International Journal of Modern Communication Technologies & Research (IJMCTR)
ISSN: 2321-0850, Volume-2, Issue-6, June 2014

FTIR Spectroscopic evaluation of oral cancer

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***Abstract*— In recent years, several prognostic markers have been used as indicators of disease progression in oncology. Accurate and reliable decision making in the spectroscopic diagnosis can help in the planning of suitable surgery, therapy and to improve patient's monitoring through different stages of the disease.**

Use of spectroscopy for detection of cancer is more reliable as compared to any other techniques. We have implemented the FTIR spectroscopic techniques for the detection of oral cancer. Bio-medical image processing has been used to derive useful information from spectrums of data. The objective of the present work is to improve the primitive methodology of distinguishing cancerous and non-cancerous images by just visual inspection so as to provide more information to the doctor and clinical treatment planning system. We have obtained FTIR spectra of malignant and non-malignant histological samples of oral tissues and differentiate the spectra using origin software.

Our results showed that for the diagnosis of oral cancerous tissues the methods used are highly applicable and give optimum accuracy.

***Index Terms*— Oral cancer, oral normal tissue, FTIR, Origin software.**

I. INTRODUCTION

Cancer is the name given to a large group of diseases, all of which have one thing in common, cells that are growing out of control.The common procedures for detecting malignant lesions are visual inspection, followed by biopsy of any suspicious lesions found. However, the processing of biopsy material and the interpretation of the results inevitably leads to diagnostic delay or inaccurate sample. Hence, techniques that can distinguish between benign from malignant types in a reliable and non invasive way will be very useful.

Growth of cancerous cells in the affected area can be observed with special types of X-rays, but use of spectroscopy for detection of cancer is more reliable as compared to any other techniques.

Medical image processing has been used to derive useful information from spectrums of medical data. Spectrophotometer is the instrument that determines the absorption spectrum for a compound. Infrared spectroscopy involves interaction of IR radiations with matter. A pattern produced by the design of the optical pathway is called interferogram. It is a complex signal but its wave-like pattern contains all the frequencies that make up the IR spectrum. A mathematical operation known as Fourier transform (FT) can separate the individual absorption frequencies from the interferogram producing spectrum. This type of instrument is FTIR. The interferogram is subjected to a Fourier transform which yield the spectrum of the background and the compound. IR rays are non-destructive to biological samples.

In India, oral cancer ranks number one in prevalence among all cancers in male patients and number three among cancers in female patients. It accounts for 16% of all female cancers and 22.9% of invasive cancers in women. 18.2% of all cancer deaths worldwide. Oral cancer is diagnosed by oral examination and palpation, usually performed by dentists or physicians. Visual inspection of the oral cavity is performed under normal white light illumination, followed by palpation of suspicious lesions. These are not of use due to their limited spatial resolutions, accuracies, and/or mobility. Hence, a new technique is needed for the detection of oral cancer. Spectroscopy is a technique of interaction between matter and radiated energy that can be used for the analysis of oral lesions.

FTIR spectroscopy has been used for cancer detection in oral mucosa [1]. The biomarkers of oral cancers include variation in protein, lipid, NADH and Collagen. The intrinsic fluorescence spectra was extracted from in vivo fluorescence spectra in the oral cavity with a mathematical model and NADH increases and collagen decreases with oral cancer progression was observed [2]. Studies using Raman spectroscopy for diagnosis of oral cancer are reported and shown that lipids dominated normal oral epithelial tissue spectra while malignant tissues showed protein-dominated spectra [3, 4, 5]. The normal and malignant oral tissue types in both retrospective as well as prospective studies based on large spectral data were also classified [6]. The performance of visual examination for oral cancer detection has been systematically reviewed [7]. Thus, there remains an important need for alternative diagnostic methods that can enhance the visualization of oral lesions and particularly help discriminate benign and premalignant lesions.

Our objective is to develop FTIR Spectroscopic methods that will separate cancerous spectra from the normal cell spectra.

II. MATERIALS AND METHODS

Malignant and non-malignant tissues of oral parts were obtained from Sasson General Hospital. Hematoxylene Eosin stained microscopic slides of the tissues were prepared. Slides were subjected to the FTIR spectroscopic analysis. Statistical data in the form of multiple frequency component obtained from spectroscope is processed using ORIGIN software.

