On the Use of a Diode Array for Commissioning of Dynamically-Wedged Asymmetric Fields Generated by Varian EDWs into the Pinnacle® Treatment Planning System

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Purpose/Objective:
To present a validation study of enhanced dynamic wedges (EDWs) implemented into Pinnacle® treatment planning system (TPS) using a diode array, Monte Carlo (MC), and measurements.

Materials/Methods:
Modeling of EDW dose distribution into the Pinnacle TPS is based on a combination of open-field beam data and the Varian “Golden Segmented Treatment Table” (GSTT) unique to each photon beam. To calculate the central axis percentage depth doses and dose profiles for the open and EDW fields in water emerging from the treatment head of the Clinac 2100C/D were fully simulated using the Monte Carlo code and DOSXYZnrc. This cylindrical chamber for comparison with the collapsed-cone convolution (CCC) calculations. The 6- and 10-MV photon beams from a Clinac 2100C/D were measured in virtual water at depths from near-surface to 30 cm for a wide range of asymmetric field sizes and wedge angles using the Profiler-2 diode array system. The EDW output factors for asymmetrical fields were measured in virtual water using a Farmer-type cylindrical ionization chamber placed at a depth of 10 cm on the central axis. In addition, absolute dose on central axis at depths of 5, 10, 15, and 20 cm were measured in virtual water using a Keithley electrometer: 35040. The measurements were performed using a Solid Water Phantom: 40x40x40 cm³. This was used to calculate the central-axis percentage depth doses and dose profiles for the open and EDW fields in water phantom.

Results:
1. The off-axis dose profiles of various EDWs compared with the CCC dose model and MC simulations agreed with measured EDW dose distributions to an accuracy of better than 2%/2 mm.

2. Measured EDW output factors used for MU calculations in Pinnacle® TPS agreed with CCC predictions within 1%.

3. Doses measured on central axis at selected depths in asymmetric EDW fields agreed with the Pinnacle® CCC model within less than 1%.

Conclusions:
The utility of Profiler-2 diode array to measure dose profiles for commissioning EDWs into the Pinnacle® TPS has been demonstrated to acceptable accuracy for clinical implementation of EDWs.