Imaging the human microcirculation

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Structural and functional imaging of the microcirculation is necessary to understand many diseases such as diabetes mellitus, heart disease, peripheral vascular disease and arteriosclerosis [1]. We have developed several methods for assessment of both the structural and dynamic properties of the capillaries in the upper dermis and the vessels which supply them [1-5].

We have developed 2D devices based on polarisation spectroscopy which output colour-coded maps which are sensitive to the concentration of red blood cells in the skin tissue [2]. The hardware design consists of two orthogonally placed polarisation filters over the light source and sensor of a standard digital camera and utilises the video mode to provide an acquisition frequency of 15/30 Hz at a resolution of ~200 µm. We have also developed correlation mapping optical coherence tomography (cmOCT) to render the 3D microcirculation [2,3,4]. To obtain microvascular maps without motion artefact, we used the full-field technique developed by Boccara and others and applied the cmOCT algorithm to the data [5]. Since the depth is limited to one or two millimetres with OCT and much less with full-field OCT, we have recently begun to work with photoacoustic tomography. A backscatter type probe, similar to existing clinical ultrasound has advantages of ease of use, speed and familiarity for radiographers.


Fig. 1. Imaging the microcirculation i) TiVi, ii) cmOCT of the nailfold plexus, iii) 3D cmOCT on the fingertip with structure and iv) 3D photoacoustic and ultrasound imaging of the volar aspect of human wrist.