

AbstractID: 8441 Title: Track-based treatment planning for radiosurgery: a modified McGill technique

Purpose: Linac-based radiosurgery is performed using arcs delivered at different couch angles. The goal of this study is to present the idea of track-based, instead of arc-based planning. Various beam tracks can be delivered to a given isocenter if the couch and gantry are rotating simultaneously. Such a technique would be a modification of the McGill technique introduced in 1987.

Method and Materials: In theory, track-based planning should have advantages over the arc-based planning because every set of acceptable arc-based plans is a subset of all acceptable track-based plans. The total-arc-degree parameter in arc-based planning would be replaced by the track length over a sphere with a unity radius. In order to illustrate track-based planning, several different plans using large number of 10-degree arcs and appropriate couch rotations between adjacent arcs were generated. The dose distributions were calculated using the XKnife TPS (Radionics, Boston, MA). Several treatment plans were created for several targets shapes and sizes. A track-based plan for a lesion with AP elongation (the most difficult ellipsoid target) was compared with two conventional single isocenter plans (15-mm cone).

Results: The three plans for the AP-elongated lesion achieved the same conformality (PITV 1.4). However, the track-based plan delivered significantly lower doses to the surrounding normal brain defined by the volume receiving 20% and 50% of the prescription dose (20.8 cc & 4.7 vs. 32.3 cc & 5.6). The size of the isodose lines was also smaller for the track-based plan (5.9 cm & 3 vs. 19.7 cm & 4.2). Similarly, the track-based planning achieved similar conformalities with all targets.

Conclusion: There is no doubt that the track-based planning will be more flexible and offer a greater variety of solutions compared to arc-based planning. Track-based planning could be the future of automated forward or inverse planning.