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Modern Advances in Oral Diagnostic Medicine

Dr. Puneet Kumar[1], Dr. Chandni Batra[2*]

[1]Professor, Department of Public Health Dentistry, Santosh Dental College & Hospital, Santosh Deemed to be University, Ghaziabad.
[2*]Reader, Department of Oral Medicine, Diagnosis & Radiology, Santosh Dental College & Hospital, Santosh Deemed to be University, Ghaziabad.

Corresponding Author: [2*]Dr. Chandni Batra

ABSTRACT
Dentistry's field of oral medicine is undergoing ongoing change. Oral medicine has grown in both scope and complexity over the last few years. Oral medicine deals with the diagnosis and treatment of complicated medical and diagnostic conditions that affect the mouth and jaws. The diagnostic field of oral medicine has made significant strides in the last ten years, moving from the lab to dentist offices and hospitals. It's crucial that these developments don't just benefit the industry's experts. To deliver a high level of treatment, every general dentist should be knowledgeable about contemporary developments in diagnostic oral medicine. This essay explores how recent developments in oral medical technology have affected clinical dental practise.

Keywords: Spectroscopy, oral CDX, oral diagnosis, oral medication, vital staining, chemiluminescence, diagnostic AIDS, and current developments.

1. INTRODUCTION

In terms of diagnostic decision-making, oral medicine has come a long way in recent years. Technological developments from the fields of biochemistry, immunology, histology, molecular biology, and optical physics have made their way from labs into dentistry clinics and have combined to fundamentally alter the process of making a diagnosis or confirming one. Increased study interest in this area and the application of recent technology improvements that allowed the investigation of previously unanswerable topics have both contributed to advancements in the discipline. In response to the need for quick and affordable communication between the department of radiology and other dental specialties, radiology has joined the recent trend toward computerised management in health services. The art of diagnosis has, however, become much more of a science as a result of recent technological advancements, and physician attitudes have shifted from clinicocentric to technocentric.The goal of improvements in diagnostic oral medicine is to lower the morbidity and death linked to oral illnesses. For instance, the 5-year survival rate for patients with head and neck squamous cell carcinoma has stayed around 50% for the past 50 years, despite major advancements in treatment.[1] Implementing screening techniques to monitor at-risk individuals seems sensible given the rising frequency of head and neck malignancies, issues with late diagnosis, and the public health conundrum they provide. Early diagnosis would enable conservative therapy modalities with a speedier recovery and a better outlook. All conditions that impact the oral cavity should be treated using this fundamental idea.

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Diagnoses should be made on a very regular and frequent basis rather than at the first indication of a problem. Patients who exhibit any signs of developing pathology during such screening visits should have more thorough examinations and treatment. Even in the science that underpins the practical practise of dentistry, changes are unavoidable. The fields of molecular biology, basic science, and social sciences are becoming more diverse and sophisticated. These will alter the way we now handle oral and dental diseases. This essay will examine recent developments in oral medicine technology that could have an effect on clinical dental practise.

ADVANCES IN EARLY CANCER DETECTION

Even by highly experienced specialists, precancers and early stage oral malignancies may be easily overlooked and neglected and may not be sufficiently detected by visual inspection alone. [2] Tolonium chloride or toluidine blue dye, Lugol's iodine, oral brush biopsy kits, photodiagnosis, and chemiluminescence are examples of clinical diagnostics available for the early detection of oral cancer. The part that follows will go over these systems.

