studies showed a sensitivity ranging from 98 to 100% and specificity from 78 to 100%.\(^10\) VELscope has reportedly been better able to determine lesion margins more accurately than visual examination.\(^10\) Because VELscope does not detect all cases of dysplasia and has a hard time differing inflammatory lesions from benign lesions, its use should be complimentary to COEs.\(^9\)

Two additional chemiluminescence diagnostic aids which have not been highly researched include the Micrlux DL system and the Orascoptic DK system. The Micrlux DL system is a blue-white light-emitting diode (LED) and a fiber optic light-guide.\(^10\) The Orascoptic DK system uses an acetic rinse, to help enhance the visualization of cellular changes, an LED instrument and an oral lesion screening instrument.\(^10\) While both are geared towards increasing the clinician’s ability to visualize abnormal lesions, research regarding how effective these two aids are at doing so has not been done in great depths. Clinicians who decide to use either of these aids should be skeptical and, as important with all diagnostic aids, continue to perform COEs at all patient maintenance visits.

Another technique used to assist in oral cancer diagnosis is cytopathology. Cell collections via lavage, smear, scraping, or fine-needle aspiration, are microscopically examined to determine if there have been cellular changes.\(^10\) The OralCDx Brush is an example of cytology adjunct, collecting transepithelial cells which are fixed onto glass slides and sent off to a laboratory to be stained, scanned,
and analyzed. A cytopathologist examines the results and either determines whether the cells are “negative,” indicating it is benign, “positive,” indicating a carcinoma, or “atypical,” indicating an unsure diagnosis of abnormal epithelial changes. Both “positive” and “atypical” OralCDx Brush biopsy results should be evaluated by scalpel biopsy in order to confirm the diagnosis, as scalpel biopsy is currently the only method of confirming oral cancer diagnoses. Sensitivities of the OralCDx Brush biopsy method have ranged from 71.4 to 100% and specificities have ranged from 27 to 100%. One problem that has been associated with the use of OralCDx as a diagnostic aid is the number of false negatives it provides.

Recently, Rice University has been awarded grant money from NIH to develop a new tool to aid in the early detection of oral cancer. A microchip, the size of a postage stamp, has been designed to be mounted onto disposable, plastic cards which are slotted into an analyzer. Brush biopsies are placed on this card and with the use of LEDs, healthy and diseased cells can be distinguished through different light variations. This cutting edge intervention method would provide an easy, time and cost-efficient way of recognizing and diagnosing oral cancer early, overall improving and possibly saving the patient’s life. This new aid hopes to establish a technique that is able to consistently and accurately detect abnormal oral lesions, as this is something that all current diagnostic aids fall short of.

While these diagnostic aids and intervention methods have been developed, scalpel biopsy with histopathology examination remains the gold standard. Each of the diagnostic aids mentioned above should be used in conjunction with a COE and should not be relied upon independently. If the diagnostic aids, in conjunction with a COE, determine there is an abnormal lesion, the patient should have a scalpel biopsy as this is the only way to confirm the lesion is in fact cancer. With further research, the efficacy of these adjuncts will allow for a clearer understanding of their assistance in early oral cancer detection. Future diagnostic aids, such as the microchip at Rice University, should focus on being able to provide consistent and accurate readings.
Prevention

As with other health conditions and developments, oral, head and neck cancers and several factors (both non-modifiable genetic factors and modifiable lifestyle factors) have been positively related to their development. An example of a modifiable risk factor comes from Horowitz who states smokers have a 2-18 times increased risk of developing cancer in comparison to non-smokers, and tobacco and alcohol use accounts for 75% of all oral and pharyngeal cancers. An example of a non-modifiable risk factor associated with the development of oral, head and neck cancers is a person’s age. In the United States, more than 90% of oral and pharyngeal cancers occur in individuals over the age of forty-five.

Although early detection and lifestyle changes are important to help treat oral cancer, not everyone has the access to do so or the education to know the risks. Health care utilization is low in certain populations, such as those over the age of 65, lower socioeconomic (SES) citizens, those with less than a high school education, those who lack private insurance, and minorities. Without routine screenings, early diagnosis of oral cancer in these populations is made more difficult, and unfortunately some of these populations are at an increased risk for the development of oral cancer. Those with a low SES are more likely to engage in high-risk behaviors, like smoking and drinking; older edentulous individuals also have an increased risk of oral cancer development. One way to reduce the high risk among these populations is to increase their awareness of oral cancer prevalence and destruction, as well as promote collaboration among oral health care providers and high risk communities allowing COE’s to be performed outside of dentist offices.

In order to decrease the alarming morbidity and mortality rates of those diagnosed with oral cancer, action must be taken. With new clinical adjuncts being developed to help diagnose patients at earlier stages, it is important to remember these diagnostic aids should be used in conjunction with COEs as further research is needed to determine the extent of their efficacy. Along with visual exams
and palpation of tissues, dental hygienists must also use education as a tool to increase earlier diagnosis. By educating patients of the risk factors that have been associated with the development of oral, head and neck cancers, patients will be more aware and able to adjust their habits if necessary. Providing patients with education on at-home oral cancer screenings that they could perform themselves can also help the patients become more aware and involved in sustaining overall health by identifying questionable areas in the oral cavity that seem suspicious, and overall, potentially saving their lives.
References


