University of Basel
Department of
Biomedical Engineering

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Master of Science – Biomedical Engineering
Thesis Proposal

Smart OCT system as a tool for time-resolved dehydration detection in biological tissues: investigating the potential and limitations

Optical coherence tomography (OCT) is a well-established and reliable medical imaging system that operates through interferometric imaging, enabling non-invasive and three-dimensional generation of histology-like images of the biological tissue. Due to these unique capabilities, OCT has founded numerous applications in various medical fields, including ophthalmology and dermatology. One of the main factors contribute to the imaging range of the OCT system is attenuation of the OCT's laser in the biological tissue. Leveraging this fact, it is possible to determine the quantity of the material responsible for the attenuation within the tissue. For instance, during laser osteotomy, changes in the water level of the bone tissue directly influence the tissue's water content, which can be quantified using the attenuation profile of the OCT system. In Figure 1, the preliminary results of monitoring the dehydration level of the bone tissue during laser osteotomy is demonstrated.

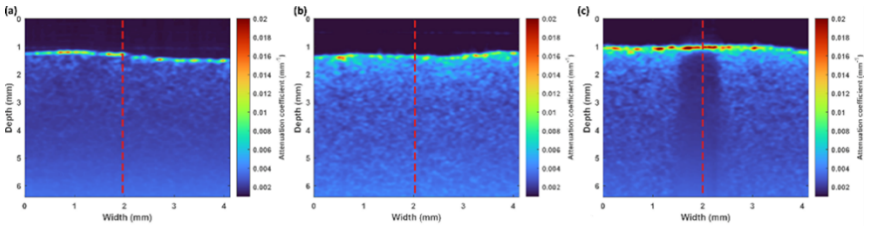

Fig. 1. Preliminary results of dehydration detection of bone tissue using OCT system. (a) hydrated bone tissue, (b) dehydrated bone tissue and (c) carbonized bone tissue.

This study aims to further investigation of the potential of the OCT system to determine the changes in the water level of the biological tissue influence by external factors over time.

1. Literature review on the existing methods for monitoring the water content of biological tissue.
2. Desing and develop the experimental setup.
3. Performing experiment and optimization of the imaging parameters.
4. Developing the image processing algorithm.
5. Integration of the developed image processing software to the OCT's software

Nature of the thesis:
Experimental: 50%, Programming: 30%, Documentation: 20%
Requirements:
Background in biomedical engineering, physics, or related field. Basic knowledge of optics and interferometry and laser. Prior knowledge in programming (Python, MATLAB, LABVIEW) is desirable.
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