

ABSTRACT

BACKGROUND

Severe complications, such as eye damage and dysfunction of salivary glands, have been reported after radiotherapy among patients with head and neck cancer. Complications such as visual impairment have also been reported after proton therapy with pencil beam scanning (PBS). In the case of PBS, collimation can reduce the penumbra of the surrounding normal tissue in the low energy region of the proton beam. In the current study, we examined by how much the dose to normal tissue was reduced by using a multi-leaf collimator (MLC) with intensity-modulated proton therapy (IMPT) among patients with maxillary sinus cancer.

METHODS

Computed tomography findings of 26 consecutive patients who received photon therapy at Okayama University Hospital were used in this study. We compared D2% of the region of interest (ROI; ROI-D2%) and the mean dose of ROI (ROI-mean) with and without the use of an MLC. The organs at risk (OARs) were the posterior retina, lacrimal gland, eyeball, and parotid gland. IMPT was performed for all patients. The spot size was approximately 5–6 mm at the isocenter. The collimator margin was calculated by enlarging the maximum outline of the target from the beam's eye view and setting the margin to 6 mm. All plans were optimized with the same parameters.

RESULTS

The mean of ROI-D2% for the ipsilateral optic nerve was significantly reduced by 0.48 Gy, and the mean of ROI-mean for the ipsilateral optic nerve was significantly reduced by 1.04 Gy. The mean of ROI-mean to the optic chiasm was significantly reduced by 0.70 Gy. The dose to most OARs and the planning at risk volumes were also reduced.

CONCLUSIONS

Compared with the plan involving IMPT without an MLC, in the dose plan involving IMPT using an MLC for maxillary sinus cancer, the dose to the optic nerve and optic chiasm were significantly reduced, as measured by the ROI-D2% and the ROI-mean. These findings demonstrate that the use of

an MLC during IMPT for maxillary sinus cancer may be useful for preserving vision and preventing complications.