Summary

X-ray radiography is a noninvasive imaging technique for a visualization of internal structures of investigated samples. In past years, imaging of biological samples in a micro-CT is gaining in popularity. The disadvantage of this technology is a low ability to display soft tissues like muscles, fat tissue or nerves due to their low intrinsic contrast. The aim of this study was to modify a conventional micro-CT MARS in order to improve the scanning of the soft tissues and to create a protocol for simple and cheap fixation of ex-vivo soft tissues for micro-CT scanning.

In the study, a modified micro-CT MARS was used together with a photon-counting detector Timepix Quad with the resolution 30μm. The micro-CT was afterward tested on the phantom and also on the real soft tissues. For scanning soft tissues in the micro-CT, the ethanol fixation method was invented. Hearts and lungs from laboratory mice were either fixated in 97%, 50% ethanol solution or in a series of ascending ethanol concentrations. Images were acquired after 72, 168 and 336 hours. The resulting images were compared among themselves and with the native specimens. This fixation method was also used in scanning healthy mice brains in order to evaluate the contribution of displaying of a brain in a micro-CT in the research of the central nervous system.

The modified micro-CT machine was successfully tested for displaying ex-vivo soft tissues. As for the ethanol method, the best results were obtained in case of a heart after 168 hours of fixation in a series of ascending ethanol concentrations and in case of lungs after 336 hours. In scans of the brain, it was possible to visualize 42 clinically important structures of white matter and 53 structures of grey matter.

In this study, it was proven, that the modified micro-CT MARS is suitable for high-quality scanning of ex-vivo soft tissues. The ethanol method of fixation of soft tissues is a cheap and simple method for increasing intrinsic contrast in soft tissues and therefore allows distinguishing clinically important structures of white and grey matter in the brain of a laboratory mouse.