

AbstractID: 10941 Title: TomoAxial for Stereotactic RadioTherapy/RadioSurgery (SRT/SRS)

Purpose: TomoTherapy® technology is routinely used to delivery helical TomoTherapySM treatments (HT) for stereotactic radiotherapy/radiosurgery(SRT/SRS) due to its flexibility of intensity modulation, precise image guidance, and continuous radiation delivery. In this work, we investigated the feasibility of using the TomoTherapy® system with a fixed couch position (TomoAxialSM), for SRT/SRS treatments. TomoAxialSM has the potential to improve longitudinal penumbra and reduce the delivery time.

Material and Methods: We modified the TomoTherapy® planning system so that the couch position is fixed at the center of the tumor. For TomoAxialSM treatment planning, the field width is custom-selected so that 90% of the longitudinal beam profile, considering the beam divergence, covers the whole tumor region. We studied 5 SRT/SRS cases, including both intracranial and extracranial cases, with total tumor length from 0.6cm to 4.5cm. Using the same prescription and constraints, we optimized and compared plans for three delivery modes, TomoAxialSM, HT with field width 1cm (HT1) and HT with field width 2.5cm (HT2.5). Both 3D dose distribution and DVHs were used for plan evaluation. We calculated the delivery time for each mode based on its optimized plan.

Results: For SRT/SRS with tumor size up to 4.5 cm longitudinally, TomoAxialSM plans have comparable plan quality to HT1 but the delivery time of TomoAxialSM treatments is only 14%-35% that of HT1. While compared with HT2.5, TomoAxialSM has much better plan quality with delivery time only 32% -54% that of HT2.5.

Conclusions: For the 5 SRT/SRS cases with longitudinal target extension up to 4.5 cm studied, TomoAxialSM plans with custom field width have comparable or superior plan quality to helical plans and TomoAxialSM plans have significantly reduced delivery time: for SRT/SRS plans with dose of 10Gy /fraction, the delivery times are generally around 5 minutes. Clinical implementation of TomoAxialSM treatments is underway.