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DIAGONISTICS ADJUNTCS IN ORAL MEDICINE AND RADIOLOGY

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ABSTRACT
Oral medicine is an area of dentistry which is constantly changing. Over the past several years Oral medicine has expanded in both scope and complexity. Oral medicine involves the diagnosis and management of complex diagnostic and medical disorders affecting the mouth and jaws. Current decade has witnessed enormous advances in the diagnostic oral medicine, which have moved from the laboratory to the dental clinics and hospitals. It is important that these advances do not remain as domain of the specialists in this field. Every general dental practitioner should be aware of recent advances in diagnostic oral medicine in order to provide a high level of care. This paper discusses the recent technological advances in the field of oral medicine that have made an impact on clinical dental practice.

KEYWORDS: Chemiluminescence, diagnostic AIDS, oral CDX, oral diagnosis, oral medicine, spectroscopy, recent advances, vital staining.

INTRODUCTION
Oral medicine with respect to diagnostic decision making has seen remarkable advances over the years. Technical advances from biochemistry, immunology, histopathology, molecular biology, and optical physics have moved from laboratories into dental clinics and have combined together to radically change the way diagnosis is arrived at or confirmed. Advances have come about both through a greater degree of research activity in this field, and as a result of the application of recent technical developments which have permitted the investigation of questions which could not previously be approached. Radiology has participated in the recent trend toward computerized management in health service and has responded to the demand for cost-efficient and rapid communication between department of radiology and other dental specialties. But, with these recent technical innovations, the art of diagnosis has become much more of a science and the attitude of clinician has changed from clinicocentric to technocentic.

Advances in diagnostic oral medicine are aimed at reducing the morbidity and mortality associated with oral diseases. For example, despite numerous advances in treatment, the 5-year survival rate of patients with squamous cell carcinoma of head and neck has remained approximately 50% for the last 50 years.[1] Based on the increasing incidence of head and neck cancers, problems associated with late diagnosis, and the public health dilemma they represent, it seems prudent to enact screening protocols to check at-risk people. Early diagnosis would allow for conservative therapeutic approaches with a brief recovery and a more favorable prognosis. This basic concept should be applied to all diseases affecting the oral cavity. Diagnosis should not be done at the first sign or symptom of a problem but on very routine and very frequent basis. Patients, at such screening visits, who show any indication of developing pathology should be more intensively examined and treated.

Changes are inevitable, even in the science foundational to the clinical practice of dentistry. Increased diversity and sophistication are developing in the areas of molecular biology, basic science, and social sciences. These will transform our traditional approaches to oral and dental disease management. In this paper, we shall see the recent technological advances in the field of oral medicine that may make an impact on clinical dental practice.

Advances in Early Detection of Cancer
Chemiluminescent Illumination
The term "chemiluminescence" refers to the emission of light from a chemical reaction.[8] In this system, a nontoxic blue-white chemiluminescent light is shone into mouth and tissue reflectance is observed. Under this light, dysplastic tissues with enlarged nuclei, highlighted by dehydration with acetic acid, appear "aceto white."[9] The Vizilite chemiluminiscent light stick comprises an outer flexible plastic capsule containing aspirin or acetyl salicylic acid and an inner fragile glass vial containing

hydrogen peroxide. The activation of the capsule is achieved by flexing it, wherein, the inner fragile glass vial ruptures releasing the hydrogen peroxide. The chemicals react to produce light of blue-white color (430-580 nm) which lasts for 10 min.[8] Another device that works on the principle of chemiluminescence is the Microlux DL unit, which offers a reusable battery-powered light source.[1] The accuracy of the technique to detect oral cancer and potentially malignant epithelial lesions is 80.6% as compared to 64.5% of toluidine blue.[8]

Photodiagnosis

Optical spectroscopy provides tissue diagnosis in real time, noninvasively and *in situ*. This relies on the fact that the optical spectrum derived from any tissue will contain information about the histological and biochemical makeup of that tissue. Photodiagnosis is used for the detection of dysplasia and malignancy, in performing guided biopsies, monitoring of hemoglobin tissue perforation in free flap and therapeutic drug levels during chemotherapy and photodynamic therapy, assessment of the surgical margins, and plays a role in sentinel node biopsy.[11] Three main techniques currently utilized in the detection of oral dysplasia and malignancies are

- Flourescence spectroscopy: Flourescence, which can be autofluorescence or a laser-induced phenomenon, occurs due to the presence of flourophores like NADPH, collagen, elastin, and cofactors. A significant increase in red/green fluorescence is an accurate predictor of dysplasia and malignancy.[11] VELscope is a portable device based on narrow-emission tissue fluorescence which provides light in the range of 400- 460 nm. Under the intense blue light, normal mucosa emits a pale green autoflourescence while the suspicious tissue appears dark.[1]
- Elastic scattering spectroscopy (ESS): It generates a wavelength-dependent spectrum that reflects both scattering and absorptive properties of the tissue. ESS is sensitive for nuclear size, chromatin content, nuclear-cytoplasmic ratio, and cellular crowding, which are all criteria for establishing malignancy.[11]
- Raman spectroscopy: It is a form of elastic scattering and is generated by a shift in the frequency of the incident excitation light. It is most accurate technique but signals are weak.[11]
- Trimodal spectroscopy: It is a combination of all the above-mentioned three to increase the accuracy of the technique.[11]

Two photosensitizers which are known to have a high specificity and sensitivity for tumor diagnosis are mTHPC (Foscan) and δ-amino levulinic acid (levulan). An increased uptake of these photosensitizers is due to the limited ability of the malignant tissue to metabolize iron, thus resulting in increased intracellular protoporphyrin IX.[12]

Advanced Measures to Detect Incipient Dental Caries

In the research arena, recording carious lesions only at the cavitation level is no longer acceptable. The ideal caries detection method should capture the whole continuum of the caries process, from the earliest stages through the cavitation stage. The real challenge is to detect the lesional activity at a threshold that leads to an appropriate early intervention with prevention and not just treatment.

