

Purpose:

To obtain an accurate assessment of the relationship between peripheral dose and beam modulation among three commercially available IMRT delivery systems. These systems differ as a consequence of collimator jaw behaviour during IMRT field delivery, with the Varian system using static jaw settings encompassing the fluence from all segments, the Elekta Synergy jaws conforming to individual segment and the Elekta Synergy-S maintaining a maximum collimated opening for all fields independent of MLC segment shape.

Method and Materials:

Fields with various degrees of modulation were created using Pinnacle 7.6C to deliver a uniform dose in phantom. Rotated rectangular apertures were used to engage both MLC leaves and jaws in aperture definition. Fields were characterized by an intensity modulation factor (IMF), defined as the ratio of the IMRT MU to that of an open field delivering the same dose. Multiple ionization chamber measurements were made for each delivery system outside the delivered field in solid water at 10cm depth.

Results:

The Elekta Synergy accelerator delivered the lowest peripheral doses. The Varian produced intermediate peripheral doses and the Elekta Synergy S produced the largest peripheral doses. For an IMF of 8, the peripheral doses 6cm from the field edge were 1.8%, 3.1% and 8.2% for the Elekta Synergy, Varian and Elekta Synergy S, respectively.

Conclusion:

Differences in peripheral dose levels were measured and compared among a number of available delivery systems for IMRT type treatments. As with all radiation treatments, efforts should be made to minimize the dose to normal tissues. The results of this study extend the information available for balancing treatment benefits against the risk of late side effects and secondary cancer induction, particularly when a choice of delivery platforms is available to a center.