Purpose: A three-dimensional conformal radiotherapy (3DCRT) has been recently introduced to helical tomotherapy, allowing the user to plan and treat patients that do not require sophisticated IMRT planning and delivery. This study aims to test treatment planning on this modality and evaluate its performance by comparing to conventional LINAC-based 3DCRT planning.

Methods: Four clinical cases (whole brain, extremity, lung, and partial breast irradiation) were retrospectively selected from a Pinnacle planning system (Philips Medical System, Fitchburg, WI) and planned on Tomotherapy (Accuray Inc., Sunnyvale, CA). Computed tomography (CT) images together with contours of target and critical structures were exported from Pinnacle to the Tomotherapy planning station. The same prescription and fractionation scheme was adopted. The pitch factor for all clinical cases was set to 0.287. A 2.5 cm jaw was employed except in the lung case the field size was set to 1.0 cm for better dose conformity. The dose grid size was chosen to be half of that of the planning CT images. On Pinnacle 100% prescription dose was delivered to the treatment isocenter while on Tomotherapy it was stipulated that at least 95% of the target volume received the prescribed dose. Comparison between two planning strategies was performed, in terms of dose volume histograms (DVH), dosimetric and radiobiological parameters, for plan quality assessment.

Results: Comparison of DVHs reveals that up to 25% healthy tissue sparing in volume can be accomplished with Tomotherapy 3DCRT while the same target coverage is ensured. Dosimetric and radiobiological indices between Tomotherapy and Pinnacle planning agree to within 3.0%. Additional beam modifiers and non-coplanar beams associated with LINAC-based 3DCRT are not needed on Tomotherapy, making it more favorable.

Conclusions: Tomotherapy 3DCRT has similar dosimetric performance when compared to conventional LINAC-based 3DCRT while it is substantially easier to use.