explores the feasibility of utilizing dual-modality optical reflectance imaging for the accurate detection of thyroid cancer.

METHODS: Pilot study including 7 subjects undergoing thyroidectomy for papillary thyroid cancer (PTC) diagnosed by fine-needle-aspiration biopsy between August 2012-June 2013. Immediately after removal of the thyroid gland, measurements using light reflectance spectroscopy (LRS) and auto-fluorescence lifetime measurement (AFLM) were taken from the known cancer lesions and compared to those taken in identical fashion from normal thyroid tissue within the same gland. Sites of measurements were identified by the study pathologist and later vetted against the final pathologic diagnosis to ensure they represented the appropriate tissues. The data were compiled and analyzed using SAS repeated measures mixed model ($p < 0.05$ significant).

RESULTS: There were 7 total thyroidectomy specimens. There were no differences in AFLM measurements between normal tissue and PTC. Using LRS, differences were detected between normal tissue and PTC for light scattering parameters at both 500 nm and 1000 nm ($p < 0.0021$ and $p < 0.003$, respectively), oxygenated hemoglobin concentration ($p < 0.0066$) and melanin concentration ($p < 0.0211$).

CONCLUSIONS: Optical reflectance imaging technology, specifically LRS, is capable of distinguishing normal thyroid tissue from PTC ex vivo. This modality has the capability to be adapted into a non-invasive platform, which may eventually serve as a novel imaging technique for the evaluation of indeterminate thyroid nodules.

Feasibility of Augmented Reality Glasses for Real-Time, 3-Dimensional (3D) Intraoperative Guidance

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INTRODUCTION: Intraoperative visualization may be significantly enhanced by adding wearable augmented reality technology. The goal of this study is to evaluate the integration of prior 3D ultrasound (US) imaging analysis to a real-time imaging for display as an augmented reality (AR) figure with position tracking (PT) coordination using commercially available AR glasses (Vuzix STAR 1200XLD).

METHODS: We developed and tested a software algorithm for real-time, intraoperative visualization of 3D ultrasound (US) images (Philips iU22 and GE Logiq). The algorithm permits radiologists to mark a radiological volume-of-resection (rVOR) and imports this saved information, to the surgeon's visual field as a real-time surgical volume-of-resection (sVOR), integrating it with the intraoperative 3D US image.

RESULTS: 32 images were analyzed for single tumor detection and 34 for multi-tumor detection; the accuracy between the rVOR and sVOR was calculated. Single tumors ranged from 0.55 to 4.12 cm^3 in volume, and 18 had hypodense features in US. Comparison of the sVOR was within 1.5 mm from the rVOR per axis, providing a volumetric accuracy of 1.2 mm^3 (range: 0.02-12.2 mm^3; SD: 1.8 mm^3; SEM: 0.04 mm^3). Multi-tumor visualization had similar excellent results, with sVOR within 2.5 mm of rVOR per axis, with volumetric accuracy of 5.4 mm^3 (range 1.3-8.5mm^3; SD 2.6 mm^3; SEM 0.08 mm^3).

CONCLUSIONS: This novel technology appears to accurately integrate prior imaging to real-time augmented visualization. Ongoing studies will further evaluate intraoperative feasibility using AR glasses.

Conceptualizing Smartphone Use in Outpatient Wound Assessment: Patients and Caregivers Willingness to Utilize Technology

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INTRODUCTION: Communication technology is transforming healthcare. Using smartphones to remotely monitor postoperative incisional wounds via digital photos has the potential to improve patient outcomes and promote patient-centered care. We surveyed a vulnerable patient population to evaluate current smartphone capability and willingness to adopt this new technology.

METHODS: We surveyed 44 patients over a 1-year period on the vascular surgery service at a tertiary care institution. Descriptive statistics and logistic regression analysis were performed.

RESULTS: 95.5% (42 out of 44) of recruited patients participated. The cohort was 54.8% female, and the mean age was 68.7 years old (range: 41-87). The majority of patients had cellphones (81%) and 21% of these cellphones were smartphones. Younger age was associated with smartphone ownership after controlling for sex ($p=0.017$). 88.1% of patients either owned a smartphone or had a friend or family member who could help take and send photos with a smartphone. 90.4% of patients reported they would be willing to take a digital photo of their wound via smartphone (64.3% daily, 23.8% every-other day, 2.4% less than every-other day, 9.5% not at all). 100% reported they would be willing to answer questions related to their current health via smartphone. Patient's identified several potential difficulties with regard to adopting a smartphone wound protocol including logistics related to taking photos, health-related questions, and coordination with caretakers.

