AbstractID: 9205 Title: Verification of accuracy of the Monte Carlo based electron treatment planning system

Purpose: To verify accuracy of the Monte Carlo based electron treatment planning system (Varian Eclipse, eMC 8.1) in modeling blocked electron fields.

Method and Materials:

Dose distributions, for open field with cones sizes $10\times10cm^2$ and $15\times15cm^2$ at standard source-to-surface distance (SSD) and extended SSD (113cm); plus blocked fields of $3\times3cm^2$, $4\times4cm^2$, 5-cm diameter circle, and an irregular field at 100SSD, using various electron energies, measured using MapCheck device, are compared to those generated by eMC algorithm. γ index (3%/3mm) is used for analysis. Inhomogeneous (air and 3mm Al) and angular effects are also evaluated. Output measurements are confirmed with ion chamber.

Results:

There is a good agreement between measured and planned dose distributions for $10\times10cm^2$ and $15\times15cm^2$ cones at 100SSD and 113SSD at the depth of 2.5cm for 9 MeV and 3cm for 12-22 MeV, except eMC algorithm overestimates low dose regions in all energies. For 12 MeV, the algorithm overestimates dose less than 20cGy by 40%. The eMC algorithm can predict dose distributions well when different cutouts are inserted. However, 34% of measured points had γ >1 (TH= 10%) for irregular field with 18 MeV. Obliquity effect has test for 9 and 15 MeV. γ values for 9 and 15 MeV, measured at 105SSD with 10×10 cm^2 cone, are 97.7% and 89.2% for gantry angle of 10° and 94.7% and 91.5% for 20°. The algorithm also shows a good agreement when inhomogenity present. But it underestimates dose under an air cavity for 9 MeV by 13.7%. Dose measured when computed MU delivered is within tolerance.

Conclusion:

Study shows that eMC can model dose distributions for blocked fields and different setup geometries with more than 90% of accuracy. This provides better dose estimation for treatment over critical organs. Further study is need for air cavity interface.