Section: **Visualisierung**

ID: 114

Abstract-Title:
3D VISUALIZATION AND IDENTIFICATION OF RAT BRAIN STRUCTURES USING OPTICAL COHERENCE TOMOGRAPHY

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Abstract-Text:
Purpose:
Optical coherence tomography (OCT) is a powerful, real-time technique for investigating depth structure of biomedical tissue. Since entering the field of medical imaging it has been well established for imaging purposes in certain medical disciplines e.g. ophthalmology and dermatology (1). Major advantages are the high resolution, the video-rate scanning capability, and the non-invasive nature of OCT-imaging. Recent research results show the applicability of OCT to image brain morphology ex vivo and in vitro (2). OCT therefore presents a novel imaging modality in neuronavigation applications e.g. intraoperative path validation for instrument guidance. This contribution examines 2D-OCT scans of coronal sectioned rat brain in order to identify different brain regions and provides a 3D reconstruction for better visualization of OCT images. Methods:
Brain from a freshly decapitated rat was dissected in an ice-cold Krebs-bicarbonate buffer. A coronal section crossing the cortex, the external capsule and the striatum (figure 1) was scanned by a Swept Source OCT Microscope System (Thorlabs, Inc., Newton, USA) with a center wavelength of 1325nm and an axial scan rate of 16kHz. The axial depth z was 2.14mm, the transverse range of the B-scans (x) 3mm. 255 images were obtained in dorsal direction (y) with a range of 3mm. To reduce speckle noise and to enhance brain structures, the acquired images were filtered by a common gaussian low-pass and an anisotropic filter (3). The standard deviation of the gaussian filter was set to σ=1.5, the step size of the anisotropic filter was set to 1, the smoothing coefficient to 1.5 and the number of iterations was set to 5. 3D visualization of the coronal section was done by MevisLab image processing software (MevisLab, MeVis GmbH, Bremen, Germany). Identification of different brain structures in the 2D-scans is based on an analysis of the slope of the log intensity in axial direction (see figure 4). Results:
The Swept Source OCT system is able to resolve different brain structures e.g. grey and white matter in the coronal section of the rat brain. 3D reconstruction of the filtered images are clearly comparable to macroscopic images and histologic information from rat brain atlases (e.g. Paxinos atlas (4)) (see figure 2). Analysis of the log intensities allows identification of grey and white matter (external capsule) as the attenuation coefficients of white matter is higher than the attenuation coefficient of grey matter. Conclusion:
Based on the preliminary results, OCT can be used as image modality in neurosurgery

settings. The filtered 3D reconstruction allows better spatial orientation for the surgeon whereas the analysis of the 2D scans allow identification of different brain regions. Further research will concern the development of adequate image processing methods and advanced brain structure identification tools. References: (1) Handbook of Optical Coherence Tomography. Marcel Dekker, Inc.,2002

(2)
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Imaging Ex Vivo and In Vitro Brain Morphology In Animal Models with Ultrahigh Resolution Optical Coherence Tomography. J. Biomedical Optics, vol. 9,pp. 719-724,2004

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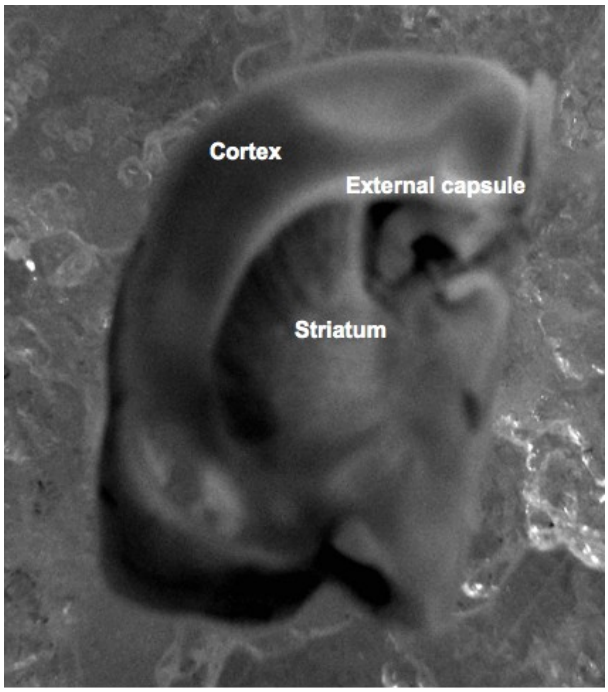
(4) Paxinos,G.;Watson,C.;The Rat Brain in Stereotaxic Coordinates, Academic Press, San Diego, 1998

Bild 1/JPG



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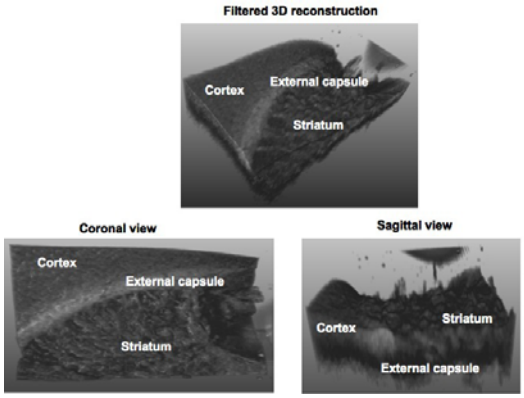

Bild 3/JPG