

TO REDUCE DOSE INHOMOGENEITY AT NECK JUNCTION BY USING A ROTATING COLLIMATOR ON IMRT-TREATED HEAD-AND-NECK CANCER PATIENTS

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Purpose : To improve dose homogeneity at the neck junction in head-and-neck cancer radiotherapy, we employ a rotating collimator and compare the differences between it and conventional intensity-modulated radiation therapy (IMRT).

Materials and Methods : CT images for 10 head-and-neck cancer patients previously treated with SIHB technique in our clinic were used for this planning study. We generated a new CR IMRT in each case and compared the differences between the conformity index and homogeneity index. The new planning technique also used 9 beams with equally-spaced gantry angles but only for the neck above the shoulder. We made 9 beams above the shoulder with a slightly lower field border (normally 3 to 5 mm), to have a built-in feathering. Three of the nine beams treated the entire neck, including the lower neck and supraclavicular lymph nodes. Only three beams are required to split and therefore the total number of fields is 12. The AAPM TG-40 recommended an accuracy of field size and jaw symmetry calibration to be within 2 mm. Hence, for an accelerator operating within these guidelines, two abutting fields can overlap or gap up to 2 mm. Field mismatches of ± 1 mm and ± 2 mm because of imperfect jaw/MLC calibration were simulated. We used film to measure junction inhomogeneity.

Results : The new technique could be used to successfully generate IMRT plans for head and neck cancers. Both conventional IMRT and CR IMRT had almost the same conformity index and homogeneity index. Upon evaluating the dose distribution of critical organs, we found all of them were within the tolerance ranges. Film measurements showed that dose inhomogeneities that resulted from 1 mm, 2 mm, 4 mm junction area as jaw/MLC calibration errors were reduced from as large as $\pm 12\%$, $\pm 22\%$, $\pm 41\%$ with the single-isocenter and half-beam (SIHB) technique to less than $\pm 6\%$, $\pm 8\%$, $\pm 12\%$ with this newly developed technique.

Conclusion : Compared with the conventional SIHB technique, the new technique provides superior dose homogeneity in the abutment region between the supraclavicular and head-and-neck IMRT fields. With a modulating lower border of 9 fields, the feathering mechanism substantially reduces dose inhomogeneities that result from imperfect jaw/MLC calibration.

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Key words: IMRT, Head-and-neck, Field match