A treatment plan was constructed using 12 different MLC defined sub fields. The collimator rotated from 0-165° in 15° increments to deliver each sub field of 6 MV beam energy. The delivered MLC plan was compared to the original MLC plan from the treatment planning system (TPS) using gamma analysis. In addition, dosimetry measurements from the MLC plan were compared to those from a brass grid block.

A Novel Approach to Multi-leaf Collimator Based Spatially Fractionated Radiation Therapy

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INTRODUCTION

Spatially fractionated radiation therapy (SFRT) has very promising results for the treatment of bulky and/or radio resistant tumors. The two ways to implement treatment is through a solid grid block, or multi-leaf collimators (MLCs). MLC based delivery makes it easier to customize treatment plans, is more cost effective than the solid grid applicator, and has the advantage of not having to lift the heavy (48 lb.) block into position on the gantry. This investigation utilizes a novel delivery method using 12 static MLC patterns delivered by rotating through various collimator angles. The dosimetry and overall feasibility of this MLC technique compared to that of the solid brass grid block applicator and other methods of MLC delivery are explained.

AIM

The purpose of this work is to develop a more cost and time effective way of implementing spatially fractionated radiation therapy in the clinical environment.

METHODS

- A treatment plan was constructed using 12 different MLC sub fields (*figures 1 and 2*)
- The collimator rotated from 0-165° in 15° increments to deliver each sub field of 6 MV beam energy
- The delivered MLC plan *(figure 3)* was compared to the original MLC plan from the treatment planning system (TPS) using gamma analysis *(figure 4)* from the SNC MapCheck patient software.
- Additionally, peak to valley measurements were taken along the various axis's from the MLC plan *(table 1).*

RESULTS

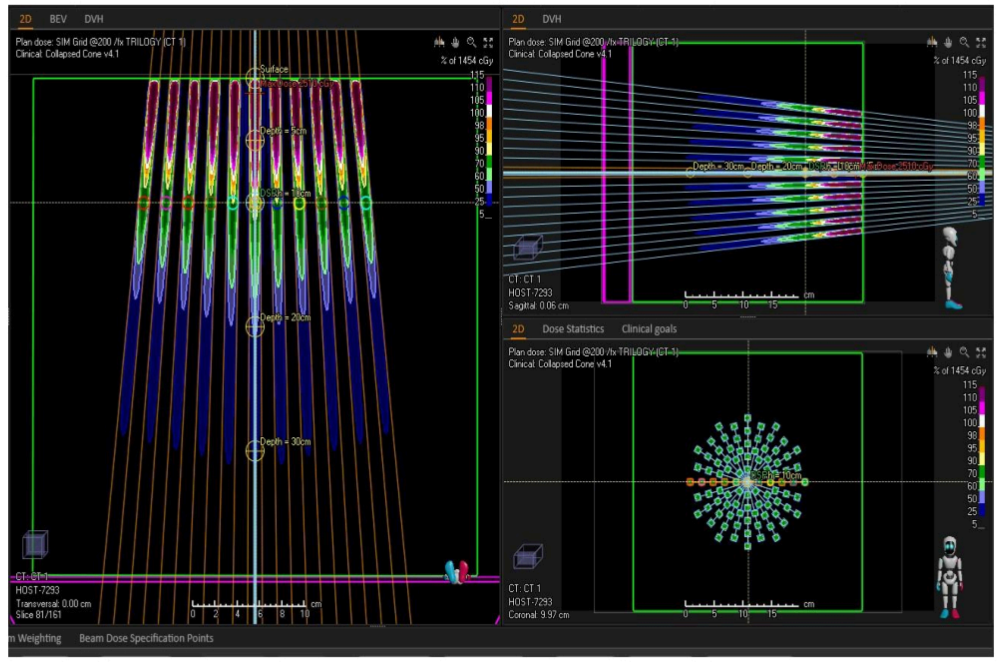

Figure 1. Twelve field treatment plan with rotating MLC patterns at 15° increments

