INTRODUCTION

For some LINACs like Elekta SynergyS, Jaws are open at a fixed field size. Non-used MLC leaves have to move to under the jaws during the segments of each IMRT field to minimize the leakage. The trade-off is increased MLC traveling and hence longer delivery time. In this study a





Figure 2.

script was written in the Pinnacle planning system to let non-used leaf pairs within the PTV aperture stay as 2mm-wide gaps distributed through the aperture. MLC gaps were automatically generated after the final optimization of a treatment plan, and then the dose was recomputed at 2mm dose grid resolution. Implementation of this technique would bring minimal impact on the clinical workflow.

RESULTS

Film Dosimetry EBT film was used to measure the dose through two small MLC gaps, one gap on central axis (2mmx8mm) and the other off axis (2mmx4mm) (Figure 1). An AP beam of 800 MUs was shot on a phantom made of water-equivalent material with an EBT film sandwiched 4cm deep in the phantom (Figure 2). The difference between measured dose and dose computed at 0.5mm dose grid resolution was < 3% at the center of the MLC gap field. An example of dose comparison between measured and computed is shown in Figure 3. Two data sets were well matched as the corresponding isodose lines align with each other.

Patient Dosimetry DVHs between the plan with and without MLC gaps for one IMRT case are shown in Figure 4. In this case the dose increase is nearly invisible. For other cases, the dose to the PTV can be up to 1-2% hotter. However, the dose increase to all critical structures is minimal or even negligible.

CONCLUSIONS

An effective method was developed to improve IMRT beam delivery efficiency, which is especially useful for LINACs with fixed jaws. Significant time saving on beam delivery (~27%) can be expected, with minimal impact on the patient dosimetry or on the clinical workflow.



Figure 3. Comparison of the measured and computed dose for the on-axis gap.



Figure 4. Comparison of the IMRT plan generated with (dotted line) and without MLC gaps (solid line).