Convergence of light, devices, and molecules to detect and treat cancer

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ABSTRACT

Surgeons still rely on vision and touch to distinguish cancerous from healthy tissue, often leading to incomplete tumor removal that necessitates repeat surgery or favors relapse. To address these issues, we have developed Cancer Viewing Glasses (CVGs) that can provide real-time intraoperative visualization of tumors and sentinel lymph nodes without disrupting the surgical workflow. The CVGs were designed to detect near-infrared fluorescence (NIRF) from molecular probes targeted to cancer cells. Both NIRF and normal visible light used in the operating room are projected to a head-mounted display. The optical see-through CVGs prototype allows direct visual access to the surgical field while projecting NIRF to the eyes under normal operating room light conditions. Aided by a new tumor-targeted NIR fluorescent molecular probe capable of accumulating in most solid tumors, CVGs provided real-time image guidance for complete tumor resection in subcutaneous and metastatic mouse models and cancer patients. Ongoing clinical studies demonstrate that combining light, molecules, and CVG enhances high throughput surgery with improved accuracy.