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Accuracy Evaluation of the Beam Center from the Planning Target Position

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Purpose: To evaluate the accuracy of the beam center from the planned target throughout the whole treatment process of CT scanning, planning and beam delivery. Methods and Materials: Movable lasers (Gammex, RMI) for a CT simulator (GE, QX/i) were adjusted using a QA phantom from TG66. As a target, a tiny (<0.3 mm) metal fragment was attached to a Gafchromic EBT film which was inserted between two acrylic slabs with fiducial marks (independent from the target) for later setup. The slabs were scanned with a slice thickness of 1.0 mm. On Pinnacle3, MLC fields of 1.0 mm opening for the target were planned for a set of gantry, collimator and couch angles. After verification of the laser alignment in the treatment room, the phantom was irradiated with 6 MV photon beams (Varian, 21EX) and the films were analyzed. Results: Until planning, the beam center was accurate within ±0.5 mm (perpendicular to axial) and ±0.1 mm (in axial) except the positioning error of fiducial marks. Film analysis showed that with the couch angle of zero, the beam center was within 1 mm from the target in both transverse/vertical and longitudinal directions of couch, respectively. The discrepancy gradually increased up to 2 mm when the couch angle is 90/270 with the gantry downward. Conclusions: A relatively minute error was estimated for fiducial marker positioning and the following CT scanning and planning. Most errors of beam center from the target were attributed to the linac's inevitable mechanical inaccuracy. Accuracy evaluation of the beam center from the target is essential for the radiotherapy planning, especially for the extracranial SRT.

Keywords : QA, Beam Center, Accuracy Evaluation