Surgical Imaging and Biophotonics

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Surgical imaging describes the application of a broad range of imaging, vision and optical techniques to assist surgeons for intrasurgical decision making. Some of these techniques aim to replace current technology such as the xenon lamp with new ergonomic and functional light sources that are able to enhance the surgeon's view. During this presentation a number of surgical imaging and biophotonics devices that are currently in development will be reviewed. Some of these are able to distinguish between healthy and diseased tissue non-invasively and without the use of external biomarkers, while others can be used for general illumination using spectrally flexible broadband lasers or LED illumination. Another area where surgical imaging may find an important role is in robotic-assisted minimally invasive surgery. Devices that are capable of precise motion have led to the possibility of careful movement of spectroscopic instruments across the tissue surface and improved mosaicing of microscopic image fields. Furthermore, the use of a da Vinci rigid endoscope will be described with 3D stereoscopic reconstruction and alignment of multimodal optical images. This registration allows the extraction of tissue oxygenation and perfusion in bowel and womb tissue, which could potentially be used to image changes in tissue blood supply during a surgery. Finally a new endoscopic method for detecting the 3D surface profile of different tissues has been developed based on the projection of spectrally encoded spots onto the tissue surface together with a method of triangulation. This technology has been assessed in vitro and results suggest that it could be used to align and register pre-operative medical images onto the live endoscopic view for surgical guidance.