Of all the technologically advanced measures to detect caries, fluorescence and transillumination have the most potential. Two methods based on the fluorescence of the organic components of teeth are quantitative laser or light florescence (QLF) which uses an arc lamp with a 290- to 450-nm wavelength, and DIAGNOdent which uses infrared light of 655-nm wavelength. A new approach in this field is a fluorescence spectrophotometer, which uses several wavelengths. Also, recent developments in the DIAGNOdent technique have led to the introduction of a hand-held laser caries detection aid, DIAGNOdent pen. It uses a probe with a wedge-shaped, solid, single sapphire fiber tip that is designed specifically to fit the interproximal space between posterior teeth.[13]

Methods based on transillumination are FOTI (fiber optic transillumination) and direct imaging fiber optic transillumination (DIFOTI). FOTI allows for the detection of a carious lesion because of the changes in the scattering and absorption of high-intensity light photons resulting from a local decrease in transillumination owing to the characteristics of the carious lesion. Enamel lesions appear as gray shadows, and dentinal lesions appear as orange-brown or bluish shadows. DIFOTI is a more recent development combining FOTI with a charge-coupled device digital intraoral camera.[13]

Advanced Clinical Diagnosis of Periodontal Disease

Over the years, different periodontal probe prototypes, such as the Florida probe system have been developed to overcome limitations of conventional probes. The latest of them being Florida PASHA probes.[14] Also, ultrasonic periodontal probes have been developed based on a noninvasive ultrasonic technique to detect, image, and map the upper boundary of the periodontal ligament and its variation over time as an indicator of periodontal disease.[15]

Recently, radionuclides, like technetium 99m-tin-diphosphonate, have been tried as an indicator of active alveolar bone loss in the diagnosis of a periodontal disease activity.[16]

Conventional clinical and radiographical methods of periodontal diagnosis are only capable of retrospective diagnosis of attachment and bone loss; these are unable to either detect or predict the periodontal disease activity.

Therefore, potential biomarkers of the periodontal disease activity are being assessed, such as

- Subgingivalbacteria and their products
- Inflammatory and immune products
- Enzymes released from inflammatory cells and dead cells
- Connective tissue degradation products.[17]

Also, host inflammatory products synthesized by the periodontium appear within the gingival crevicular fluid (GCF) and thereby offer a rich potential for the use of GCF to obtain diagnostic information regarding periodontal health or disease status.[16]

Thus, in periodontal diagnostics, it is anticipated that these new tools will enable subclinical disease to be detected or perhaps even future disease activity to be predicted.

Sialoendoscopy

Sialoendoscopy is a promising new method for use in the diagnosis, treatment, and postoperative management of sialolithiasis, sialadenitis, and other obstructive salivary gland diseases. It permits the surgeon to observe and diagnose intraductal and sometimes intraglandular pathologies, through insertions of a 1-mm-diameter endoscope (mostly semirigid type) through the dilated duct of any major salivary gland. It is an outpatient procedure, using local anesthetic, and does not have major complications.[19] With the use of specially designed mini forceps, graspers, baskets, and balloon catheters, it is possible to remove calculi located in deeper portions. It has unfolded the microanatomy of the inner portion of the duct, revealing strictures, the opening of the sublingual gland, and secondary channels.[20]

Nanodiagnostics

Nanodiagnostics, defined as the use of nanotechnology for clinical diagnostic purposes, was developed to meet the demands of clinical diagnostics for increased sensitivity and earlier detection of disease. The use of nanotechnologies for diagnostic applications shows great promise to meet the rigorous demands of the clinical laboratory for sensitivity and cost-effectiveness. New nanodiagnostic tools include quantum dots (QDs), gold nanoparticles, and cantilevers. QDs, which are the most promising nanostructures for diagnostic applications, are semiconductor nanocrystals characterized by high photostability, single-wavelength excitation, and size-tunable emission. QDs and magnetic nanoparticles can be used for barcoding of specific analytes. Gold and magnetic nanoparticles are key components of the bio-barcode assay, which has been proposed as a future alternative to polymerase chain reaction (PCR). The potential diagnostic uses of QDs are numerous, with the most promising applications being in the areas of tumor detection, tissue imaging, intracellular imaging, immunohistochemistry, infectious agent detection, multiplexed diagnostics, and fluoroimmunoassays. Nanodiagnostics promise increased sensitivity, multiplexing capabilities, and reduced cost for many diagnostic applications as well as intracellular imaging.[21]

CONCLUSION

We are in the era of information overload. The fields of medicine and oral medicine are changing and we have come a long way. There is still much to be done as far as patient management and accuracy of diagnostic methods is concerned, which will enable the society as a whole to be more productive and healthier.

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