

Purpose: To investigate the relationship of clinically observed incidence and severity of acute skin toxicity and the skin dose received by the patient after intensity-modulated radiotherapy (IMRT) or conventional radiotherapy of breast cancer.

Method and Materials: The study population consists of 133 women with early stage breast cancer treated with breast-conserving surgery and radiation therapy. Seventy three patients have been treated using IMRT and the rest 60 were treated using conventional techniques. The dose distributions were calculated retrospectively with the Monte Carlo method for all the patients. Beam phase space was used for dose calculation and the Monte Carlo results were validated by comparing with measurements. The smallest voxel size ($0.9 \times 0.9 \times 2.7 \text{mm}^3$) converted from patient CT scan is used for Monte Carlo dose calculation. Dose to the skin epidermis which is less than 0.1mm thick can be estimated from the dose of the 0.9mm thick voxel based on the experience established from Monte Carlo simulations in a fine layered water phantom for beams with different incidence angle and ultra thin TLD measurements.

Results: There was no desquamation in 42% of IMRT patients while 37% developed dry desquamation and 21% developed moist desquamation. The degree of desquamation was greater for conventional patients compared to IMRT patients - 52% grade 0, 10% grade 1 and 38% grade 2 ($p=0.001$). The IMRT dose distributions were more uniform compared with conventional treatments; 24% of the breast volume received dose more than 105% of the prescription dose for conventional treatment but only 7% for IMRT. Results show that a strong correlation exists between the area of skin receiving high dose and the severity of acute skin reaction.

Conclusion: IMRT is associated with a decrease in severity of acute desquamation compared with conventional radiotherapy. Significant correlation is observed between the acute skin toxicity and the skin dose.