Autofluorescence Spectra Changes in the Colonic Mucosa of the Rat During Early Colorectal Cancer Formation

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Background

We focus on the Laser-Induced Autofluorescence (LIAF) diagnosis technique for identifying the early tissue disease including tissue tumour. The result could lead to the development of a clinical study of cancer diagnosis. Diseased tissue exhibits significant physical and chemical composition changes. Our hypothesis is that these changes will alter the tissue autofluorescence patterns, and that these alterations can be utilised to differentiate disease or cancer from the normal tissue. The objective of our study is to test the hypothesis and develop non-invasive optical methods for cancer diagnosis. We have built a rugged, compact spectrometer system based on a fibre optic PC plug-in spectrometer and used it in the volunteers' skin to collect the normal human skin autofluorescence spectral data. This time we collaborated with the Department of Colorectal Surgery, SGH, in using the LIAF spectra detector system to observe the tumour's LIAF spectra changes *in vivo* rats' colon and rectum as the tumour grew. The results show that the optical spectroscopy is a rapid and sensitive technique for non-invasive detection of the colorectal cancer.

Method

Preparing in vivo rats colon & rectal tumour model

We gave rats in the control group 0.9% Sodium Chloride and azoxymethane (AOM) to the non-control group (0.015mg/kg) administered via subcutaneous injection for inducing the tumor model in colon and rectum once a week for two weeks. After ten weeks, we began to detect the rats' colorectal autofluorescence via our detection system. Before testing, rats from both groups fasted at least one day and were anaesthetised with the same dose of mixer Valium and Ketamine (1:1) 0.1ml/100mg administered via intramuscular injection.

Modification of the detection system

Our autofluorescence (AF) spectra detection system included the excitation laser source (He-Cd laser Model 4206N, LiCONiX, Inc.), micospectrophotometer (MSP) system, Charge Coupled Device (CCD) detector, a PC, a choledochoscope (OLYMPUS for adult), white light source (HALOGEN Lamp), fibre optic cables and other accessory tools.

The fibre optic bunch was composed of two single fibre optics. The diameter of the top of fibre bundle was around 1mm. It could travel through the biopsy channel of the choledochoscope easily. Two connectors of the fibre bundle connect with laser source and detection system.

Conclusion

It was found from this study that AF spectral changes were useful in monitoring colorectal tumour growth. Furthermore, the use of *in vivo* laser induced autofluorescence (LIAF) spectra method was also noted to have a bright prospect in the early diagnosis of colorectal cancer, non-destructively.

Dental Caries Activity Determination Using Fibre Optic Spectroscopy

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Background

Dental caries is an infectious, communicable, multifactorial disease in which bacteria dissolve the enamel surface of a tooth. Uninhibited, the bacteria may penetrate the underlying dentin and can result in extensive loss of tooth structure and discomfort. Consequently an excruciating pain due to dental pulp necrosis, tooth extraction and loss of dental function is common. It is important to note that the failure to meet the minimum standard of having six opposing teeth was a leading cause of rejection from military service in both world wars. The major etiologic factors causing this disease are specific bacteria in dental plaque (particularly Streptococcus mutans and lactobacilli) on susceptible tooth surfaces and the availability of fermentable carbohydrates. To date, there are no effective measures to prevent this disease, and the most frequent treatment is tooth extraction. A caries activity test evaluates a patient's current status with regard to dental caries, distinguishes between active and arrested disease and predicts future disease and disease progression. It enables dental professionals to formulate and incorporate a treatment plan for patients. Many attempts have been made to establish the risk profile of dental caries; however, no diagnostic test procedures are yet available to reliably predict such risk, particularly among the paediatric and adolescent population.

Method

In the present paper, a fibre optic evanescent wave (FOEW) spectroscopy-based method has been developed to monitor the "acidogenic" profile of *streptococci mutans* in the patient's saliva.

Results and Conclusion

This method predicts the caries activity directly from the subject's mouth in a short time. An additional bacterial incubation and culturing period is not required. Further studies are indicated to determine their sensitivity and specificity based on test in large population.