

AbstractID: 14024 Title: How could fixed-beam Intensity-Modulated Radiation-Therapy exceed SmartArc?

Purpose:

To discover the number of beams required in fixed-beam IMRT to achieve similar plan quality to SmartArc in prostate cancer treatment.

Method and Materials:

Previous study showed that IMRT with as many as 24, uniformly-distributed, beams still could not exceed SmartArc. In this work, we first studied the dose distributions of IMRT and SmartArc plans in a cylindrical water phantom, which provided guidelines for the beam-angle-selection in the patient study. Then, IMRT with respectively 8 to 16 beams and a SmartArc plan were generated for each of five prostate-cancer patients. The 8-beam plan used our Institution's standard configuration; other IMRT plans applied re-selected gantry angles for better rectum sparing. All plans were generated using our in-house developed automatic inverse-planning algorithm and were optimized to at least similar quality as the clinical plan for each patient. Dose distributions in the OARs from each plan were compared.

Results:

The phantom study shows that SmartArc produced generally uniform penumbra in dose profile all around the target; in contrast, the fixed-beam plans resulted in narrower penumbra perpendicular to beam directions whereas wider penumbra at other directions, which indicates that, for IMRT to achieve better sparing of OAR, beams along the tangent direction of the connection between the OAR and PTV should be included. The IMRT plans in the patient study shows obvious dose reduction in the rectum when more beams were selected based on such principle; when the number of beams reaches 16, the rectum starts to receive comparable dose to SmartArc with similar PTV coverage.

Conclusion:

Fixed-beam IMRT is capable of exceeding the performance of SmartArc in prostate cancer treatment as long as 16 or more beams with properly selected gantry angles are used. Considering the superior delivery efficiency of SmartArc, however, SmartArc may still be preferable in clinical applications.