

Intensity modulation in radiotherapy: Photons versus protons.

Aims.

To investigate the potential differences between intensity modulated photon and proton therapies through the application of progressively more stringent dose constraints.

Methods.

Intensity Modulated (IM) treatment plans for a para-nasal sinus case have been calculated for both photons and protons using an identical, dose based optimisation algorithm. IM plans (X1 and P1) for both modalities were initially constructed using standard maximum dose constraints. Additional photon plans were then calculated to try to match the DVHs of the orbits (plan X2) and all critical structures (plan X3) to the corresponding DVHs of the proton plan.

Results.

Plans X1 and P1 both produced good target coverage, and provided similar compliance of all identified critical structures to the defined dose constraints. On reducing the low dose contribution to both orbits in the photon plan (X2), an increased dose heterogeneity across the target resulted. Similarly, when all normal tissues were more strictly constrained (plan X3), target dose homogeneity was further compromised, as was conformation of the dose to the target volume. Analysis of normal tissue integral dose showed an increasing dose load to non-critical normal tissues when progressing from plan X1 to X3.

Conclusions.

Both IM protons and photons were found to provide comparable target volume conformation and high dose sparing of critical structures. However, the use of IM protons provided the only method by which critical structures could be spared at *all* dose levels, and still provide an acceptable dose homogeneity within the target volume.