Universal hand-held three-dimensional optoacoustic imaging probe for deep tissue human angiography and functional preclinical studies in real time.

The exclusive combination of high optical contrast and excellent spatial resolution makes optoacoustics (photoacoustics) ideal for simultaneously attaining anatomical, functional and molecular contrast in deep optically opaque tissues. While enormous potential has been recently demonstrated in the application of optoacoustics for small animal research, vast efforts have also been undertaken in translating this imaging technology into clinical practice. We present here a newly developed optoacoustic tomography approach capable of delivering high resolution and spectrally enriched volumetric images of tissue morphology and function in real time. A detailed description of the experimental protocol for operating with the imaging system in both hand-held and stationary modes is provided and showcased for different potential scenarios involving functional and molecular studies in murine models and humans. The possibility for real time visualization in three dimensions along with the versatile handheld design of the imaging probe make the newly developed approach unique among the pantheon of imaging modalities used in today’s preclinical research and clinical practice.