A simple optimization technique useful for dynamic arc radiosurgery planning

Purpose: To demonstrate a simple but efficient optimization technique improving the conformity, uniformity, and tumor coverage for SRS plans with equally weighted dynamic conformal arcs.

Material and method: Dynamical arc radiosurgery in Brainscan planning shapes the arcs every 10 degrees based on the limited 2D projection. Although desired shapes of arc segments can be automatically achieved through user-defined margin around the target, the plan doesn't fully consider the 3D dose distribution information. The conformity with equally weighted arcs is far less optimal for highly irregular target. To improve it, a simple and efficient technique was developed to fine tune the plan. With initial isodose distribution in each slice, one hot and one cold dose regions were drawn as two new structures. The hot structure is where the prescribed isodose line is outside the PTV, and cold one for inside the PTV. Then on beams-eye view of the individual arcs, simply opening the leave to the cold structure and closing the leave to hot structure modified the multileaf apertures. The procedure could be repeated until a satisfied plan was obtained.

Result: Analyzed total nine cases. Average conformity index was increased by 10% and the hotspot volume was reduced by 15% after two iterations. For the highly irregular case, it can be 23% conformity enhancement and 36% hot dose decrease. The improvement for spherical shape target is not significant, 1.2% conformity increment and 2.6% hotspot reduction.

Conclusion: Manual fine-tune technique is useful for improvement of dose distribution conformity, tumor coverage and eliminated the hot spot for highly irregular targets. The plan time can be reduced with users' experiences. This technique is better using as a fine adjustment. The initial arc configuration such arc ranges, separation, and number should be considered first.