AbstractID: 8735 Title: Predicting calibration curves for Kodak XV film using model-based parameters

Purpose: Film calibration is time-consuming work necessary to achieve good accuracy for film dosimetry. This study analyzed the calibration curves varying with the depth, field size and delivery day using model-based parameters in order to predict calibration curves for future use.

Methods and Materials: The Kodak XV film was placed perpendicular to the beam axis in Solid Water phantom (30×30 or 40×40 cm^2). Standard calibration films (one dose point per film) were irradiated at 90 cm SSD with various doses (0-128 cGy) at several depths (0.2, 0.5, 1.5, 5, 10 cm) for 5×5, 10×10, and 20×20 cm^2 fields. Standard calibration responses were compared to an 8-field calibration response (eight doses per film), irradiated at 5 cm depth and 95 cm SSD with doses from 16 to 128 cGy. All films were developed using a Kodak X-OMAT 3000RA Processor and digitized with a Lumiscan75. All curves were fitted with single-target-single-hit model ($y=y_0+a(1-e^{-bD})$). The parameters were compared for different delivered days, calibration methods, field sizes and depths. The method to predict the calibration curve was verified with previous data for 20×20 cm^2 fields.

Results: The daily variation of y_0, a, and b parameters were 2.2%, 2.9%, and 11.4% using the 8-field method. The "a" ratio of standard to 8-field curves was 1.083. The "b" ratio ranged from 0.91 to 0.97 depending on the field size and depth. The "b" ratio decreases with increasing depth below 0.5 cm for the three field sizes. This ratio increases with increasing depths above 0.5 cm except for 5×5 cm^2 field. The local differences between expected and measured calibration curves were within 5%.

Conclusion: Predicting the calibration curve using one calibration film is possible by using a model-based parameter relationship. This method reduces film processing and batch errors without re-acquiring complete calibration curves.