

AbstractID: 8995 Title: Planning and Delivery of IMAT: practical considerations of dose rate modulations

Purpose: To investigate Intensity Modulated Arc Therapy plans (IMAT) with variable dose rate single arc and constant dose rate multiple arc approaches; to provide a formula for the prediction of their delivery times, and a metric to evaluate IMAT treatment plan adaptability.

Method and Materials: IMAT plans were generated for localized prostate and oropharynx cancers. For each site, we generated IMAT plans for delivery with variable dose rate single arc and with constant dose rate multiple arcs. Treatment delivery times were modeled mathematically. A maximum leaf motion per unit gantry angle metric is used here to measure the complexity of leaf motions in treatment deliveries, and we proposed to use this metric to assess IMAT plan adaptability. IMAT plans were compared based on dosimetric qualities (target conformality and uniformity indices, dose-volume indices of critical organs), delivery times, and plan adaptabilities. All IMAT plans were generated on Pinnacle 8.1v (Philips Medical Systems) for Varian linacs.

Results: Overall, both IMAT approaches have comparable dosimetric plan qualities, although generating variable dose rate single arc IMAT plans required increased angular sampling to accommodate larger leaf motions, especially when there are two or more target volumes. The delivery time for the single arc is limited by both the gantry rotational speed and the maximum leaf motion between field segments, whereas, the multiple arc approach is generally limited by the gantry rotational speed alone. For the prostate plan, the delivery times are 1.2 minutes and 2 minutes respectively. In the oropharynx case, the single arc and the multiple arc deliveries were similar at approximately 2 minutes. The adaptability indices reflected the complexity of leaf motion in the single arc compared to the multiple arc approach.

Conclusion: IMAT plans with variable and constant dose rate deliveries were evaluated under multiple considerations for potential clinical utilizations.