Purpose: To establish a film dosimetric method for high-resolution measurement in the dose build-up region.

Methods: Percent depth dose (PDD) curves were measured in water for TomoTherapy using Gafchromic EBT2 films. Depth dose measurements were also performed using Standard Imaging A1SL and PTW PinPoint ionization chambers, as well as a PTW DiodeE detector. The film and detector measurements were then compared to Monte Carlo (MC) simulation data computed using PENELOPE. An in-house support apparatus was constructed to hold the films parallel to the beam central axis while being suspended in the water, simultaneously demarcating the water surface on the film. The films were converted to dose using a corrected net optical density method involving the red and blue color channels of an Epson Expression 10000XL scanner. Film analysis was performed using ImageJ software and MATLAB code developed in clinic.

Results: In our film method, a systematic shift of 1.2mm downstream is seen for the sample of five films, with good reproducibility within the sample (s=0.3mm). The film measurements showed a mean PDD difference of 0.3% (s=0.4%) with a maximum of 1.3% from that of MC between depths of 0.5mm to 20mm. The average film dose measured at the water surface (d=0mm) was 13.1% greater than that calculated by MC. EBT2 film shows much better agreement with MC in the dose build-up region than the ionization chamber and detector measurements.

Conclusions: This study demonstrates the capability of EBT2 films for simple and accurate superficial dose measurements. A suspected reason for the systematic shift in film alignment is attributed to difficulty in determining water surface due to the meniscus that forms at the film.

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