Purpose

To develop a quality assurance procedure for the multileaf collimator (MLC) in volumetric modulated arc therapy (VMAT) beam delivery.

Method and Materials

A general pattern for MLC QA is proposed in this study to test the interaction between gantry speed and the MLC traveling speed on different linacs for VMAT dose delivery. An independently mounted film was used to catch the entire arc movement. To utilize similar concept for picket-fence test, we divided the gantry 360degrees into two counterclockwise fields, 180 to 0 and 0 to 180degrees, and dynamic abutted segments were delivered on every 15degree gantry rotation. The MLC traveled 3cm distance in each segment dynamically, from starting opening at 0 and ending at 3cm. Starting point for each 15 degree segment was from 0th, 3rd, 6th, 9th…to 36th cm with MLC bank B moving. But each segment was delivered twice, first in counterclockwise and second time in clockwise directions with MLC travelling in opposite directions with starting point 3rd, 6th, 9th, 12th …to 39th cm with MLC bank A moving. These two fields had the same MLC segments. The accumulated dose on film was analyzed.

Results

With perfect speed combination between gantry and MLC, the total dose profile along the leaf-motion direction is uniform. All leaves in each bank move together that will be reflected in the width of the strip and conjunction lines, while one leaf is out of range by 1mm, the profile will show non-uniform profile only at that leaf position. The conjunction lines of each segment also represent the reproducibility of the combination of gantry and MLC positions.

Conclusion

We have investigated a quality assurance procedure for the MLC used in VMAT treatment. It can detect the mismatch between gantry speed and MLC motion to quantify the accuracy of VMAT dose delivery.