A crucial stain

As a method of surveillance in patients who are at risk of developing oral cancer and for those who have had a confirmed tumour in other areas of the aerodigestive tract, vital staining of the oral epithelium has been proposed. Colposcopy has been used frequently in gynaecology to detect malignant changes of the cervix using in vivo vital staining. [3] Toluidine blue staining is regarded as a sensitive supplementary method for detecting high-grade dysplasia and early oral squamous cell cancer (OSCC). [4] Toluidine blue is an acidophilic, metachromatic dye of the thaizine family that specifically stains DNA and RNA, two acidic cellular components. [5] Its application in vivo is predicated on the quantitatively higher nucleic acid content of dysplastic and anaplastic cells compared to normal cells.
Squamous cell cancer and inflammatory traumatised tissue are the two types of lesions that toluidine blue stains the most frequently. Patients who have a positive test result are retested in 10–14 days, and a second positive result necessitates a biopsy. This method's specificity falls between 0.31 to 1.0, while its sensitivity goes from 0.78 to 1.0. [1] Toluidine blue and Lugol'siodine have been used in combination because toluidine blue stains aberrant epithelium and Lugol's solution binds to glycogen found in normal epithelium. [3] The application of 3-5% acetic acid, which has been utilised for cervical cancer screening, is an intriguing screening technique. [6] According to reports, utilising acetic acid for an oral cancer examination has a sensitivity, specificity, and accuracy of 83.33%, 84.21%, and 83.64%, respectively. [6] Methylene blue, which has been used to find bladder, prostate, and stomach malignancies, may also be used to find lesions in the mouth. [7] The oral cavity application has a 90% sensitivity, 69% specificity, 74% positive predictive value, and 87% negative predictive value. [7]

Illumination with chemiluminescence

The emission of light as a result of a chemical process is referred to as "chemiluminescence." [8] In this approach, tissue reflectance is measured while a non-toxic blue-white chemiluminescent light is directed into the mouth. Dysplastic tissues with expanded nuclei and dehydration with acetic acid are emphasised in this light and appear "aceto white." [9] The Vizilitechemiluminiscent light stick is made up of an inner, brittle glass vial holding

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hydrogen peroxide and an exterior, flexible plastic capsule containing aspirin or acetyl salicylic acid. Flexing the capsule causes the inner, delicate glass vial to break, releasing the hydrogen peroxide, and this activates the capsule. Blue-white light (with a wavelength of 430–580 nm) is produced by the chemical reaction and lasts for 10 minutes. [8] The Microlux DL unit, which provides a reusable battery-powered light source, is another gadget that operates on the chemiluminescence principle. [1] Compared to toluidine blue, the approach has an accuracy of 80.6% for the detection of oral cancer and potentially malignant epithelial lesions. [8]

Mouth brush biopsy

In a dental office, oral brush biopsy samples are subjected to a highly specialised computer-assisted analysis called oral CDx. [2] A complete transepithelial tissue sample is collected after a brief chairside procedure that causes little bleeding, doesn't call for topical or local anaesthesia, and results in minimal bleeding. Investigators are given oral CDx kits that include an oral brush biopsy tool, a precoded glass slide and matching coded test request form, an alcohol/polyethylene glycol fixative pouch, and a preaddressed container to send the results in. In addition to detecting precancerous and malignant lesions, it can also show morphological signs of a number of benign oral conditions, including candidiasis, herpes infection, pernicious anaemia, radiation side effects, and pemphigus. However, oral CDx detects oral lesions that need a histologic analysis and does not serve as a substitute for a scalpel biopsy. For "positive" oral CDx results and "atypical" oral CDx results, respectively, the specificity rates are stated to be 100% and 92.9%. Additionally given as 100% is the sensitivity rate for oral CDx. [2] Oral brush biopsy without computer-assisted analysis has been used to evaluate oral lesions in resource-constrained settings in order to rule out dysplasia and cancer. Compared to the commercially available oral brush biopsy with computer-assisted analysis, the toothbrush biopsy with manual analysis demonstrated somewhat lower sensitivity and specificity. [10]

Photodiagnosis

Real-time, noninvasive, in-situ tissue diagnostics is provided via optical spectroscopy. This assumes that any tissue's optical spectrum will reveal information about the tissue's histology and biochemical composition. When performing guided biopsies, detecting dysplasia and cancer, monitoring haemoglobin tissue perforation in free flap surgery, determining the therapeutic drug levels used during chemotherapy and photodynamic therapy, determining the surgical margins, and performing sentinel node biopsy, photodiagnosis is used.