Manuscript received June 09, 2014

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III. RESULTS

It was observed that graph obtained from spectral data of malignant tissue using origin software has a steep slope [Fig. 1].While the graph obtained from spectral data of non-malignant tissue using origin software has a straight slope [Fig. 2]. Also because of overgrowth of cells in cancerous oral tissue [Photograph I] the % transmission of the different wavelengths of light showed peaks distinctly variable from that of non-cancerous oral tissue [Photograph II].

Photograph I. HE stained histological section of malignant oral tissue

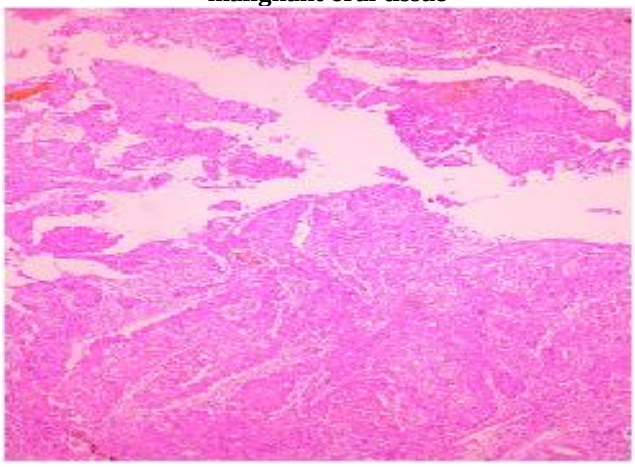
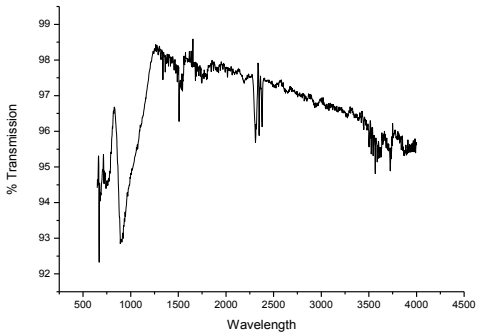


Fig. 1 FTIR spectrum of oral malignant tissue



Photograph II. HE stained histological section of non-malignant oral tissue

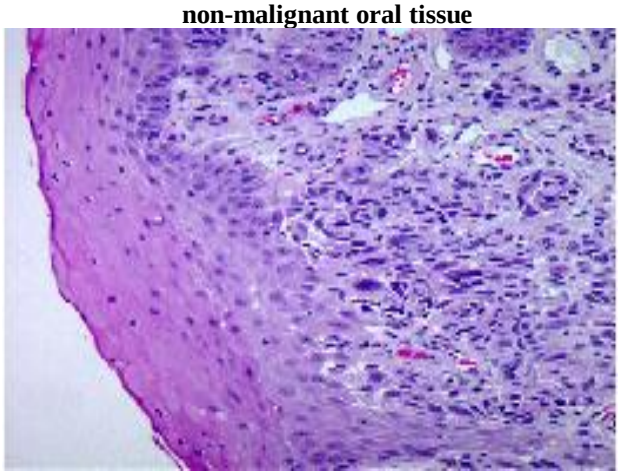
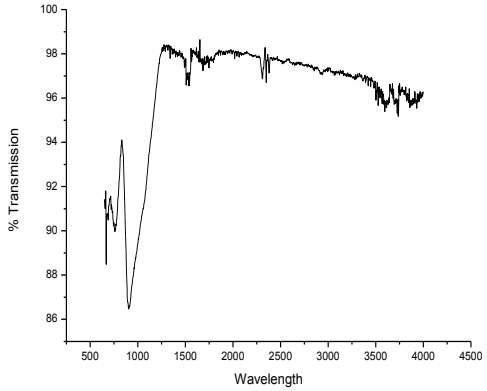


Fig.2 FTIR spectrum of oral non-malignant tissue



IV. CONCLUSION

For accurate results data from image domain can be converted to statistical domain using FTIR spectroscopy. Our results showed that for the diagnosis of oral cancerous tissues the methods used are applicable and give optimum accuracy. However further analysis of the data using different software can be used for additional information.

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