AbstractID: 10447 Title: A multileaf collimator quality assurance tool for modulated electron radiation therapy

Purpose: Modulated electron radiation therapy (MERT) is an efficient treatment modality for shallow tumors. MERT provides superior target dose uniformity and conformity and spares distal critical structures. We have acquired a portable, motorized eMLC for MERT delivery at our institution. This work aims to investigate a quality assurance (QA) tool to check the leaf position accuracy for the eMLC using aSi-EPID images.

Materials and methods: The motorized eMLC consists of 27 pairs of 6mm width, 2cm thick tungsten leaves. Standard eMLC patterns were designed to test actual leaf positions using EPID images (pixel size:0.392mm) taken with 6MV photon beams. Compared to electron beams, photon beams provide sharper EPID images and therefore more precise leaf location determination. The leaf-end positions were detected using an edge function, calibrated using film data to derive the optimal window-level and contrast. A computer program was developed to check the leaf-end position automatically using the EPID images. The position tolerance was set to 1mm.

Results: Optimal image parameters have been obtained to detect eMLC leaf-end position accurately. Extensive analysis of standard (reference) eMLC fields showed that EPID detected leaf-end positions agreed their actual positions to ±2 pixels. After the eMLC leaves were moved back and forward 50 times the maximum leaf position error was 3 pixels. Online MERT eMLC segmented fields showed higher quality; leaf positions were within 0.5mm of their actual positions. We are using this eMLC QA tool to study the eMLC long-term accuracy.

Conclusion: An eMLC QA tool has been developed to check the leaf-end position accuracy for MERT beam delivery using EPID images. This can be used as a routine QA procedure to ensure the accuracy of the eMLC so as to use a Monte Carlo based dose verification tool with the MUs and leaf sequences from the record and verify system.