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 cm²). 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 cm² 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 ($y=y_0+a(l-e^{-b})$). 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 cm² 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 cm² 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.