

Dosimetric Characteristics of Single Arc Cone and MLC Linac based Stereotactic Radiosurgery

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Abstract

Objectives: Single Arc Linac based Stereotactic Radiosurgery (SRS) was in advantage of simplex of treatment planning, dose delivery, relatively easiness in tracking geometric variation and so on. In this retrospective study, the dosimetric characteristics were analyzed for the single Arc cone and MLC Linac based SRS for brain targets.

Methods: All clinical targets were selected from our patient pool from 2013 to 2016, the locations of the targets were randomly distributed. There were 30 cone based treatments, and 28 MLC based treatments. The cones included 10mm, 12mm, 14mm, 16mm, 18mm, 20mm and 24mm. All the cones were mounted on Trilogy Linac machine from Varian Medical System. MLC were utilize both Trilogy and TrueBeam machine with energy at 6MV SRS beam and 6MV flatten filter free beam. Treatment planning dosimetric characteristics were evaluated by dose coverage, conformity index, dose spillage, and homogeneity level. For evaluation of the dose delivery pattern, an Energy Density Delivery Rate(EDDR) was defined to be the total dose multiplied by the volume of interested and then divided by the total delivery time.

Results: For single Arc Cone based cases, the average TV was 0.98cc, with standard deviation(STDEV) at 1.41cc, and the corresponding diameter in average was 1.02cm with STDEV at 0.5cm; V12Gy was 4.91cc with STDEV at 4.52cc; conformity index was at 2.04 with STDEV at 0.84; dose homogeneity index was at 1.13 in average with STDEV at 0.09; and EDDR was 0.170GyCC/s in average with STDEV at 0.219GyCC/s. For single Arc MLC based cases, the average TV was 15.05cc with STDEV at 15.89cc, and the corresponding diameter in average was 2.73cm with STDEV at 0.98cm; V12Gy was at 27.91cc with STDEV at 24.46cc; conformity index was 1.16 in average with STDEV at 0.26; dose homogeneity index was at 1.32 in average with STDEV at 0.16; and EDDR was 1.195GyCC/s in average with STDEV at 1.302GyCC/s.

Conclusions: Single Arc Cone based plan was suitable for target volume smaller than 2.5cc and diameters less than about 1.6cm. The efficacy of multiple Arc SRS procedure could be further estimated. And the energy density delivery rate could be further investigated in different physical scales.

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Abstract

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