Flourescence spectroscopy: Flourescence, which can be autofluorescence or a laser-induced phenomena, arises owing to the presence of flourophores such NADPH, collagen, elastin, and cofactors, and is currently used in three main methods for the identification of oral dysplasia and malignancies. An accurate indicator of dysplasia and malignancy is a considerable rise in red/green fluorescence. [11] The portable VELscope uses narrow-emission tissue fluorescence to produce light with a wavelength between 400 and 460 nm. Normal mucosa displays a mild green autoflourescence under the bright blue light, but the questionable tissue appears black. [1] Elastic scattering spectroscopy (ESS): This technique produces a wavelength-dependent spectrum that exhibits the tissue's absorptive and scattering characteristics. Nuclear size, chromatin content, nuclearcytoplasmic ratio, and cellular crowding are all indicators of malignancy and are all detectable by ESS. Raman

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spectroscopy, a type of elastic scattering that is caused by a shift in the frequency of the incident excitation light, is described in [11]. Although signals are feeble, it is the most precise method. [11] Trimodal spectroscopy: This technique combines all three of the previously mentioned three to improve accuracy.[11] mTHPC (Foscan) and -amino levulinic acid are two photosensitizers with a good specificity and sensitivity for tumour diagnosis (levulan). The restricted capacity of the malignant tissue to digest iron leads to an increase in intracellular protoporphyrin IX, which leads to an enhanced uptake of these photosensitizers. [12]

ADVANCED TECHNIQUES TO IDENTIFY INCIPIENT DENTAL CARIES

It is no longer appropriate in the field of research to report carious lesions just at the cavitation level. The optimal approach for detecting caries should be able to record the entire progression of the disease from its earliest stages all the way to cavitation. The main difficulty is in identifying lesional activity at a point that allows for an adequate early intervention that includes prevention rather than just treatment.

Fluorescence and transillumination have the most promise of all the technologically advanced methods for detecting caries. Quantitative laser or light florescence (QLF), which makes use of arc lamps with 290–450 nm wavelengths, and DIAGNOdent, which makes use of infrared light with a 655–nm wavelength, are two techniques based on the fluorescence of the organic components of teeth. The usage of a fluorescence spectrophotometer, which employs many wavelengths, is a novel method in this area. Additionally, recent advancements in the DIAGNOdent technology have resulted in the invention of the DIAGNOdent pen, a hand-held laser caries detection tool. It makes use of a probe with a tip made of a solid, single sapphire fibre wedge-shaped to fit the interproximal gap between posterior teeth. [13]

FOTI (fibre optic transillumination) and direct imaging fibre optic transillumination are two techniques based on transillumination (DIFOTI). Due to variations in high-intensity light photon scattering and absorption brought on by a local reduction in transillumination brought on by the characteristics of the carious lesion, FOTI enables the diagnosis of a carious lesion. Dentinal lesions are represented by orange-brown or bluish shadows, while enamel lesions are represented by grey shadows. A charge-coupled device digital intraoral camera and FOTI have been combined to create DIFOTI, a more recent innovation. [13]

PERIODONTAL DISEASE: ADVANCED CLINICAL DIAGNOSIS

Different periodontal probe concepts, including the Florida probe system, have been created over time to address the drawbacks of traditional probes. The most recent of them are Florida PASHA investigations. [14] Additionally, noninvasive ultrasonic techniques have been used to build ultrasonic periodontal probes that can detect, scan, and map the upper limit of the periodontal ligament and its changes over time as a sign of periodontal disease. [15]

Technetium 99m-tindiphosphonate, a radionuclide, has recently been tested as a marker of active alveolar bone loss in the detection of periodontal disease activity.[16] Periodontal disease activity cannot be detected or predicted using conventional clinical and radiographic methods of diagnosis, which are only able to diagnose attachment and bone loss retrospectively. Therefore, putative indicators of the activity of periodontal disease, such as subgingival bacteria and their products, are being evaluated. Enzymes released from inflammatory cells and dead cells; Inflammatory and immune products; Products of

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connective tissue disintegration.[17] A vast potential exists for using gingival crevicular fluid (GCF) to diagnose periodontal health or disease status since host inflammatory products produced by the periodontium also show up within GCF.[18] Thus, it is envisaged that these new technologies will make it possible to detect subclinical illness in periodontal diagnostics and possibly even forecast future disease activity.

