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Characterization of Collagen Structure and Tissue Mechanics in Intestinal Biopsies from IBD Patients

Inflammatory Bowel Diseases (IBD), including Crohn's disease and ulcerative colitis, have been estimated to affect between 10 and 40 per 100.000 people in Europe, with an increasing burden over the last few decades [1]. The presence of chronic inflammation associated to these diseases is a known risk factor for the development of colorectal cancer [2]. In this work, we seek to better understand the structural differences between inflamed and healthy pairs of tissues obtained from the same patient. The collagen architecture of the snap-frozen samples was analysed using second harmonic imaging microscopy (SHIM), a non-destructive technique that enables the formation of three-dimensional images of the collagen content encompassing the entire thickness of the sample. Simultaneously, the samples were scanned using a Brillouin microscope to investigate the gradients of stiffness resulting from the fibrotic and healthy regions of the intestine. The use of Brillouin microscopy allows for the contact-free measurements of the mechanical properties of tissue, specifically the longitudinal modulus in the GHz range [3].

The high-resolution scans of the sample pairs could result in improved in-vitro models to be used as a platform for drug development, scaffold design, and 3D cell-culture, among many other tissue engineering applications.

[1] - Caron B, et al. Epidemiology of Inflammatory Bowel Disease across the Ages in the Era of Advanced Therapies. J Crohns Colitis. 2024 Oct 30;18.

[2] - Axelrad JE, et al. Inflammatory bowel disease and cancer: The role of inflammation, immunosuppression, and cancer treatment. World J Gastroenterol. 2016 May 28;22(20):4794-801.

[3] - Prevedel, R., et al. Brillouin microscopy: an emerging tool for mechanobiology. Nat Methods 2019 16, 969–977.

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