Validation of calculations for electrons modulated with conventional photon multileaf collimators

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Treating shallow tumors to homogeneous doses while minimizing dose to distal critical organs remains a challenge in radiotherapy. Electron beams have finite range, and with proper modulation methods, the dose can be customized to the tumor shape. One promising approach is modulated electron radiotherapy (MERT) using the inherent photon multileaf collimators (MLCs) to create multiple segments. Unfortunately commercial planning systems that provide calculations don’t support electron calculations collimated by MLCs. The purpose of this study was to develop and evaluate calculations modulated electron beams using MLCs. We used the BEAMnrc Monte Carlo (MC) code and DOSXYZnrc MC dose calculations. Dosimetry validation was performed using radiographic film and various chambers. Calculated and measured data were compared. Comparisons demonstrated excellent agreement within 3 %, 1 mm. This study shows accurate calculations for MERT delivered with existing photon MLCs is feasible and allows the opportunity to take advantage of the dynamic leaf motion capabilities and control systems to provide conformal dose distributions.