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Large area mapping of excised breast tissue by fluorescence confocal strip scanning: a preliminary feasibility study

Larson BA, Abeytunge S, Murray M, Rajadhyaksha M., SPIE 8577, Optical Biopsy XI, 857706 (March 19, 2013); doi:10.1117/12.2005464

ABSTRACT

Lumpectomy, in conjunction with radiation and chemotherapy drugs, together comprise breast-conserving treatment as an alternative to total mastectomy for patients with breast tumors. The tumor is removed in surgery and sent for pathology processing to assess the margins, a process that takes at minimum several hours, and generally days. If the margins are not clear of tumor, the patient must undergo a second surgery to remove residual tumor. This re-excision rate varies by institution, but can be as high as 60%. Currently, no intraoperative microscopic technique is used routinely to examine tumor margins in breast tissue. A new technique for rapidly scanning large areas of tissue has been developed, called confocal strip scanning, which provides high resolution and seamless mosaics over large areas of intact tissue, with nuclear and cellular resolution and optical sectioning of about 2 microns. Up to 3.5 x 3.5 cm² of tissue is imaged in 13 minutes at current stage speeds. This technique is demonstrated in freshly excised breast tissue, using a mobile confocal microscope stationed in our pathology laboratory. Twenty-five lumpectomy and mastectomy cases were used as a testing ground for reflectance and fluorescence contrast modes, resolution requirements and tissue fixturing configurations. It was concluded that fluorescent imaging provides the needed contrast to distinguish ducts and lobules from surrounding stromal tissue. Therefore the system was configured with 488 nm illumination, with acridine orange fluorescent dye for nuclear contrast, with the aim of building an image library of malignant and benign breast pathologies.