Contribution ID: **14** Type: **not specified**

3D in situ and ex vivo characterization of tissue engineered scaffolds using synchrotron imaging technique

In tissue engineering, especially soft tissue engineering, three-dimensional (3D) characterization of tissue scaffolds is still challenging due to the limitations of current characterization techniques, which affects tissue scaffold design, fabrication, and longitudinal studies. Synchrotron propagation-based imaging with computed tomography (SR-PBI-CT) technique provides enhanced image contrast and is suitable for tissue scaffold imaging. In this study, the 3D-printed hydrogel-based tissue scaffolds were non-destructively visualized in 3D using the SR-PBI-CT technique for the fabrication and structural design studies. In the mechanical in situ study [1], subjective to controllable compressive loadings, the structural responses of scaffolds were visualized and characterized in terms of the structural deformation within physiological environments caused by the compressive loadings. Furthermore, hydrogel scaffolds were later implanted in rats as nerve conduits for SR-PBI-CT imaging, and the obtained images illustrated their high phase contrast and were further processed for the 3D structure reconstruction and quantitative characterization [1]. In addition, combining with helical CT mode, the SR-PBI-CT shows potentials for tissue scaffold in vivo studies in tissue engineering applications [2]. The study demonstrates unique capability of this synchrotron imaging technique for noninvasive characterization of 3D hydrogel structures pre- and post-implantation in diverse physiological milieus. The established synchrotron imaging platform can therefore be utilized as a robust, high-precision tool for the design and longitudinal studies of hydrogel scaffold in tissue engineering.

Reference

[1] Ning L, Zhu N., Smith A., Rajaram A., and et al. (2021) Noninvasive Three-Dimensional In Situ and In Vivo Characterization of Bioprinted Hydrogel Scaffolds Using the X ray Propagation-Based Imaging Technique. ACS Applied Materials & Interfaces 12(40): 44563-44577

[2] Duan X, Li N, Ding XF, Cooper D, Chen XB. and Zhu N. (2023) Study of Synchrotron Radiation Propagation-Based Imaging CT with Helical Acquisition Mode in Tissue Engineered Applications. Journal of Synchrotron Radiation 30: 417–429

Primary authors: ZHU, Ning (Canadian Light Source); Prof. NING, LIqun (Cleveland State University); Ms DUAN, Xiaoman (University of Saskatchewan); Prof. CHEN, Daniel (University of Saskatchewan)

Presenter: ZHU, Ning (Canadian Light Source)