AbstractID: 2812 Title: Aperture Effects in Dynamic Fields

Purpose:

We have measured collimator and phantom scatter factors (S_c, S_p) as a function of field size for a variety of moving slit widths and compared them with static field factors. Dynamic treatment plans were devised to compare the ability of two planning systems to model the aperture effect on dose delivery, especially for small targets.

Materials and Methods:

An 80 leaf Varian 2300cd and a 120 leaf Varian 21ex accelerator were used with 6 MV photons. 0.6 cm^3 ionization chambers were used, for both S_c and S_{cp} measurements. 1-10mm leaf gaps were dynamically scanned across a range of field sizes (4x4-14x40). To mimic the small aperture effect in a treatment plan, we defined a series of cylindrical targets, 1-20 mm diameter by 3cm length and an IMRT plan using Eclipse or Pinnacle^3 was developed to optimally treat them. EDR2 films were taken and used to compare delivered with planned doses.

Results:

The dynamic measurements of S_c and S_{cp} were very similar on the two Varian machines and clearly demonstrated an aperture effect in the S_c measurements of as much as 30% (1mm gap, 4x4 field) which smoothly converged to the static field distribution as the gap was increased. Derived S_p values were approximately independent of gap width, essentially matching the static field cases. Planning system intercomparison of small target doses seem to indicate the Pinnacle^3 system to be slightly better at correctly including aperture effect.

Conclusions:

Conventionally obtained output factors, using the secondary collimators, even extended down to 1-2 cm^2 still do not describe the same head scatter contribution as is delivered by a dynamic aperture. Consequently, dose uncertainty may be amplified in the treatment of single or multiple small lesions using IMRT techniques.