

Comparison of using couch kicks for lung SBRT VMAT treatments

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Background

The use of couch kicks for lung SBRT VMAT treatments are well-established to be dosimetrically beneficial. However, the added impracticality to treatment delivery has been minimally considered in determining if couch kicks provide adequate benefit to the overall treatment delivery.

Purpose

Typical lung SBRT VMAT treatment plans consist of 3 arcs with a $\pm 10^\circ$ couch kick. The added couch kicks provide increased plan quality; however, the couch kicks limit gantry rotation as well increase treatment time.

Methods

- Previously treated lung SBRT VMAT plans were replanned using no couch kicks. Plans were reoptimized and then recalculated.
- Optimizations used previously entered objectives with no alteration. Intermediate doses were calculated in-between each MR stage.
- Dose calculations used AcurosXB and were renormalized so 100% of the Rx dose covered 95% of the PTV.
- An IU Health Bloomington Radformation ClearCheck lung SBRT treatment template was used to evaluate the differences of several plan quality metrics for 10 patients

Results

Several plan quality metrics showed favorable results for no couch kick plans. Conformity and Gradient indices showed minimal improvement with couch kicks while several lung, heart, and esophagus constraints showed improvement with no kicks.

Conclusion/Implications

Treatment plans need to be considered on a patient-by-patient basis. Anatomy variation and target location significantly contribute to plan quality. Results show in some cases that no couch kicks minimally improve or degrade plan quality metrics. Physicians, physicists, and dosimetrists should work together to discuss primary objectives of a patient's treatment to adequately assess if plan quality is sufficient and treatment delivery is efficacious and efficient.

Future Directions

Further analysis of more patients' treatment plans is necessary to provide more statistical significance. With more patient plans analyzed, ANOVA could be performed on the resulting data sets to assess significant differences. Differences in treatment delivery times could also be recorded to assess the practical differences in treatment delivery efficiencies between the two groups. Consideration of motion management techniques also need to be considered in the evaluation of treatment efficiency.

Plan Quality Metric	Average Difference (- favors no couch kicks plan)
Conformity Index	-0.02%
Gradient Index	0.15%
Lung D1500cc	-6.64 cGy
Esophagus Dmax	-10.73 cGy
Trachea Dmax	53.69 cGy
Ribs Dmax	200.12 cGy
Heart Dmax	-5.16 cGy
Spinal Cord Dmax	-7.13 cGy

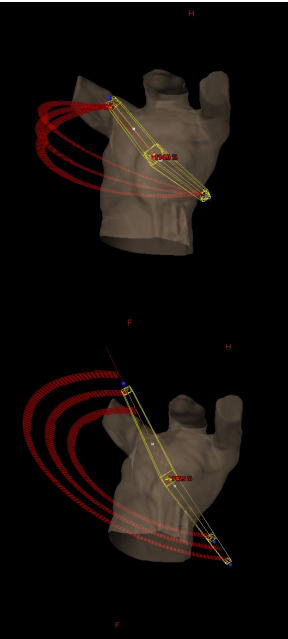


Fig. 1a (above): 3D rendering of a lung SBRT with VMAT arcs for a treatment plan using $\pm 10^\circ$ couch kicks.
Fig. 1b (below): 3D rendering of a lung SBRT with VMAT arcs for a treatment plan not using couch kicks.

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