Sialoendoscopy

In order to diagnose, treat, and manage sialolithiasis, sialadenitis, and other obstructive salivary gland illnesses, sialoendoscopy is a potential new technique. Via the insertion of a 1-mm-diameter endoscope (usually of the semirigid type) through the dilated duct of any major salivary gland, it enables the surgeon to monitor and diagnose intraductal and occasionally intraglandular diseases. It is an outpatient surgery that uses local anaesthesia and has few side effects. [19] Deeper-seated calculi can be removed with the aid of specially made micro forceps, graspers, baskets, and balloon catheters. It has shown strictures, the opening of the sublingual gland, and secondary channels in the inner duct's microanatomy. [20]

Testing of the oral fluid

Saliva, the body fluid that is easiest to acquire and least invasive, has a variety of biological indicators that can be used for clinical diagnostic purposes. The medicinal, hormonal, immunological, or toxicological molecule concentrations in tissue fluid are reflected in the molecular makeup of saliva. Also possible are illness indicators, such as those for cancer and infectious disorders. As a result, these fluids serve as sources for evaluating and keeping track of systemic health and illness states, exposure to chemicals from the environment and at work, and the use of harmful or beneficial pharmaceuticals. While it made sense to start with proteome components as salivary diagnostic analytes, genomic targets have shown to be much more insightful and selective. [21] Emerging technologies including micro- and nanofabrication, compact analytical systems, microfluidics, microsensors, and high-density DNA arrays will make it easier to analyse the constituents of oral fluid (cells, DNA/RNA, proteins, hormones, medicines, and metabolic products). [22] Saliva from OSCC patients is being examined for circulating epithelial tumour markers such Cyfra 21-1, tissue polypeptide antigen, and CA125. [23]

Nanodiagnostics

In order to address the demands of clinical diagnostics for higher sensitivity and earlier disease diagnosis, nanodiagnostics—defined as the application of nanotechnology for clinical diagnostic purposes—was created. To meet the strict requirements of the clinical laboratory for sensitivity and cost-effectiveness, the utilisation of nanotechnologies for diagnostic applications shows considerable potential. Quantum dots (QDs), gold nanoparticles, and cantilevers are three new nanodiagnostic tools. The most effective diagnostic nanostructures are quantum dots (QDs), which are semiconductor nanocrystals with exceptional photostability, single-wavelength excitation, and size-tunable emission. Specific analytes can be barcoded using QDs and magnetic nanoparticles. Key elements of the bio-barcode assay, which has been suggested as a potential replacement for polymerase chain reaction, include gold and magnetic nanoparticles (PCR). QDs have a wide range of potential diagnostic applications, with fluoroimmuno assays, tissue imaging, intracellular imaging, immunohistochemistry, infectious agent detection, and multiplexed diagnostics among the

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most promising. For several diagnostic applications, including intra cellularimaging, nanodiagnostics promises improved sensitivity, multiplexing capabilities, and lower costs. [24]

2. CONCLUSION

Information is abundant these days. We have made significant progress, and both oral and general medicine are undergoing change. There is still much to be done in terms of patient care and diagnostic procedure accuracy, which will allow society as a whole to be more productive and healthier.

