Purpose: To identify and quantify factors that can influence radiochromic film dose response and to determine whether they are suitable for absolute dose measurements.

Methods: The effect of the film storage temperature was investigated by comparing the performance of three lots of Gafchromic EBT2 films (ISP Corp. inc.) stored either at 4°C or at room temperature. The effect of ambient humidity was determined by placing the films in a sealed container in the presence of either a bath of water or drierite desiccant. The resulting ambient humidity was above 80% or below 20% respectively. The effect of the scanning temperature was determined by mounting a custom made temperature controlled reflecting slab on top of the scanner bed. For absolute dose comparisons, the output of a Varian linac was measured using an Exradin A12 ionization chamber.

Results: Storing the film at 4°C improves stability of the film over time but does not eliminate film autodevelopment. Relative humidity variations from 80% to 20% have a strong impact on the optical density (4% difference for an optical density of 0.5) and could introduce dose errors of 15%. During the scanning procedure, the film temperature influences the optical density measured (0.1% per ºC for an optical density of 0.5). When controlling these parameters, the absolute dose difference between EBT2 and the A12 chamber is 3% or less over a dose range of 20-350 cGy.

Conclusions: Humidity is the dominant factor that influences film dose response and must be controlled. The scanning temperature influences the optical density of the film to a lesser degree. Storing EBT2 at low temperature reduces the autodevelopment of the film, but cannot fully prevent it. When controlling for these parameters, absolute dose measurements can be performed to an uncertainty of 3%.

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