A B S T R A C T

Aim: The aim of our study was the dosimetric and physical evaluation of the CK and IMRT treatment plans for 16 patients with localized prostate cancer.

Background: Intensity modulated radiation therapy (IMRT) is one of the recent technical advances in radiotherapy. The prostate is a well suited site to be treated with IMRT. The challenge of accurately delivering the IMRT needs to be supported by new advances such as image-guidance and four-dimensional computed conformal radiation therapy (4DCRT) tomography. CyberKnife (CK) provides real time orthogonal X-ray imaging of the patient during treatment course to follow gold fiducials installed into the prostate and to achieve motion correlation between online acquired X-ray imaging and digital reconstructed radiographs (DRRs) which are obtained from planning computed tomography images by translating and rotating the treatment table in five directions.

Methods and materials: Sixteen IMRT and CK plans were performed to be compared in terms of conformity (CI), heterogeneity indices (HI), percentage doses of 100% (V100), 66% (V66), 50% (V50), 33% (V33) and 10% (V10) volumes of the bladder and rectum. Dose-volume histograms for target and critical organs, (CI) and indices (HI) and isodose lines were analyzed to evaluate the treatment plans.

Results: Statistically significant differences in the percentage rectal doses delivered to V10, V33, and V50 of the rectum were detected in favor of the CK plans (p values; <0.001, <0.001 and 0.019, respectively). The percentage doses for V66 and V100 of the rectum were larger in CK plans (13%, 2% in IMRT and 21%, 3% in CK plans, respectively). Percentage bladder doses for V10 and V33 were significantly lower in CK plans [96% in IMRT vs 48% in CK (p < 0.001) and 34% in IMRT vs 24% in CK (p = 0.047)]. Lower percentage doses were observed for V50, V66 of the bladder for the IMRT. They were 5.4% and 3.45% for IMRT and 13.4% and 8.05% for CK, respectively. Median CI of planning target volume (PTV) for IMRT and CK plans were 0.94 and 1.23, respectively (p < 0.001).

Conclusion: Both systems have a very good ability to create highly conformal volumetric dose distributions. Median HI of PTV for IMRT and CK plans were 1.08 and 1.33, respectively (p < 0.001).

Keywords: Prostate, IMRT, CyberKnife, Radiosurgery