CONCLUSIONS: Our survey demonstrates that an older patient cohort with significant comorbidity is able and willing to adopt a smartphone-based postoperative monitoring program. Caregiver participation will be essential to the success of this intervention.

Mobile Wound Assessment using Novel Computer Vision Methods

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INTRODUCTION: Chronic wounds affect 6.5 million patients in the US, incurring $25 billion healthcare expenditure annually.

Despite the significant clinical burden, wound care is plagued by a general lack of objective evidence to guide management. The problem stems from deficiencies in wound assessment that still relies on crude visual observation. We introduce novel computer vision techniques that will pave way towards an accurate and consistent wound assessment solution.

METHODS: We used a state-of-the-art computer vision programing library (OpenCV) to implement the algorithms on a mobile platform (iPad, Apple Inc.). Wound segmentation is based on the Graph Cut algorithm, which delineates wound borders using quick finger strokes. We employed machine learning methods for tissue classification (ie, granulation, slough, necrotic tissues). Five wound experts analyzed 60 wound images using two methods (manual tracing and algorithm automation) to define wound borders, as well as the three tissue types for each image. Performance speed and consistency were measured.

RESULTS: Compared to manual tracing, algorithm automation performed the task 33% faster, averaging 31.6 seconds/image for both border delineation and tissue classification; inter-rater reliability is also considerably higher. The automation method is highly consistent with the ground-truth tracing, with variability within 10% pixel count.

CONCLUSIONS: The proposed image analysis technique provides an objective and accurate method for real-time wound border delineation and tissue classification—two critical components of wound assessment. Currently, we are incorporating these capabilities with a novel 3-dimensional structure sensor to implement a comprehensive wound assessment solution that also captures wound dimensions and generates 3-dimensional modeling.

Polyester Mesh Functionalization with Nitric Oxide Releasing Silica Nanoparticles Prevents MRSA Colonization and Biofilm Formation In Vitro and In Vivo

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INTRODUCTION: Infection in ventral hernia repair continues to be a significant cause of morbidity after reconstruction. Nitric oxide (NO), a diatomic free radical with no known resistance mechanism, plays a key role in the natural immune response to fighting infection. We sought to study the antibacterial efficacy of a NO-releasing mesh in vitro and in vivo. We hypothesized that a NO-releasing polyester mesh would prevent MRSA colonization and biofilm formation both in vitro and in vivo.

METHODS: A polyester mesh functionalized with NO-releasing silica nanoparticles (NaNO Mesh) was synthesized and characterized using scanning electron microscopy and chemiluminescence NO analysis. In vitro, NaNO mesh was inoculated with 104,106,and 108 MRSA and bactericidal efficacy quantified through tryptic soy broth assay. Utilizing a rat model of ventral hernia repair, in vivo anti-biofilm activity was similarly quantified. Erythema, mesh contracture, and adhesion severity were also assessed.

RESULTS: In vitro, MRSA colony forming units recovered relative to treatment demonstrated a dose dependent response with 99% bactericidal effects at 104 and 106 MRSA. In vivo, bacterial clearance correlated with in vitro results. Treated rats were noted to have less severe adhesions, and fewer had erythema or mesh contracture.

CONCLUSIONS: We have demonstrated the bactericidal efficacy of a NO-releasing mesh on MRSA, both in vitro and in vivo. Creation of a novel class of nanotechnology enhanced prosthetics, enabled with non-antibiotic antibacterial activity may lead to a paradigm shift in treating not only contaminated abdominal wall defects, but perhaps all operations that require use of synthetic prostheses in contaminated environments.

Results of a Web-based Patient Education Program in a Multi-Center University Health System

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INTRODUCTION: The informed consent process for surgery and anesthesia can be overwhelming for patients. To improve understanding and empower patients to make informed decisions regarding the perioperative process, our institution supplemented the process with a web-based platform to educate patients on risks, benefits, and perioperative experience.

METHODS: A video-based patient education and informed consent module (EMMI) was initiated at the University of California Health Sciences campuses and data was collected from 2012-2013. Providers discussed all aspects of informed consent, additionally instructing patients to watch the module. Prior to surgery, each patient was given a survey regarding the utility of the web-based program.

RESULTS: The module was distributed to 8,438 patients and 2,766 (32.7%) were completed. Of those, 1,680 (60.7%) also completed the accompanying survey. 82% watched the video in their home, 89% indicated that the video answered questions that they would have otherwise asked their surgeon, 81% thought the video covered risks that were previously unknown to them, and 79% believed that the module provided them with new information about the procedure. The majority of patients (77%) felt it empowered them to ask questions of their surgeon, and 84% indicated that the availability of this technology improved their opinion of the institution. Patients indicated that the web-based video was the more informative than their provider.