AbstractID: 8474 Title: Interpretation of dosimetric results in terms of expected treatment outcome when optimizing treatment plans using different methods of regularizing dose inhomogeneity

**Purpose:** Regularization techniques for determining the optimal dose distribution have been proposed because the dose distributions produced by different IMRT treatment planning optimization algorithms are highly non-uniform in the target volume. In the present work, an analysis is made about the relation of the DVH gradient and the dose to the PTV and normal tissues.

**Material and Methods:** In this study, two head & neck and prostate cancer cases treated with IMRT were employed. Three different dose distributions were obtained by using a dose-based optimization technique, an EUD-based optimization without regularization of non-uniformity and an EUD-based optimization using a variational regularization technique. The clinical effectiveness of the three dose distributions was investigated by using the complication-free tumor control probability, $P_+$ and the biologically effective uniform dose.

**Results:** In the head & neck case, for the dose-based optimization, the $P_+$ value is 32.9%, the total control probability $P_T$ is 79.6% and the total complication probability $P_C$ is 49.0%. For the EUD-based no-reg optimization, the $P_+$ value is 56.4%, the $P_T$ value is 71.9% and the $P_C$ value is 15.5%. For the EUD-based reg optimization, the $P_+$ value is 67.3%, the $P_T$ value is 87.4% and the $P_C$ value is 20.1%. In the prostate case, for the dose-based optimization, the $P_+$ value is 94.8%, the $P_T$ value is 97.8% and the $P_C$ value is 3.0%. For the EUD-based no-reg optimization, the $P_+$ value is 86.0%, the $P_T$ value is 97.3% and the $P_C$ value is 11.3%. For the EUD-based reg optimization, the $P_+$ value is 95.3%, the $P_T$ value is 98.4% and the $P_C$ value is 3.1%.

**Conclusions:** The radiobiological comparison shows that the EUD-based optimization with regularization gives better results than the EUD-based optimization without regularization and dose-based optimization in both clinical cases, which indicates better clinical effectiveness.