AbstractID: 5151 Title: Prediction of collimator scatter and phantom scatter factors for kilovoltage x-ray radiation fields

Purpose: Kilovoltage x-ray tube therapy beams are used for treatment of keloids and localized superficial malignancies. The purpose of this work is to predict the collimator scatter factor and phantom scatter factor for kilovoltage x-ray radiation fields.

Method and Materials: The radiation field is defined by a variable collimator with or without lead sheets on the patient's skin. Measurement and prediction were done at tube potentials of 60, 100, 120 and 250 kVp. Our approach uses three different sets of field types: square fields defined by the collimator and square and circular fields defined by lead sheets. Two calculation methods are employed: the equivalent field and Clarkson's method. Calculation and measurement were also done for rectangular and irregular shape fields. The relative difference between predicted and measured values is given in the form of percentage error as follows: 100% (predicted value – measured value) / (measured value).

Results: The error ranges between calculated and measured collimator scatter factors for the equivalent field method and Clarkson's method are, respectively, 2.41% and 1.84%. All errors are within ±1% with Clarkson's method. The results show that Clarkson's method is more accurate at predicting collimator scatter factors. The error ranges between calculated and measured phantom scatter factors for the equivalent field method and Clarkson's method are, respectively, 6.3% and 3.5%. The spread of errors is narrower for Clarkson's method. Clarkson's method is therefore more accurate at predicting phantom scatter factors.

Conclusion: Using the measured data for square fields defined by the collimator together with Clarkson's method is recommended. The implementation of this method requires a minimum number of measurements which are acquired during the commissioning of the unit and can be applied in dose calculation for a variety of field shapes and sizes.