

AbstractID: 11387 Title: Pulsed reduced dose-rate radiotherapy on a helical Tomotherapy unit

Purpose/Background: Pulsed reduced dose-rate radiotherapy (PRDR) re-irradiation has the potential to reduce late normal tissue toxicity while yielding nearly identical tumoricidal effect. A typical method using a conventional linac is to deliver a series of 20cGy pulses separated by 3-minute intervals to give an average dose-rate of 6.67cGy/min. Dissimilarly, PRDR done via helical tomotherapy would not require an interlude if the sub-fraction time is approximately 3 minutes, since the top of the PTV will have had a 3-minute “rest” by the time the bottom is finished. However, intrinsic MLC leaf open time (LOT) limitations in tomotherapy deteriorate plan quality and deliverability when attempting to deliver very low doses (<40cGy). We investigated various means to overcome this limitation to deliver PRDR with a helical tomotherapy device.

Method and Materials: Two different cases (central and non-central targets) were studied. Plans were generated with different combinations of jaw-width (1.05cm and 2.5cm), pitch (0.43 and 0.86), and modulation factor (MF) (1.5 and 2.5) to administer eight 25cGy sub-fractions as part of 2Gy to PTV for 20 fractions, giving a total of 40Gy dose. Plans were compared using dose-volume histogram (DVH), homogeneity indexes (HI), conformation number (CN), and treatment time. DQA for each plan was performed to assess deliverability.

Results: Clinically acceptable DVHs with a ~3 minute treatment duration are achievable with several combinations of jaw width and pitch. **However, dose discrepancies were >3% in those plans where** average LOT is <70msec, which falls into the high-error region in the MLC latency curve. The combination of small jaw-width (1cm), low MF (1.5) and large pitch (0.86), as well as **using directional blocks** gives clinically acceptable results in dose distribution, beam-on time, and delivery accuracy (<3%).

Conclusion: With a careful selection of planning parameters, PRDR re-irradiation is deliverable in an efficient fashion on a tomotherapy unit.