

Purpose: The respiratory organ motional effect on the dosimetric accuracy in IMRT was analyzed and the function of RPM gating system in reducing the organ motional effect was evaluated with the respiration simulating phantom.

Method and Materials: The phantom system which can simulate respiratory organ motion was manufactured. Total 4 IMRT plans for liver cancer were evaluated in the 3 cases of situation that were a static status, a no-gated free-breathing motion and a gated radiotherapy with RPM system. The motional range was set 1.6 cm considering the real movement of tumor in the fluoroscopic images and respiratory movement cycle was fixed to 5 sec. The dosimetric accuracy of all the fields of IMRT plan was analyzed with MapCHECK (SunNuclear, USA) device laid on the moving table of the phantom. The comparison analysis between a dose distribution in plan and a real one in treatment was done with a coronal dose distribution in the depth of diode detector arrays in the MapCHECK. The decision of pass in each measurement points was verified by a gamma evaluation in the criteria of 3 mm distance and 3% dose.

Results: The average pass rates in each motional status are 98.4% at static case, 49.9% at motional case and 97.9% at gated IMRT case. These data shows that the RPM gated radiation therapy decreased a large amount of dosimetric error due to the organ motional effect in IMRT.

Conclusion: The considerable dosimetric error due to organ motion was occurred even in the motional range (1.6 cm) of normal breathing condition. This organ motional error could be reduced with a RPM gating system and the gated radiation therapy with a proper gated phase should be performed for the IMRT of abdominal lesions which are moved by a respiration.