

AbstractID: 1652 Title: Incorporating Dose-Volume Effect into the Ranking of Beam Orientations

Optimisation of beam directions in IMRT is computational intensive due to the huge search space and several groups are seeking to use a single beam ranking to effectively reduce the solution space. Even though such technique ignores the beam interplay and does not yield the final beam configuration, it affords useful information on which are potentially good/bad directions and is thus valuable to aid the beam placement. Currently, the ranking is still dosimetry and geometry-based, in which the maximum achievable intensity of each beamlet is computed based on the tolerance of the critical organ (CO) located on the path of the beamlet. This ranking is valid only for serial CO and fails to yield adequate score when parallel organ(s) is involved. Here we develop an EUD-based function to take the dose-volume (DV) effect into the ranking. In this approach, the CO tolerance is described by EUD with clinical data-derived EUD parameter. The maximum intensities of the incident beamlets that empty the DV tolerance of the CO is obtained by using an iterative optimisation technique with the goal of maximizing the integral target dose (optimisation is required since there are multiple intensity profiles that can empty the same DVH). The technique was applied to two head and neck and a thoracic cases. Results show DV effect plays an importance role in angular ranking and the new IMRT plans generated by beam ranking techniques are superior over beam configurations selected by trial-and-error.