Purpose:In this study we proposed an application of the Hough algorithm for an EPID-based Winston-Lutz (WL) test.

Methods:The WL test was performed by using an amorphous silicon (a-Si) electronic portal imaging device (EPID) of Novalis Tx at 6 MV beam energy. The images from the EPID were stored in DICOM format. Due to the low gradient of pixel intensity of the obtained images, a Contrast-Limited Adaptive Histogram Equalization (CLAHE) was applied to enhance their contrast. The second step was the application of a circular Hough transform to the EPID images to calculate the centers of the cone and the ball. The calculation of the two centers was done separately by applying twice the Hough transformation with two different radii ranges [rmin, rmax]. Finally, given the resolution of the image in 0.39 mm/pixel, the calculated distance in pixels was transformed to a physical distance in mm at the isocenter. For evaluating the accuracy of our method we repeated the WL with GAFCHROMIC EBT2 film which was further processed with the RIT 113 software.

Results:A good agreement between our method and the film-based method was achieved. Particularly an average discrepancy of 0.06 mm was obtained compared to the results of the RIT 113.

Conclusions:An EPID-based Winston-Lutz test has been developed by applying a circular Hough transform. The accuracy of our method compared to the film-based method was demonstrated. The setup and implementation were faster and the acquisition of the data was easier than the traditional film-based method.