EFFECT OF LEAF POSITIONING THRESHOLD IN RAYSTATION TREATMENT PLANNING FOR STEREOTACTIC TREATMENT

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Introduction: Dose conformity index (CI) and gradient index (GI) are key plan quality metrics for stereotactic radiosurgery (SRS) and stereotactic ablative radiotherapy (SABR), influencing treatment outcomes (1,2). This study systematically evaluates the impact of leaf positioning thresholds in combination with treatment margins used during inverse optimisation.

Method and Material:

- Total of 14 SRS/SABR retrospective clinical cases investigated.
- Nine plans per patients were simulated by varying leaf threshold and treat margin function in Raystation Planning system(v2024A) as illustrated in figure 1.
- Plan Quality metrics were compared for among each simulated plans.
- Treatment delivery accuracy was assessed via 3D gamma analysis, with criteria of 3%/2 mm for lung cases measured using SNC ArcCHECK, and 5%/2 mm for spine and CNS stereotactic treatments evaluated using Gafchromic film.

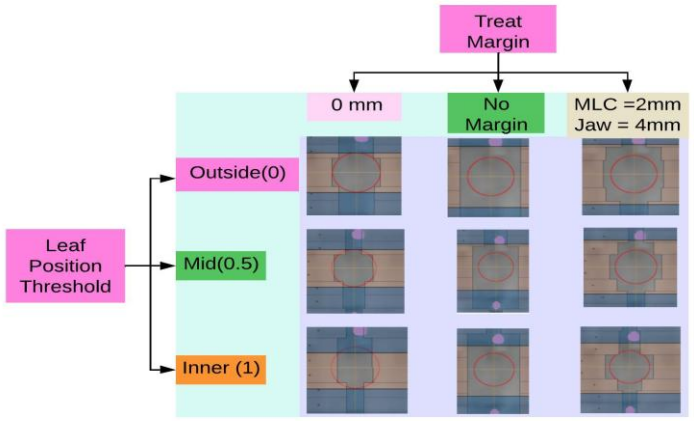

Figure 1: Schematic of 9 simulated plans with three leaf Position threshold along with three treatment margin

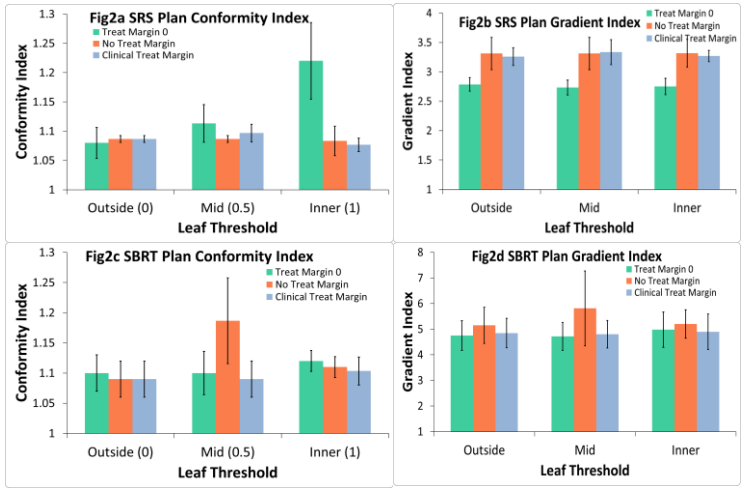

Figure 2: CI and GI comparison for SRS and SBRT plans

Conclusion: Outside (0) leaf positioning threshold with zero treatment margin achieved optimal GI and reduced MU while maintaining CI for VMAT-based SRS/SBRT plans; all thresholds met PSQA gamma acceptance criteria.

Reference:

1. doi: 10.1118/1.3438081 ;
2.https://doi.org/10.1016/j.ijrobp.2021.07.1493 ;
3. https://doi.org/10.1120/jacmp.v12i2.3449; 4.
4.https://doi.org/10.1016/0360-3016(93)90548-a

Results: Figure 2 compared plan quality metrics from treatments plans.

- CI remained consistent across all leaf position thresholds, except for Inner(1) with zero treat margin.
- GI varied by up to 20% with treatment margin; best values achieved with leaf position threshold Outside(0) and Mid (0.5) at zero margin with 10% lower MUs compared to other plans.
- All plans satisfied PSQA criteria, with gamma passing rates ≥95%