AbstractID: 11006 Title: Significance of RBE optimization in proton radiotherapy and its impact in the low energy treatment case

Purpose: Current treatment planning systems use a constant Relative Biological Effectiveness (RBE) value of 1.1 for proton radiotherapy treatments - irrespective of the tumor volume, location, tissue type, initial energy of the proton beam or dose/fraction. However, research shows that the RBE value is not constant and it increases significantly in particular, over the distal falloff region of the Bragg peak. Uncertainty associated with both the calculation and effect of dose delivered to the tumor region compels physicians to consider a relatively larger Clinical Treatment Volume (CTV). This error margin may be reduced by incorporating appropriate variable RBE corrections and thereby facilitating optimization of the CTV. **Method and Materials:** In order to most effectively make use of this treatment modality, we suggest it is important to adopt biological cellular dose response models for tumors for implementation into treatment planning systems. An RBE model based on the existing Microdosimetric-Kinetic (MKM) based model with a modification in one of its parameters namely beta(p), in the high LET range (20-33 keV per micrometer) can be used for the calculation of biological dose. **Results:** The described model is able to calculate the biological dose distribution of the clinical proton energies, taking into consideration both the physical and biological parameters of the incoming beam line and tissue type. The models accuracy in RBE calculations and computational speed makes it convenient for implementation purposes. **Conclusions:** The existing MKM based RBE model, making use of both the linear quadratic and track structure models, is a viable candidate for high energy (>70 MeV) treatments. Similarly, a modified version of this MKM based model has to be used for low energy (~up to 70 MeV) applications, such as the treatment of ocular tumors.