

AbstractID: 3367 Title: Regular lesions stereotactic treatment:physical and dosimetrical comparison between circular and mini/micro multileaf collimators

Purpose: The comparison of stereotactic treatments for small spherical and ellipsoidal intracranial lesions using three different collimators with single isocenter: the standard circular collimators and two dynamic multileaf collimators (DMLC) with 3 mm and 5 mm leaf thickness, micro and mini DMLC respectively.

Method and Materials: Spherical and ellipsoidal lesions of different sizes were designed to evaluate treatments with collimators under consideration. For spherical lesions with diameter from 15 mm up to 35 mm a treatment with 9 arcs of 140 degrees was performed. For ellipsoidal lesions treated with circular collimators, different combinations of treatment variables were studied to achieve 80% isodose surface conformation: number of arcs, gantry start/stop angles, couch angles and arc spacing. This treatment was matched up to 9 arcs with the two DMLCs. For the comparison geometrical (penumbra, difference between the target volume and 80% isodose volume and conformal indexes) and radiobiological (EUD, TCP and NTCP) parameters were used.

Results: Circular collimators and micro DMLC behave similarly with spherical targets in terms of conformal indexes and TCP/NTCP, but EUD and 20% isodose volume are greater for micro DMLC.

In the case of ellipsoidal target TCP/NTCP are comparable, EUD is greater for micro DMLC but conformal indexes are higher for circular collimators. The 20% isodose volume is less with micro DMLC; the difference, however, is entirely due to the wider penumbra along the deformation axis with circular collimators. The same considerations are valid for targets with diameters ≥ 35 mm, where mini DMLC becomes competitive versus circular collimator.

Conclusions: The analysis shows that micro and mini DMLC are more functional for non spherical lesions. Circular collimators however are widely used and yield sharper dose fall off along directions perpendicular to the deformation axis and thus are preferable in the case of neighbourhood of organs at risk.