

Quality Assurance Procedure for Synchrony Respiratory Tracking System of CyberKnife System

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Abstract

The purpose of this quality assurance procedure is to verify the treatment accuracy for Synchrony Respiratory Tracking System of CyberKnife system. This procedure can give us dose delivery accuracy estimation in organ moving in the clinical treatment. The CyberKnife system includes a 6MV medical linear accelerator mounted on a robotic arm, a target locating system, a 6D automatic motion couch, and an infrared Synchrony Respiratory Tracking System. Motion phantom can simulate patients' breathing cycle which includes two kinds of movements, abdomen surface motion and inside organ motion. Film (Gafchromic dosimetry film-media type MD-55) and ball-cube are used for the routine procedure of quality assurance. IR-synchrony camera array and IR-tracking markers can monitor patient's chest and abdomen surface motion during respiratory cycle. The results of End to End test could give us the error estimation of this system. The accuracy error (total targeting error) of quality assurance procedure for Synchrony Respiratory Tracking System of CyberKnife system must be smaller than 1.5 mm. The data of our quality assurance procedure is smaller than 1 mm. The total targeting error of the system with this QA procedure is obviously smaller than the standard value (p value of the t-test is smaller than 0.005 with P = 0.0016). Mechanical error and personal technique may affect the accuracy of the Synchrony Respiratory Tracking System. The routine procedure of quality assurance shows, the Synchrony Respiratory Tracking System of CyberKnife system can reduce the influence of breath to ideal level, and can compensate the displacement error causing by breathing motion efficiently.

Keywords: Synchrony respiratory tracking system, Motion phantom, Ball-cube, End-to-End test