

Potential Advantages to Radiobiological Optimization as Compared with Conventional Physical Optimization for Stereotactic Treatment Planning

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Abstract

Objective: To investigate the different planning optimization methods (Physical and radiobiological) in stereotactic treatments for a variety of anatomical sites.

Methods: Thirty patients were selected retrospectively following treatment with stereotactic VMAT treatments based on standard physical planning objective optimization: brain n=10; thorax n=10; and spine n=10. For each patient, an additional Stereotactic VMAT plan was generated using a radiobiological planning optimization method, incorporating gEUD concepts in Varian Eclipse (version 15.1). Radiobiological metrics were estimated using BioSuite software (NTCP models & EUD). Dosimetric parameters of CI, Gradient Index, HI, MU and DVH constraints, were compared, across plans, with statistical significance determined by Kruskal-Wallis test (2-tailed $p < 0.05$).

Results: Optimization in stereotactic plans were better for radiobiological optimization compared with physical objective optimization, for the dosimetric parameters mean p-value being 0.0168, SD=0.0119 and for the radiobiological parameter mean of p being 0.0126, SD=0.0108.

Conclusion: Radiobiological optimization in stereotactic treatment plans showed a statistical advantage. This was more apparent in highly heterogeneous dose distributions around the target, especially regarding the sparing of surrounding critical organs.