AbstractID: 11057 Title: Energy Modulated Electron Therapy using Few Leaf Collimator: Plan Optimization

Purpose: Energy modulated electron therapy (EMET) has been proven to produce optimal plans for shallow tumors. This study investigates automated approaches to the field determination process in generating optimal EMET plans for few-leaf electron collimator (FLEC) based EMET, by generating a large database of pre-calculated fieldlets stored as phase-space files. Fieldlets can be used in an overlapping feathered pattern to reduce the effect of abutting fields, which can contribute to dose inhomogeneities within the target. The optimization results are used to evaluate the effect of abutting fields and feathered fields on target homogeneity. The second part of the study examined a preliminary clinical comparison between FLEC-based EMET and TomoTherapy.

Methodology: This study used a motorized FLEC as EMET delivery device, BEAMnrc and DOSXYZnrc for the dose calculation engines and in-house developed direct aperture optimization (DAO) software. External beams were planned using an abutting and feathered pattern technique. Electron beam energies of 6, 9, 12, and 16 MeV where used for all fields. Target homogeneity was evaluated using the resulting DVH and dose profiles. A TomoTherapy patient was re-optimized using EMET.

Results: The feathered pattern technique conformed closer to the target constraints than the abutting pattern. A simple two-angle EMET plan for a nasal case was not able to conform to the PTV dose constraints as closely as the TomoTherapy plan. Despite the remaining gradients in the PTV, the EMET plan was far superior in reducing the low-dose bath typical for Tomotherapy plans.

Conclusion: DAO using a feathered field and abutting field EMET technique were compared and the former was shown to improve dose homogeneities throughout the target. The strength of EMET relative to Tomotherapy is whole body dose reduction. It is expected that multi-angle, feathered field EMET technique will find an important niche in clinical radiation therapy.