Fast Optical-resolution Photoacoustic Microscopy

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1. ABSTRACT

Optical resolution photoacoustic microscopy (OR-PAM) is a non-invasive, label-free, in vivo microscopic imaging modality with high optical resolution and strong optical contrast. Based on endogenous contrasts, OR-PAM has been widely used in preclinical research fields by imaging blood vessels, mapping physiological parameters, and tracking circulating cells. However, in order to be used even more widely, the current OR-PAM system has the following issues: fixed table-top configurations, large system sizes, low signal-to-noise ratio (SNR), narrow field of view, and/or slow imaging speeds. Here, we present a high signal-to-noise ratio (SNR) and a fast OR-PAM system for preclinical and clinical applications. Using a microelectromechanical systems (MEMS) technology, we can successfully develop the high speed and high SNR OR-PAM system[1,2]. We have successfully imaged various parts of small animals in vivo in real time.

2. FIGURES, EQUATIONS AND REFERENCES

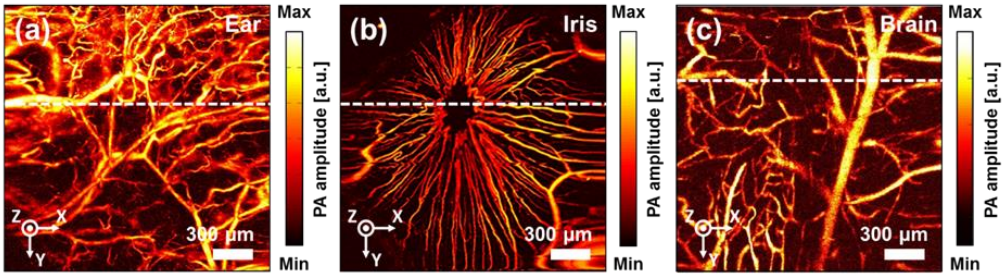

Figure 1: In vivo photoacoustic images of mouse ear, eye, and brain (a), (b), (c) Photoacoustic maximum amplitude projection images of a mouse ear, eye and brain.

The microvasculatures in a mouse ear, eye, and brain are clearly delineated in the photoacoustic maximum amplitude projection (MAP) images (Fig. 1a-c). The acquisition time of the MAP image is 20 s. The image of vasculature in the ear contains capillary beds and single capillaries (Fig. 1a). The MAP image of mouse eye demonstrates for iris microvasculature (Fig. 1b). Image FOV of 2 mm by 2 mm is able to obtain the whole eye morphology in one frame. The MAP image of mouse brain demonstrates brain cortical vessels (Fig. 1c).

References;

[1] J. Kim, C. Lee, K. Park, S. Han, and C. Kim, "High-speed and high-SNR photoacoustic microscopy based on a galvanometer mirror in non-conducting liquid", *Scientific Reports*, **6**, pp. 34803 (2016).
[2] J. Kim, C. Lee, K. Park, G. Lim, and C. Kim "Fast optical-resolution photoacoustic microscopy using a 2-axis water-proofing MEMS scanner", *Scientific Reports*, **5**, 7932 (2015)