University of Houston - Biomedical Engineering Seminar
Friday, February 14 at 12 noon, Room Science 105

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Assessment of Systemic Sclerosis using multifunctional optical coherence tomography

Abstract

Systemic sclerosis (SSc), or scleroderma, is a chronic autoimmune condition distinguished by fibrosis affecting the skin and internal organs. The modified Rodnan skin score (mRSS) measures skin involvement in SSc, relying on dermal thickening and fibrosis as critical indicators. This assessment entails the manual pinching and rolling of the skin across 17 designated areas, with scores determined based on the degree of thickness observed. Despite its established status as a standard metric, the mRSS is not without limitations, including the necessity for extensive training and the potential for inter-observer variability. OCT can delineate the epidermis-dermis interface, facilitating a quantitative assessment of skin layer thickness in patients with SSc. Furthermore, OCT supports advanced functional applications, encompassing non-invasive mechanical imaging through OCT-based elastography (OCE) and label-free vascular imaging via OCT angiography (OCTA). In this study, we have developed and designed a multifunctional OCT system, which was initially employed to investigate vascular and mechanical characteristics in a murine model simulating SSc. Subsequent to validating our methodology, we modified the system for deployment at UTHealth in a clinical study involving patients diagnosed with SSc. Our multifunctional OCT system was utilized to assess vascular and mechanical properties in a cohort comprising 75 participants, including 55 individuals with SSc and 20 matched controls. Our results show that multifunctional OCT demonstrates considerable promise, as we successfully distinguished between patients and controls with high statistical significance. We are currently working on differentiating patients according to the severity of their diseases, which may hold considerable significance for therapeutic interventions.

Biosketch

Harshdeep Singh Chawla is currently a Doctor of Philosophy candidate and a research assistant at the Biomedical Optics Laboratory within the Biomedical Engineering Department at the University of Houston. He has obtained a Master of Science degree in Computer Engineering from the Rochester Institute of Technology in Rochester, New York, as well as a bachelor's degree in Electronics and Communication Engineering from Rajiv Gandhi Technical University in India. His primary research interests encompass biomedical imaging and biomechanics.