COMBINED TWO-PHOTON MICROSCOPY AND OPTICAL COHERENCE TOMOGRAPHY

Bumju Kim, Tae Jun Wang, Ki Hean Kim
Division of Integrative Biosciences and Biotechnology & Dept. of Mechanical Engineering
Pohang University of Science and Technology
San 31, Hyoja-dong, Pohang Gyeongbuk 790-784, Rep. of Korea
E-mail: kiheankim@postech.edu

KEY WORDS: Multimodal imaging, Two-photon microscopy, Optical coherence tomography, In vivo tissue, Tissue microenvironments

1. ABSTRACT
Combination of two-photon microscopy (TPM) and optical coherence tomography (OCT) is useful for biological tissue studies by providing complementary information at different length scales. Two-photon microscopy provides molecular, cellular information of tissues based on both fluorescent and nonlinear signals in a few hundred microns field of view (FOV), and OCT does structural and physiological information in a few millimeter FOV with sub-tenth micron scales. A combined TPM and OCT was developed for the multimodal imaging of same tissues [1], and various tissue studies were conducted by using either the combined system or separated OCT and TPM systems. In a mouse cancer model, both the local distribution of cells and extracellular matrix (ECM), and the gross tissue structure and vasculature were visualized in vivo [2]. In a mouse inflammation models, both the inflammation agents and immune cells, and swollen tissue structure and vasculature were visualized. TPM and OCT were applied to study colorectal cancer in a mouse model. Separated OCT and TPM were applied to characterize changes of the colon tissues in terms of structure and cellular distribution respectively, and an endoscopic system of combined TPM and OCT was developed based on a gradient index (GRIN) lens for in vivo study.

2. Figures

Figure 1. Combined angiographic OCT and TPM images of a mouse cancer model. (a) and (d): OCT cross-sectional images of the mouse ear, (b) and (e): angiographic OCT images, (c) and (f) TPM images

Figure 2. OCT and TPM images of the colorectal cancer models ex vivo. (a) and (b): OCT cross-sectional images, (c) and (d): TPM images.