# Evaluating the Dosimetric Benefit of "Raised Arms" Patient Positioning for Thoracic VMAT SBRT

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**Objectives**: When treating patients who present with thoracic lesions, clinics often require the patient to raise their arms out of the treatment area to utilize more angles for treatment planning. However, many patients can find this position difficult, which may cause significant issues during treatment. This study aims to evaluate the dosimetric benefits of "raised arms" Volumetric Arc Therapy (VMAT), as compared to VMAT that avoids a patient's lowered arms. Our initial hypothesis was that the benefit of "raised arms" therapy depends greatly on the position of the target volume in the thorax.

**Methods:** A lung phantom from Imaging and Radiation Oncology Core (IROC) was used to create a set of treatment plans. Normal tissue and PTV's were drawn to create two sets of treatment plans. The first set of plans treated 3 cm wide lesions placed at various locations within the lung. An Organ at Risk (OAR) ring was created around the lung to simulate radiosensitive normal tissue, and plans were optimized to reduce dose to the OAR. A spinal column PTV was drawn at the posterior of the IROC phantom and was optimized to reduce dose to the spinal cord within. The second set of plans treated targets at the center of the lung with varying PTV sizes, ranging from 1 to 9 cm wide. Both sets of plans were optimized in 4 different configurations, varying arm position and arc rotation length. 10 cm wide cylinders were drawn alongside the IROC phantom to simulate arms and determine the avoidance sectors. The differences in normal tissue dose were evaluated.

**Results:** The dosimetric impact of patient arm position was evaluated for SBRT targets located in the spine and lung. It was found that there were minimal dosimetric consequences from avoiding a patient's lowered arms for anterior and medial lung lesions, with less than a 10% increase V80% and conformity index (CI). This was the case for both full arc and partial arc treatments. The posterior lung lesion was heavily penalized, though, with over a 30% increase in V50%, V80%, and OAR D1cc. Lesions located in the spine and central lung exhibited marginal plan quality reduction, with a 20% increase in V80%. Interestingly, the lateral lung lesion exhibited little plan quality reduction when full arcs were utilized, but V50% increased by over 70% when planned with partial arcs. It was also shown that the penalty for avoiding the patient's arms was increased for lesions outside of 3 to 7 cm wide.

**Conclusions:** While it is always preferable for a patient to raise their arms fully out of the treatment field, the dosimetric penalties associated with allowing the patient to maintain a more comfortable position during treatment can be negligible for certain lesions. If the lesion is of moderate size and located in the anterior or medial portion of the lung, then the treatment plan quality should not change dramatically. However, if the target is located laterally or posteriorly, or is particularly large or small, then treatment plan quality will decrease greatly. In these cases, the uncertainties regarding patient discomfort are likely outweighed by the increase in plan quality with "raised arms" positioning, depending on the patient. If a patient is unable to raise their arms, it was found that utilizing full arc rotations can mitigate the effects of the avoidance sectors.