BL-14C/2018G041

Precise Depiction of Hepatic Lobule by X-ray Phase Contrast Imaging Aimed at Optimization of Preservation Method of Liver Perfusion

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1 Introduction

The X-ray phase contrast method using analyzer crystal (LA) is an excellent imaging technique that can clearly depict low-absorption objects. The purpose of this study is to depict porcine liver lobules. To obtain the microstructure of sinusoids, it is necessary to use a thin-blade LA for clear imaging. Two different blade thicknesses, 537 μm and 979 μm, are available for the dark field condition [(1)]. Here, we report the comparison of the two LA thicknesses for depiction of soft tissue microstructures.

2 Experiment

The blade thickness (H) that satisfies the dark field condition is $H = (p + 1/2) \cdot \Lambda$. Here, p is a natural number and Λ is the period length of the Pendel fringes. The value of Λ at X-ray energy (E) 30keV is about 63 μm in Si (220) diffraction. A forward diffraction image was taken using a pathological specimen (thickness: 8 mm) of the femur and cruciate ligament as a test sample. The exposure time was 80 ms.

3 Results and Discussion

X-ray images of the cruciate ligament with LA blade thicknesses of 537 μm and 979 μm are shown in Figure 1 (a, b). In each image the pixel intensities were measured perpendicular to the length of the fibers (yellow line). Measured spectra are shown in Figure 2 (a, b), in which, sharper peaks are seen in Figure (a) than in Figure (b). Hence, the LA with a blade thickness of 537 μm gives a sharper image of the ligament fibers than the LA image with a thickness of 979 μm. Therefore, it can be seen that a thin blade produces a higher spatial resolution image [(2)].

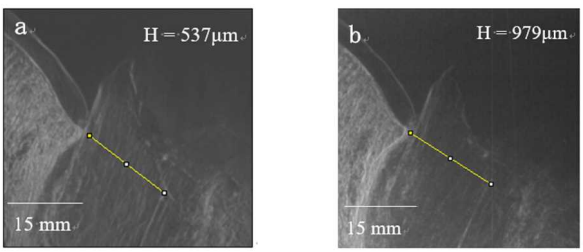

Fig.1 (a, b) X-ray images of the cruciate ligament with LA blade thicknesses (H) of (a) 537 μm and (b) 979 μm.

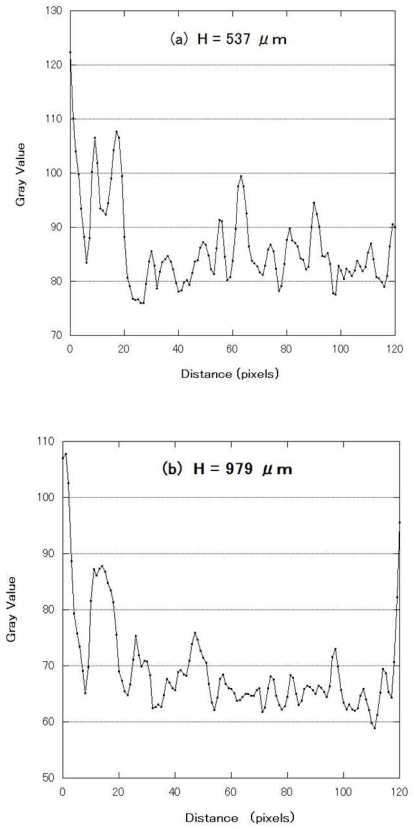

Fig.2.（a, b）Pixel intensities measured perpendicular to the length of the fibers with LA blade thicknesses (H) of (a) 537 μm and (b) 979 μm.

References

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