AbstractID: 10503 Title: Computerized Method for Quantifying the Alignment of Mechanical or Digital Graticules Relative to Radiation Fields Using Electronic Portal Images

Purpose: Accurate alignment of graticules in MV or kV portal images is important in radiation therapy, especially in sterotactic radiosurgey. A quick computerized method is developed to quantify the small misalignments of the MV and kV graticules, in either mechanical or digital form, from the radiation central axis (CAX) at selected gantry angles.
Method and Materials: A metal ball was placed approximately at a Varian linac's isocenter. The center of the ball served as a reference point in space. A pair of MV and kV portal images was taken at each cardinal gantry angle (0, 90, 180, and 270 degrees). A 10×10 cm^2 square radiation field was used for MV portal images. The images were processed to obtain the following informaiton: center of ball, radiation CAX, center of mechanical graticule, center of MV digital graticule, center of kV digital graticule. Hough transform was used to detect automatically the linear or circular features in these images. The accuracy of image analysis algorithms was tested with numerically simulated images.
Results: On test images, detection error of ≤ 0.2 pixels (or 0.05 mm for pixel size of 0.26 mm) was achieved in determining the center of ball, the radiation CAX, and the center of mechanical graticule. The centers of MV or kV digital graticules were defined at the center of imager detector array. For the linac studied, the gantry-averaged displacements of MV mechanical graticule, MV digital graticule, and kV digital graticule were 0.52 mm, 1.07 mm, 0.63 mm, respectively, from the radiation CAX.
Conclusions: An efficient method was presented to quantify the small misalignments of mechanical or digital graticules from the radiation CAX. Systematic displacements of the graticules may be compensated either mechanically or digitally. This method is useful in stereotacic radiosurgery programs that require high spatial accuracy in patient setup.