Clinical QA of the D2SRS Micro-MLC Attachment

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Introduction

Stereotactic radiosurgery requires thorough review and evaluation of equipment before being clinically accepted for patient treatment. In this study, Linatech’s micro-MLC attachment was reviewed and assessed. The Linatech’s attachment allows for superior treatment by coupling 102 2 mm thick leaves at isocenter, ten cones varying in size, and two positional cameras all into one attachment. To ensure TG-54 requirements for stereotactic radiosurgery, Linatech’s micro-MLC attachment underwent an extensive evaluation to obtain clinically relevant knowledge and develop QA practices that effectively evaluate alignment.

Methods

Beam profiles were measured for square field sizes 0.7 cm through 12 cm with depths ranging from 1.5 - 20 cm. All field sizes were measured with: TN60012 micro-diode, 0.0016 cc pinpoint, and 0.0044 mm diamond chamber for 6 MV. MLC positional accuracy was assessed with both picket fence and inverse picket fence tests. A Winston Lutz test in combination with a star pattern were created for reviewing tolerance during micro-MLC attachment and cone alignment at collimator angles 60, 120, 180, 240, 270, and 300 with gantry angles of 0, 90, 180, and 270. Patient plans were delivered and verified using PTW’s Octavius phantom and VeriSoft using a 3% and 3mm 3D gamma analysis with no optimization shifts. A 6 met plan was developed and delivered using SRS procedures to a 3D printed RTSafe gel phantom for final verification.

Conclusion

The D2SRS micro-MLC attachment has fallen within expected specifications and the RTSafe has provided verification of the systems abilities for stereotactic radiosurgery.

3D Printed Gel Phantom SRS QA

+ 3D printed gel phantom created off historical patient CT
+ Filled with VIPAR polymer gel:
  - ~90% Water
  - ~10% Organic Monomers (cross-linkers and gelatin)
+ Radiation induces polymerization of the gel
+ Scanned in MRI and reconstructed from inverse T2 signals

+ 6 Tumor sites were strategically generated to create a complex plan
+ Tumor sizes ranged 0.09 - 43.23 cc
+ Treatment plan was developed using Linatech’s TPS TIGRT

Sagittal slice of the RTSafe MRI Gel Phantom scan with dose delivered. The red line indicating the analysed gamma index profile shown in the right neighboring line graphs.

Coronal slice of the RTSafe MRI Gel Phantom with dose delivered. The red square indicated the region chosen for a 2D gamma index analysis shown in the two associated contour plots on the right.