3. REFERENCES

1. Mark WL, John RK, Theodore K, Paul MS. Critical evaluation of diagnostic aids for the detection of oral cancer. Oral Oncology 2008;44:10-22.
2. Scuibba JJ. Improving detection of precancerous and canerous oral lesions. JADA 1999;130:1445-57.
3. Epstein JB, Scully C, Spinelli JJ. Toluidine blue and Lugol's iodine application in the assessment of oral malignant disease and lesions at risk of malignancy. J Oral Path Med 1992;21:160-3.
4. Zhang L, Williams M, Poh CF, Laronde D, Epstein JB, Durham S, et al. Toluidine blue staining identifies high-risk primary oral premalignant lesions with poor outcome. Cancer Res 2005;65:8017-21.
5. Martin IC, Kerawala CJ, Reed M. The application of toluidine blue as a diagnostic adjunct in the detection of epithelial dysplasia. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 1998;85:444-6.
6. Bhalang K, Suesuwan A, Dhanuthai K, Sannikorn P, Luangjarmekorn L, Swasdison S. The application of acetic acid in the detection of oral squamous cell carcinoma. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2008;106:371-6.
7. Chen YW, Lin JS, Fong JH, Wang IK, Chou SJ, Wu CH, et al. Use of methylene blue as a diagnostic aid in early detection of oral cancer and precancerous lesions. Br J Oral MaxillofacSurg 2007;45:590-1.
8. Ram S, Siar CH. Chemiluminescence as a diagnostic aid in the detection of oral cancer and potentially malignant epithelial lesions. Int J Oral MaxillofacSurg 2005;34:521-7.
9. Satoskar S, Dinkar A. Diagnostic aids in early cancer detection. JIAOMR 2006;18:82-3.
10. Mehrotra R, Singh MK, Pandya S, Singh M. The use of an oral brush biopsy without computer-assisted analysis in the evaluation of oral lesions. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2008;106:246-53.
11. Swinson B, Jerjes W, El-Maaytah M, Norris P, Hopperl C. Optical techniques in diagnosis of head and neck malignancy. Oral Oncology 2006;42:221-8.
12. Konopka K, Goslinski T. Photodynamic therapy in dentistry.J Dent Res 2007;86:694-707.
13. Zandona AF, Zero DT. Diagnostic tools for early caries detection. JADA 2006;137:1675-84.

14. Sanz M, Newman MG, Quirynen M. Advanced diagnostic techniques. In: Newman MG, Takei HH, Klokkevold PR, eds. Carranza's Clinical Periodontology. ST. Louis: Saunders; 2006. p. 579-98.
15. Hinders M, Companion J. Ultrasonic Periodontal Probe: A painless way to monitor gum disease, Acoustical society of America, 136th meeting Lay language papers. Available from: http://www.acoustics. org/press/136th/hinders.htm. Accessed on 20.6,2008 at 10:30 pm.
16. Hawnaur J. Recent advances in diagnostic radiology. BMJ 1999;319:168-71.
17. Eley BM, Cox SW. Advances in periodontal diagnosis. BDJ 1998;184:109-13.
18. Offenbacher S, Collins JG, Heasman PA. Diagnostic potential of host response mediators. Adv Dent Res 1993;7:175-81.
19. Nahlieli O, Nakar LH, Nazarian Y, Turner MD. Sailoendoscopy: A new approach to salivary gland obstructive pathology. JADA 2006;137:1394-400.
20. Hassan O, Gan R. Endoscopy of salivary glands: What have we learnt, AAOMS 2005;S421:137-8. 21. Bernhard GZ, Noh JP, Wong DT. Genomic targets in saliva. Ann N Y AcadSci 2007;1098:184-91.
21. Bernhard GZ, Noh JP, Wong DT. Genomic targets in saliva. Ann N Y AcadSci 2007;1098:184-91.
22. David TW. Salivary diagnostics powered by nanotechnologies, proteomics and Genomics. JADA 2006;137:313-32.
23. Nagler R, Bahar G, Shpitzer T, Feinmesser R. Concomitant analysis salivary tumor markers - A new diagnostic tool for oral cancer. Clin Cancer Res 2006;12:3979-84.
24. Azzazy HM, Mansour MM, Kazmierczak SC. Nanodiagnostics: A New Frontier for Clinical Laboratory Medicine. ClinChem 2006;52:1238-46.