

Evaluation of the Gating System Using Moving Phantom in CyberKnife

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Lung, pancreas, liver, and other abdominal tumors can move as much as 35 mm with breathing. If the motions is not controlled or compensated during external beam radiotherapy, a significant volume of healthy tissue will be irradiated unnecessarily. The simplest solution is breath-holding, if it can provide a consistently reproducible position for the tumor. We treated the body radiosurgery using the breath-holding technique. This technique is a manual breath-control method. It is a difficult treatment for patients and therapist. To overcome the problems, we installed the gating system in a CyberKnife. In this gating system, we found that if position of the main body change, we did not able to get the gating point. In gating technique, it is important things to match the target localization point with gating point, and to maintain the stable respiration. For evaluation of this system, we developed the moving phantom. This phantom consisted of several parts; moving target part, speed control part and acrylic main body. This phantom can adjust moving speed and displacement. We inserted the gold marker at moving target part. We used laser sensor for gating signal. For estimation of accuracy, we performed the film dosimetry. We measured for various target speed and displacement. We adjusted the respiratory rate in 8~25/min and displacement in 1~3 cm. We analyzed data as the target movement with gating, the target movement with no gating, and the no movement with no gating. The reference data is the no movement with no gating. The total average error of the target movement with no gating is 15~20 mm about various case. The target movement with gating is 1~2 mm about various case.

Keywords : Cyberknife, Gating System, Moving Phantom