

Purpose: Intensity modulated radiation therapy (IMRT) can be delivered using several different techniques. The present study compares dosimetric characteristics of three commercial IMRT planning and delivery systems, i.e., helical tomotherapy (TOMO), sequential tomotherapy with MIMiC (MIMiC) and dynamic multileaf collimated IMRT (DMLC-IMRT).

Method and Materials: IMRT plans for three common clinical cases, head-and-neck (HN), brain and prostate cancers, were generated using respective RTOG protocols 9406, 9803 and H0022 as guidelines. For each case, multiple (more than four) plans were produced for each technique using different strategies by adjusting constraints and/or parameters such as beam width, modulation factor, the number of fields, etc. Dosimetric indices were used as figures-of-merit to evaluate the plans. These indices include coverage index (CI), overflow index (OI), sparing index (SI), and overall conformal index (COIN), where $COIN=CI \times OI \times SI$. The plans for each technique were compared among themselves to determine the best plan of each technique which in turn was used for the comparison of different techniques.

Results: For the HN case, the COINs for TOMO, MIMiC and DMLC-IMRT were 0.333, 0.064 and 0.305, respectively. TOMO had highest SI, but DMLC-IMRT had highest CI and OI. MIMiC plan performance was poorer than TOMO and DMLC-IMRT for the HN case. The COINs for TOMO, MIMiC and DMLC-IMRT were 0.471, 0.616 and 0.685 for the brain case, and 0.304, 0.487 and 0.554 for the prostate case, respectively. DMLC-IMRT had the highest COIN for both the brain and prostate cases. TOMO had best coverage for the brain case while DMLC-IMRT had best coverage for the prostate case.

Conclusion: IMRT plan optimization is a process to balance and compromise between target coverage and normal tissue sparing. The three techniques may result in different plans for similar constraints. Using different strategies, all three techniques produced clinically acceptable treatment plans for all cases.