Micro-Computed tomography for morphometry of non-mineralized fresh and plastic embedded biological tissues subjected to laser ablation

A.M. Robinson¹, S.R. Stock², C. Soriano³, X. Xiao³, C-P. Richter¹,4,5

¹Department of Otolaryngology Head and Neck Surgery, Northwestern University Feinberg School of Medicine, Chicago, IL, USA
²Department of Cell and Molecular Biology, Northwestern University Feinberg School of Medicine, Chicago, IL, USA
³Advanced Photon Source, Argonne National Laboratory, Argonne, IL, USA
⁴Department of Biological Engineering, Northwestern University, 2145 Sheridan Road, Evanston, IL, USA
⁵The Hugh Knowles Center, Department of Communications Sciences and Disorders, Northwestern University, Evanston, IL, USA

The aim of this study was to determine if we could obtain X-ray phase contrast image stacks with sufficient resolution to identify both laser ablation and thermal coagulation damage in non-mineralized biological tissues and measure their respective volumes to quantify laser tissue interactions.

Fresh porcine cadaveric tissue and plastic embedded chemically fixed mouse tissues were imaged using partial coherent synchrotron X-rays. Phase contrast images were recorded over a 180° specimen rotation. Reconstructions were on a 2k x 2k grid with TomoPy software after phase retrieval based on the Paganin algorithm.

The Fiji version of ImageJ freeware was used to identify regions of interest (laser damage) in the image stacks and render 3D volume models and generate volume measurements.

The method will allow accelerated and more accurate evaluation of surgical lasers under development without the need for time consuming microtomy and light microscopy.