

AbstractID: 5266 Title: Adaptive Radiation Therapy Using Helical Tomotherapy

Purpose: To describe and illustrate the processes required for adaptive radiotherapy (ART) with a helical tomotherapy system.

Method and Materials: ART is a radiation treatment process where the subsequent delivery can be modified using a systematic feedback of the geometric and dosimetric information in the previous fractions. The first step in the process is CT guidance to achieve soft tissue localization. Dose recalculation is used to determine the dose delivered on a daily basis. Deformable image registration is required to place the daily image set, and hence regions of interest, in a common coordinate system. The total doses delivered are accumulated, and the treatment is evaluated relative to the original treatment plan. If significant deficiencies are noted in the dose delivery, plan re-optimization can be performed to compensate for these deficiencies and make the treatment delivery more closely match the intent of the original treatment plan.

Results: Prostate and head and neck cases have been used as clinical examples to test this adaptive strategy. Plan re-optimization can maintain plan quality with no major degradation in most cases if two or three re-optimizations are performed during the course of the treatment.

Conclusions: ART provides a powerful tool to improve the delivery of radiotherapy, especially in situations where there is significant deformation of anatomy during a course of radiotherapy. In addition, it provides a powerful tool to retrospectively or prospectively examine the doses received by regions of interest, and hence, more accurately define tolerance doses for normal anatomy and curative doses for tumors.

Conflict of Interest (only if applicable): Several of the authors are employees of TomoTherapy, Inc., and portions of this research have been funded by TomoTherapy, Inc.