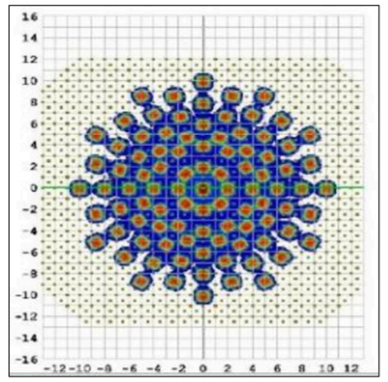

Figure 2. Calculated MLC plan

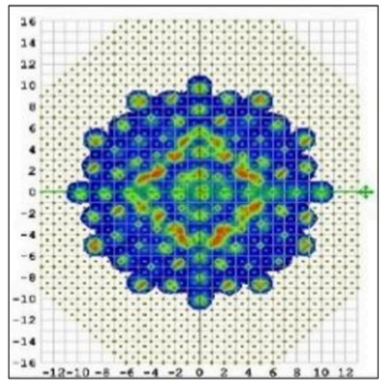

Figure 3. Delivered MLC plan

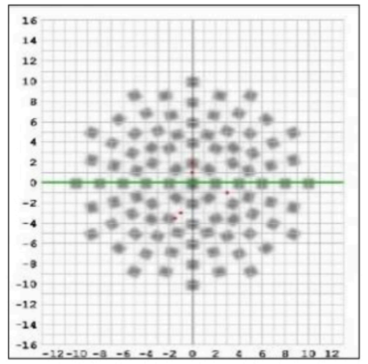

Figure 4. Gamma analysis between the calculated and delivered MLC plans. 99% Passing rate at 2%/ 3mm

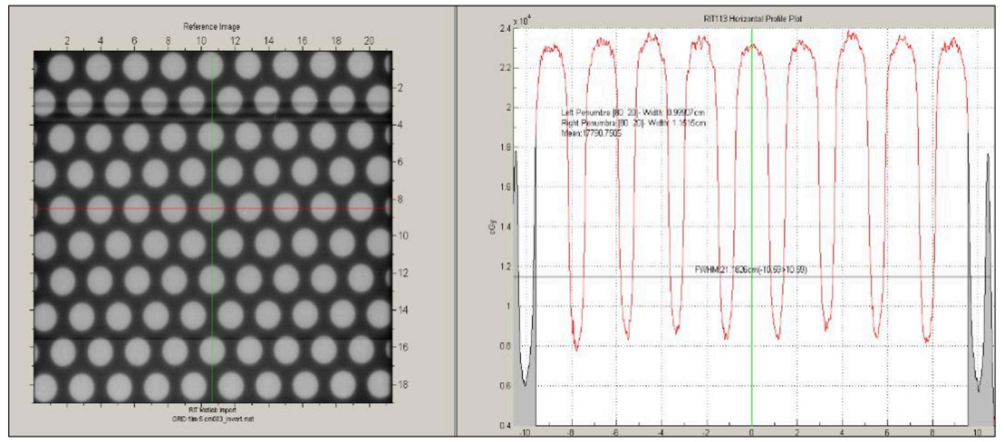

Figure 5. Film analysis of solid brass grid block. Horizontal beam profile shown with a peak to valley ratio of 3.0 (33%).

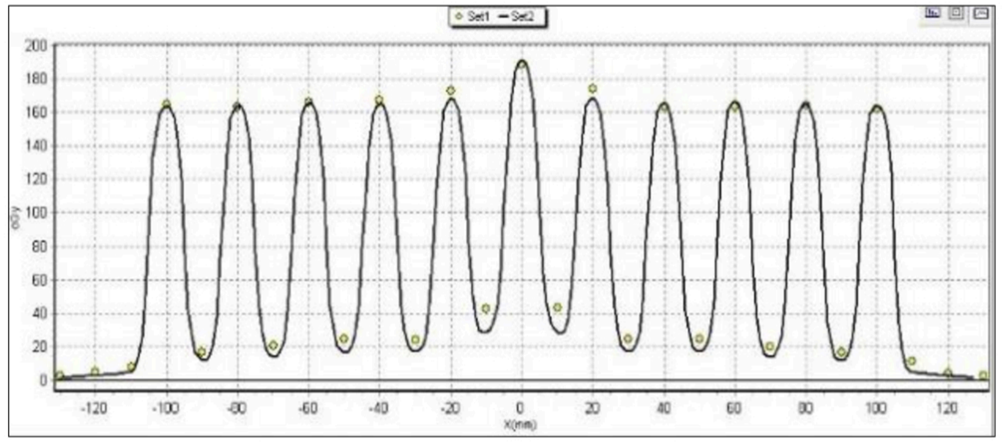

Figure 6. Horizontal beam profile of MLC based SFRT. Set 1 refers to the delivered dose while set 2 refers to the calculated dose.

Peak to Valley Ratios from MLC Plan	
Vertical	7.09 (14.1%)
Horizontal	6.59 (15.2%)
(-) Diagonal	5.65 (17.7%)
(+) Diagonal	5.72 (17.5%)

Table 1. Peak to valley ratios along the various axis's of the delivered MLC plan

CONCLUSIONS

This investigation shows that a SFRT plan is deliverable by rotating MLCs at various angles. Rotating MLC patterns deliver dosimetrically similar profiles to that of the brass grid, are more efficient and customizable than other MLC techniques, and provide a cost-effective advantage over lifting the brass grid block into position.

ACKNOWLEDGEMENTS

Thank you to all of the medical physicists in the radiation oncology department at Rhode Island Hospital, specifically Dr. Gene Cardarelli, Michelle Schwer M.S., and Dr. Eric Klein for their support and mentorship throughout the duration of the project.

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