AbstractID: 3331 Title: EUD Based Beam Orientation Selection

Purpose: To develop a clinically sensible beam orientation ranking model with incorporation of dose-volume effects and to show its utility for IMRT beam placement.
Materials and methods: Generally, a beamlet/beam is more preferable if it can deliver a higher dose to the target without exceeding the sensitive structure(s) tolerance. In previous geometry- or dose-based approach, the beamlets are treated independently and, to compute the maximally deliverable target dose, each beamlet is pushed to the maximum intensity without considering other beamlets. When volumetric-structures are involved, there are numerous dose distributions corresponding to the same dose-volume tolerance and the beamlets are no longer independent. We model a volumetric organ by using EUD and find the beam profile that delivers the maximum target dose without violating the EUD constraints using an iterative algorithm. Four clinical cases are planned with and without the guidance of the angular ranking information and the qualities of the two types of IMRT plans are compared.
Results: An angular ranking model with consideration of volumetric effect has been developed. It is shown that the previously reported dose-based angular ranking represents a special case of the formalism proposed here. Application to four IMRT cases indicated that the proposed technique is capable of producing clinically sensible angular ranking. In all cases, we found that the IMRT plans obtained under the guidance of EUD-based angular ranking are significantly improved in comparison with that obtained using the conventional uniformly spaced beams.
Conclusions: The EUD-based function is a general approach for angular ranking and allows us to identify the potentially good and bad angles for clinically complicated cases. The ranking can be used either as a guidance to facilitate the beam placement or as prior information to speed up the beam configuration optimization.