AbstractID: 7478 Title: Quantitative assessment of tissue toxicity in breast cancer radiation therapy using spectrophotometry and ultrasonic tissue characterization imaging

Purpose: To investigate a novel combination of two non-invasive techniques, spectrophotometry and ultrasound tissue characterization (UTC) imaging, to quantitatively evaluate breast tissue toxicity in radiation treatment.

Method and Materials: Skin and soft tissue injury are the most common toxicities of breast cancer radiation therapy. There is currently no objective means of measuring breast tissue injury in the clinic. We investigated the combination of Spectrophotometry and UTC imaging to examine radiation toxicity. A spectrophotometer (Mexameter® MX) was used to measure the radiation damage to the skin surface and an ultrasound scanner (Ultrasonix® with 14-MHz probe) was utilized to measure the soft tissue changes. Six imaging parameters were computed to quantitatively measure toxicity: melanin, erythema, skin thickness, UTC slope, intercept and midband value. Subjective clinical assessment of toxicity was done by a radiation oncologist. Statistical analysis was performed to correlate spectrophotometer and UTC findings with clinical assessments (RTOG clinical toxicity scale). To date, twelve breast cancer patients were enrolled. All patients received a standard course of radiation: the whole breast received 50-50.4 Gy followed by an electron boost of 10-16 Gy at the lumpectomy site. Each patient received a series of spectrophotometer and ultrasound scans prior to, during and post radiation treatment.

Results: Twenty-eight spectrophotometer and ultrasound scans were performed. The contra-lateral (untreated) breast scans showed good accuracy and reproducibility. Our spectrophotometer and UTC evaluations were consistent with the clinical breast toxicity assessments. We observed significant patient variations. During six-week radiation treatment, patient melanin increases were between 5 to 20%, erythema increases varied from 0% to 100%.

Conclusion: The combination of spectrophotometer and UTC provides effective means of assessing radiation damage to the skin and the underlying breast tissue respectively. This tool becomes increasingly valuable as we evaluate new strategies for breast cancer radiation therapy, such as partial breast IMRT and MammoSite.