

Interplay Effect from Static IMRT and VMAT SBRT Plans for Lung Tumors with Movement Over One Centimeter

Introduction

Research suggests that stereotactic body radiation therapy (SBRT) is as effective in treating low-stage lung cancer as a pulmonary lobectomy while being much less invasive.

One of the dosimetric concerns with treating mobile lung tumors with SBRT is the interplay effect. The interplay effect refers to the uncertainty of the dose that a target receives due to moving treatment components (MLC, gantry) and respiratory motion.

The American Association of Physicists in Medicine (AAPM) task group 76 state that caution should be used planning volumetric modulated arc therapy (VMAT) SBRT plans for lung tumors with movement over 1cm.

Methods

Seven patients were selected that had lung tumor movement over one centimeter and were treated with static IMRT SBRT.

The previously treated static IMRT SBRT plans were utilized in the data analysis. 2-arc VMAT SBRT and 3-arc VMAT SBRT were created for the study.

GTV's were delineated on each of the ten breathing phases and dose was transferred to the ten breathing phase scans using 'Calculate Volume with Preset Values.'

Two-Way within repeated measures ANOVA was used to analyze if there was a statistically significant difference between the GTV's D2%, D98%, and Dmean on each of the breathing phases for the three planning techniques.

Results

Measure	Source	F	Sig
D2%	Technique	1.066	0.348
Measure	Source	F	Sig
D98%	Technique	1.421	0.280
Measure	Source	F	Sig
Dmean	Technique	1.304	0.301

Table 1

The assumption of sphericity was not met with the data set so an adjusted test, Greenhouse-Geisser, was used for analysis. The significance level was set at 0.05. No significant difference was observed for the D2%, D98%, or Dmean of the three planning techniques.

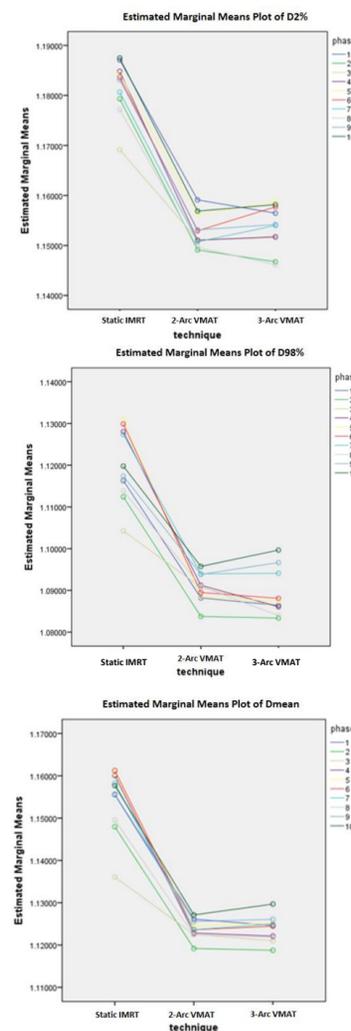


Figure 1-3

Each of the planning techniques on each plot has very similar estimated marginal means for the ten breathing phases. Represents that there are no significant differences between planning techniques.

Conclusion

The results of this study show that there is no significant difference between the D2%, D98%, or Dmean to the GTV throughout the breathing cycle for static IMRT SBRT, 2-arc SBRT, or 3-arc SBRT. This suggests that even with lung tumor movement over one centimeter, static or VMAT SBRT techniques can be used to adequately treat lung tumor volumes.

Limitations

This project was completed under the assumption that patients remain in each of the ten breathing phases for the same amount of time. Because of this, the impact of the interplay could differ on a real patient. Furthermore, because of the small sample size of this project, the results are not generalizable to the whole population of lung tumor patients with tumor movement over

References

AAPM Task Group 76. The management of respiratory motion in radiation oncology. *American Association of Physicists in Medicine*. 2006.

Li X, Yang Y, Li T, Fallon K, Heron D, Huq MS. Dosimetric effect of respiratory motion on volumetric-modulated arc therapy-based lung SBRT treatment delivered by TrueBeam machine with flattening filter-free beam. *Journal of Applied Clinical Medical Physics*. 2013;14(6),

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