KENT IMAGING

Snapshot O_2t NIR

A Synopsis of *Indocyanine Green Angiography Overpredicts Postoperative Necrosis Compared to Multispectral Imaging*

* Multispectral Imaging (MSRI) = Near-Infrared Spectroscopy (NIRS)

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George RE, Elwood ET, Jones GE. Indocyanine Green Angiography overpredicts postoperative necrosis compared to multispectral reflectance imaging. Plast Reconstr Surg, 2023; 151(3):412e-419e.

CLINICAL DATA:

BACKGROUND:
Indocyanine green (ICG) laser fluorescence angiography is an established tool used to assess adequate tissue perfusion during and following surgical breast reconstructive procedures. SnapshotNIR is a novel tool that parallels the capabilities of ICG with its ability to non-invasively assess tissue perfusion and oxygen saturation (S_tO_2) levels by utilizing near-infrared spectroscopy (NIRS). Earlier work by Dr. Glyn Jones and colleagues, demonstrated in a rodent *McFarlane flap model*, that SnapshotNIR was not inferior to ICG measurements in the ability to predict the development of necrosis in a surgical flap. This current study expands on earlier work and aims to demonstrate the utility of NIRS imaging in predicting the development of necrosis compared to ICG following breast reconstructive surgery in humans.

METHODS:
A total of 53 pre-pectoral direct implant reconstruction cases were performed for this study. All cases received imaging with NIRS and ICG intraoperatively. The S_tO_2 threshold used intraoperatively was an S_tO_2>30% which determined viable tissue and S_tO_2<30% determined non-viable tissue. Once the NIRS threshold was determined, the surgical field consisted of only viable tissue (i.e., all S_tO_2>30%), an ICG image was acquired, the procedure was completed, and patients were followed for at least 2 months post-operatively for signs of tissue necrosis. ICG images were analyzed post-operatively to identify regions of potential tissue necrosis. The performance of NIRS and ICG was then compared to determine how these technologies can predict tissue necrosis.

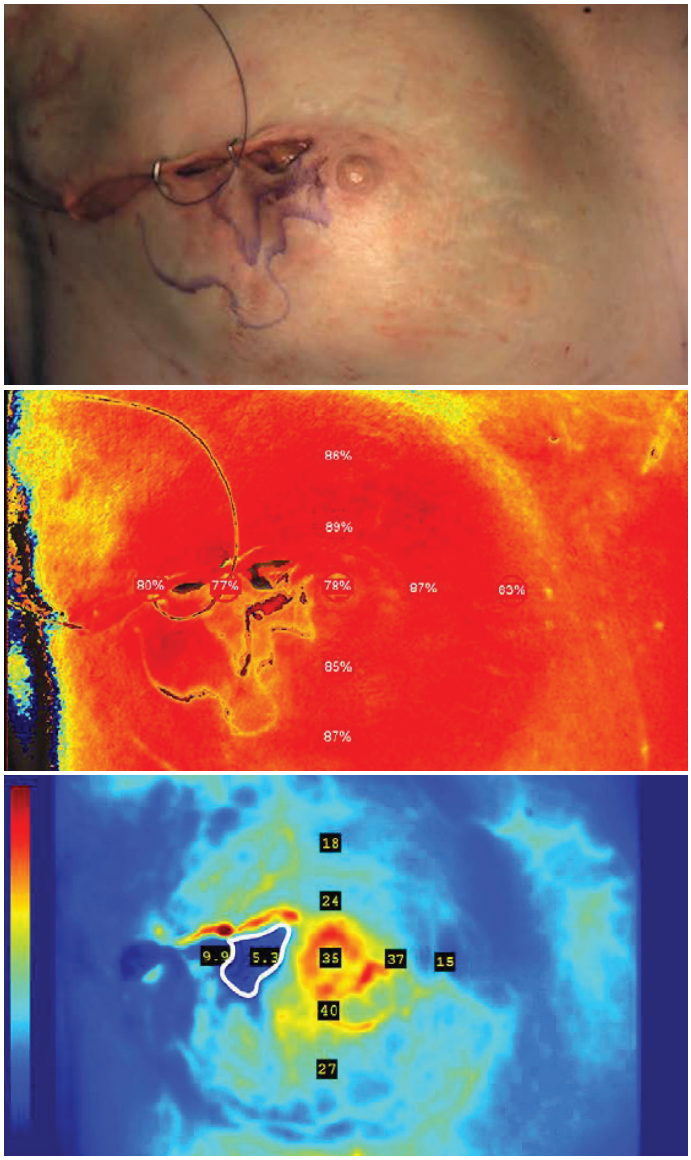

Fig 1. Images showing the appearance of each imaging technology. The clinical image (top), NIRS image (middle) and ICG image (bottom).

OBSERVATIONS:

By trial design, NIRS predicted that all 53 cases had tissue viability post-operatively (i.e., no potential for tissue necrosis). Whereas, the analysis of ICG angiography data determined potential tissue necrosis in 13 cases. Of the 13 cases that were predicted to develop necrosis with ICG, only 2 patients went on to develop necrosis in line with the ICG prediction (i.e., true-negatives, n=2). While the remaining 11, as determined by ICG to develop necrosis, did not experience any post-operative complications (false-negative compared to NIRS, n=11). Although NIRS predicted no necrosis in all cases, 2 patients (false-positive, n=2) did progress on to develop necrosis (which were also identified with ICG to develop necrosis), resulting in NIRS correctly predicting tissue viability in 51 of the 53 cases.

EVALUATION:

The findings from the study support the notion that using ICG fluorescence imaging can over predict the potential for tissue necrosis development compared to NIRS imaging. In addition to this finding, the use of NIRS with SnapshotNIR is further supported by the fully non-invasive, non-contact nature of the device which requires no dyes or injections and allows for repeated serial imaging in short succession. Furthermore, NIRS imaging with SnapshotNIR is cost-effective with no need to incur additional fees associated with dyes, drapes, injections, video processors or illuminators. Lastly, since NIRS has no injections associated with it there is no need for additional support like an anesthesiologist to implement the technology, resulting in a much easier and near-instantaneous assessment of tissue viability.

Variable	Predicted Necrosis	Predicted Viability	P
No. of patients	13	40	
Mean age ± SD, yr	50.8 ± 11.3	50.6 ± 13.1	0.952
Mean BMI ± SD, kg/m2	27.4 ± 5.29	27.8 ± 6.13	0.855
Mean implant volume ± SD, mL	448.8 ± 145.2	514.5 ± 155.0	0.187
Mean mastectomy weight ± SD, g	442.4 ± 239.0	571.2 ± 329.4	0.200
Nipple-sparing	7	24	0.792
Nicotine use	1	5	0.419
Prior radiation therapy	2	2	0.148
Mean body temperature ± SD, °F	97.9 ± 0.915	97.9 ± 0.946	0.9474

Table 1. Demographics of ICG predictions.

Fig 2. Image of SnapshotNIR (the device used in the study).

Imaging Modality	Value (%)
ICG	
Predicted necrosis	13
Incorrectly predicted necrosis	11
Actual necrosis	2
Correct predictions of necrosis	2/13 (15.4)
Incorrect overprediction of necrosis	11/13 (84.6)
Average area incorrectly predicted to necrose (cm^2)	4.7
Predicted viability	40
Actual viability	40
Correct predictions of viability	100%
NIRS	
Predicted necrosis	0
Predicted viability	53
Actual viability	51
Correct predictions of viability	51/53 (96.2)
Incorrect prediction of viability	2/53 (3.8)

Table 2. Accuracy of Imaging.