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Comparison of model-based and delineation-based target volume definition for ocular proton therapy

Introduction

Conventionally, ocular proton therapy is based on **model-based** target volume definition. The introduction of 3D image-based treatment planning systems enables **delineation-based** target volume definition. The **aim** of this study was to compare these methods.

Disclosures

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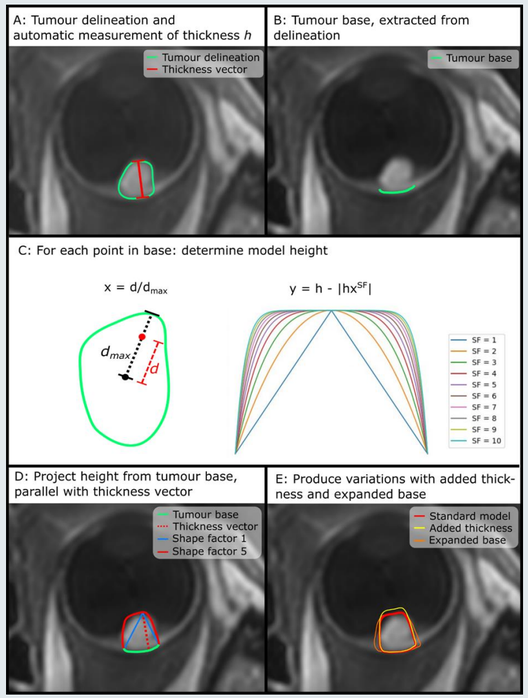
Our group @ PTCOG 2026:

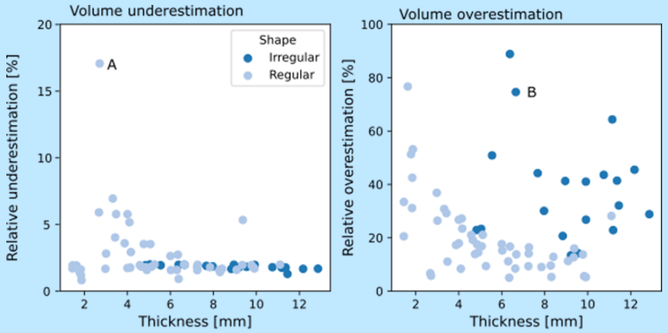
Methods

- 70 uveal melanoma patients
- 3T MRI 3D contrast-enhanced T1-weighted images with reconstruction resolution 0.4x0.4x0.4 mm^3



Best model was chosen automatically, defined as smallest model with coverage >98% or distance <0.4mm

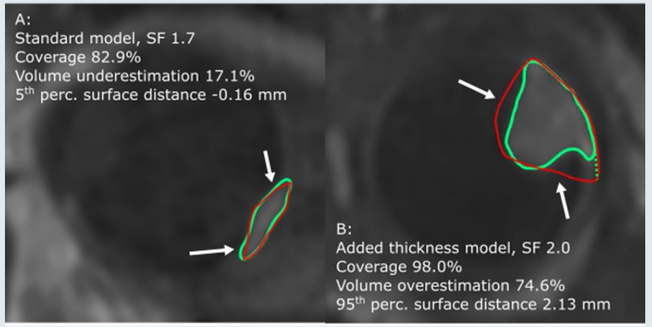
Results



Regular: dome-shaped or flat tumours, irregular: mushroom-shaped or overhanging tumours.

	Best model
Number of patients with acceptable model	69/70
Median shape factor	2.3 (1.2 – 4.3)
Volume metrics	
Coverage [%]	98.1 (94.2 – 98.7)
Overestimation [%]	**20.5 (5.7 – 59.9)**
Distance metrics [mm]	
5th percentile surface distance	-0.23 (-0.46 – 0.06)
Median surface distance	**0.41 (0.14 – 0.87)**
95th percentile surface distance	1.10 (0.53 – 2.71)
Median absolute surface distance	0.42 (0.18 – 0.88)

Examples



(A) Small tumour with a relatively large volume underestimation of 17%.
(B) Manual expansion of tumour base (green dotted line).

Conclusion

Tumour models as used in ocular proton therapy treatment planning systems can achieve **acceptable tumour coverage**. However, to achieve this coverage, the tumour models **overestimated** the delineated tumour volume.

Future directions

- The paper on this study is currently under review
- Working on a comparison between treatment plans and doses on organs at risk

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