Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **3115** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Optical Coherence Tomography as a Screening Tool for Oral Cancers

Tuesday 7 June 2022 16:15 (15 minutes)

Structural optical imaging within tissues is potentially useful for medical screening of various diseases, and particularly suitable for superficial and easily accessible oral cancers. Optical coherence tomography (OCT) is a non-invasive, low coherence imaging technique that allows micron-scale resolution for structural determinations within tissues. Intensity data from OCT images can be used to determine the optical properties of samples, such as the attenuation coefficient.

While a highly promising technique, the imaging depth of OCT is limited to only several millimetres in most light diffusing tissues. In order to overcome this limitation, we have examined the use of optical clearing agents with chemical penetration enhancing techniques to increase the axial depth of resolution at which signals can be obtained. We examined the use of penetration enhancers on porcine tongue tissue based on the time-dependent effects of the clearing effect and depth for which 50% signal intensity is lost through the tissue.

We have collected OCT data from a prospective study on lesions obtained from recently excised human oral tissues biopsied for histopathology analysis, as well as archived tissue samples embedded in paraffin. By modeling the OCT data using a form of the Beer-Lambert Law, 2D attenuation coefficient maps were computed. We have studied the attenuation coefficients obtained from the intensity decay data of 250 excised human tissue samples from our prospective study, diagnosed as non-cancerous (i.e. hyperkeratosis) and squamous cell carcinoma through histopathological analysis. The calculated attenuation coefficients were then correlated to the histopathological diagnoses (from hyperplasia to cancer). Our results suggest it may be possible to use OCT as a fast and non-invasive oral cancer screening tool.

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Session Classification: T4-1 Advances in Physics in Biology and Medicine Symp.: Novel diagnosis and therapy (DPMB) | Symposium sur les progrès en physique dans la biologie et la médecine: nouveaux diagnostics et thérapies (DPMB)

Track Classification: Symposia Day (Tues. June 7) / Journée de symposiums (mardi, le 7 juin): Symposia Day (DPMB) - Advances in Biological and Medical Physics Symposium