AbstractID: 13215 Title: Thermal effusivity changes manifest before skin reactions in locally irriadiated hairless mice

Purpose:
We aim to develop a tool to predict the patient specific risk of moist desquamation as a side-effect of radiotherapy, enabling targeted, timely intervention (re-planning, IMRT, radioprotectors). 3-D thermal tomography is a translational technology, recently developed for non-destructive, non-invasive evaluation of various materials. Our hypothesis is that skin damage will express changes in thermal properties proportional to severity, before the degree of damage is externally observable.

Method and Materials:
Eleven hairless mice were irradiated to a 40 Gy skin dose in a single fraction using an Ir-192 HDR source and a Leipzig applicator, and thermal images were acquired once per day post-treatment. Three-dimensional maps of thermal effusivity were reconstructed, and the thermal effusivity within equivalent regions of interest on the treated and control sides were tracked daily. Based on physical observation, mice were post hoc separated into high-grade (n=6) and low-grade (n=5) reaction groups.

Results:
Mice which developed high grade reactions showed a change in effusivity both earlier (mean 1.7 days post-treatment) and larger (mean 14.6% over days 3-7) than the low grade group (4.4 days, 5.3%). The first visible indication of skin reaction was erythema, which occurred at days 5 and 4.3 post irradiation for the high and low grade groups, respectively.

Conclusion:
The presented pre-clinical study indicates that thermal effusivity changes are induced before skin reactions develop after irradiation, particularly in subjects which would eventually develop more severe skin reactions. The differences in high grade and low grade groups were observable in the thermal effusivity data before there were any visible differences, which do not occur in the clinically useful time range. This suggests potential clinical utility for separating subjects into risk groups by measuring their individual response to their course of treatment, and proactively adjusting accordingly.