C12133 Motion-compensated free-hand OCT probe for image-guided intervention

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Technology description

Invention novelty: A motion-compensated free-hand scanning common-path Fourier-domain optical coherence tomography imaging probe has been developed for image guided intervention during microsurgery.

Value Proposition:

In many circumstances, a surgeon prefers to use a simple hand-held manually-scanned probe to obtain OCT images of tissues and organs which might otherwise be inaccessible using standard mechanically-scanning probes. However, a hand-held probe poses additional challenges over mechanically fixed scanners. Non-uniform motion, hand tremor, and involuntary subject motion will cause image distortion and inaccuracy. We present a novel system which may compensate for these inaccuracies and obtain better images.

Technical Details:

Johns Hopkins researchers have developed a manual-scanning OCT system capable of compensating hand tremor and of tracking a target surface. A hand-held needle probe prototype instrument was designed and fabricated by integrating an imaging fiber probe inside a stainless steel needle which is attached to ceramic shaft of a piezoelectric motor housed in an aluminum handle. The fiber probe obtains A-scan images. Real-time data acquisition, processing, motion compensation and image saving was implemented on a customized system at a compensation rate of 460 Hz with RMS error of 2.93μm. Test images from in vivo experiments showed greatly reduced hand tremor artifacts. The sample surface topology was corrected through a cross-correlation maximization-based shift method. Moreover, the system could significantly reduce the risk of tearing the target surface.

Data Availability: Under CDA/NDA

Publication(s)/Associated Cases: Y. Huang, X. Liu, C. Song, and J. Kang, "Motion-compensated hand-held common-path Fourier-domain optical coherence tomography probe for image-guided intervention," Biomed. Opt. Express 3, 3105-3118 (2012).

Categories: Medical Imaging

Keywords: OCT probe, hand-held, image artifacts, distortion correction, medical optics

Advantages

The system has the following advantages:
- The probe is small and lightweight. It allows access to tight spaces.
- The probe can provide the surgeon with freedom to obtain any image size, and is user friendly.
- The system compensates for hand tremor and sample motion.
- The system prevents accidental damage to imaging target caused by unexpected motion.
- A topology correction algorithm was implemented to restore sample topology

Institution

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