Brainlab **Novalis Circle**

9th International Conference 2023

Dose Comparison Between VMC and AXB for Brain Stereotactic Radiosurgery (SRS)

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Purpose

VMC and AXB are two advanced dose calculation algorithms used by two popular treatment planning systems, Brainlab Elements and Varian Eclipse, for brain SRS treatment planning. This large-cohort study investigates if the two algorithms are in close agreement for dose calculation.

Materials and Methods

- Cohort: 138 Elements plans, including both single-target VMAT and single-iso-multi-target DCA, treating LINAC-based SRS on 443 targets.
- Dose compared between VMC (Elements) and AXB (Eclipse) recalculation. Target dose compared using a near-maximum reference point (Dref), dose received by 95% of target volume (D95), and mean dose (Dmean).
- The occurrence of large dose differences (>5% vs. ≤5%) was analyzed with other factors for possible correlation, including: target size (<0.3 cc vs. ≥0.3cc), target-to-isocenter distance, technique (VMAT vs. DCA), and distance to skull).

Results

- Surprisingly large dose differences were found between the two algorithms for some patients, with difference as high as 15%. 53 targets (12%) had ≥5% Dref difference. Differences observed for Dref, D95, and Dmean.
- Of all 443 targets, VMC showed 2.3±2.6% higher Dref than AXB.
- Higher occurrence of large dose differences is associated with smaller target size (odds ratio=41.1, $p<10^{-10}$, <0.3cc vs. ≥0.3cc).
- No correlation was found between the occurrence of large dose differences and target-to-isocenter distance, technique (VMAT vs. DCA), or heterogeneity (distance to skull).

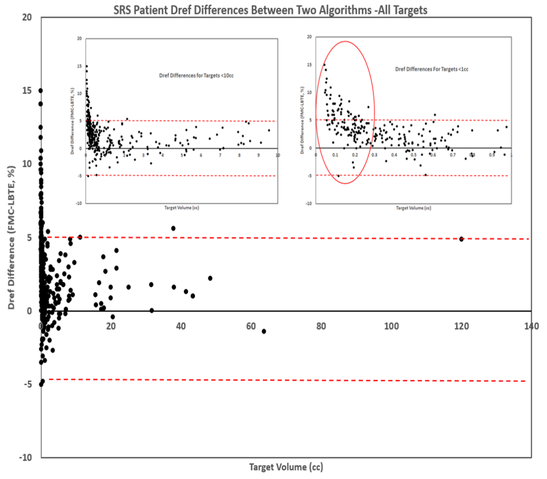

Figure 1: Dose differences at Dref between the two algorithms plotted for a total of 443 targets. When zoomed in (to <10cc upper in upper left insert and <1 cc in upper right insert), a target size dependency can be observed where larger dose differences tend to associate with smaller target sizes.

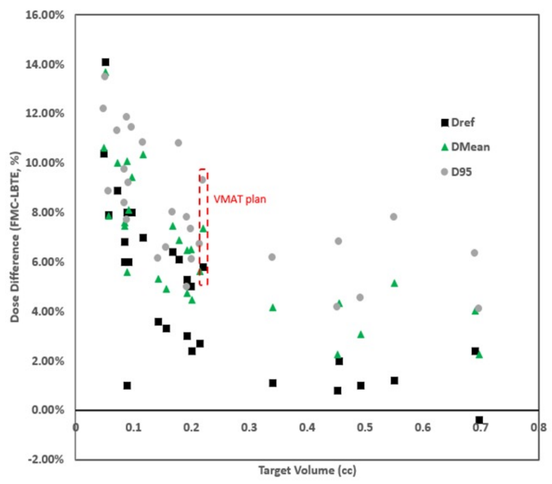

Figure 2: Differences of Dref, D95, and Dmean plotted for example cases to show a dependency with target size for all endpoints, independent of planning technique.

Conclusion

On a large patient cohort, clinical brain SRS dosimetry was compared between two advanced algorithms VMC and AXB. Our findings indicate that large target dose differences up to 15% on investigated coverage, mean, and hotspot target dose endpoints can exist between the two algorithms for small targets. Among the investigated factors, small target sizes (<0.3 cc) was found to associate with a higher chance of a >5% target dose difference between the two algorithms. Further investigation is warranted to better understand the discrepancy and improve dose calculation accuracy for modern SRS treatments.