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Vibrational Optical Coherence Tomography (VOCT) a new non-invasive method for evaluating cancerous lesions: 3D representation of the locations of cellular, blood vessel and fibrous tissue deposition associated with skin cancers

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Statement of Problem: Visual and dermoscopic observations are the standard of care for evaluating skin lesions that may be cancerous. By the year 2050 it is predicted that 50 million skin biopsies will be conducted in the USA each year which may overwhelm the current the screening abilities of the existing dermatological services. The need for new non-invasive technologies that can be used in conjunction with visual and dermoscopic analysis will be needed to meet the expanded demand for dermatological screening. The purpose of this study is to describe the results of skin cancer studies using vibrational optical coherence tomography to non-invasively quantitatively analyze the 3D cellular, blood vessel and collagen distribution in normal skin and cancerous lesions. VOCT applies audible sound and infrared light transversely from 3 cm above skin to measure the frequency dependence of the displacement of skin. The frequencies at which the maximum displacement occurs are the resonant frequencies of the skin major components. The resonant frequencies are converted into tissue stiffness by dividing by the tissue thickness based on the OCT images. Findings: Cancerous lesions contain new cellular resonant frequency peaks at 80Hz, 130Hz, and 260Hz that are not all present in normal skin or benign skin lesions. These peaks are associated with the increased stiffness of cells (80Hz), new blood vessels (130Hz) and fibrous tissue (260 Hz) that have been reported to stiffen cancerous lesions compared to normal skin. Using the OCT volume scan app and data from the raw images, 3D representation of the resonant frequency and location of cellular, fibrotic and blood vessel components of skin lesions can be analyzed non-invasively. Conclusion & Significance: VOCT in conjunction with visual inspection and dermoscopy can be used to quantitatively analyze difficult skin lesions such as melanomas.

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