

## The Effect of Prescribed Isodose Line on the Treatment Planning Quality for Pituitary Adenoma with A New Planning Quality Index

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## Abstract

**Objectives:** Radiosurgery is the most common adjunctive treatment following incomplete surgical resection, residual tumor, tumor recurrence, or failure of medical therapy. Different isodoses are selected during radiosurgery planning according to the therapy machine. However, there is not any standard in linear accelerator based systems. Since there are many critical organs are located in the neighborhood of the pituitary adenomas, it is not possible to achieve the prescription doses and critical tissue dose constraints suggested in each case. In this study, quality of the treatment planning was compared through prescribing different isodoses in the patients with pituitary adenoma by using a novel therapy planning index that we produced to compare the treatment planning.

**Methods:** A planning quality formula was produced and used to compare the treatment plans with different prescription isodoses. The smaller PQI value defines a more qualified treatment planning formula indicates a more qualified therapy planning. Plans those were calculated with different prescribed isodoses were compared on 10 selected different patients with pituitary adenoma who were treated in Medicana International Ankara Hospital, CyberKnife Radiosurgery Center using this novel formula defined with other dosimetric parameters. Planning of all patients was performed under identical conditions to evaluate the treatment planning under equivalent states. The gradient index, the maximum dose for critical organs, whole brain V10, V12 and V14 doses, the conformity index (CI), the new conformity index (nCI) and PQI were analyzed in the calculated plans performed with different prescribed isodoses.

**Results:** Tumor coverage and critical organ doses were achieved much easier in the treatment plans prescribed on lower isodoses; however, the conformity index and the homogeneity index values were found higher whereas the gradient index was lower. PQI=25.95, PQI=21.27, PQI=22.17, PQI=23.49 and PQI=25.50 were found for isodoses 60, 65, 70, 75 and 80, respectively. For isodoses prescribed to 65% with best PQI: GI; mean=3.69, median=3.47 (std=0.67), CI; mean=1.45, median=1.43 (std=0.26), nCI; mean=1.51, median=1.48 (std=0.28), coverage; mean=96.38, median=96.13 (std=1.12), Brain stem maximum; mean=5.40Gy,

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median=3.65Gy (std=4.55), optic chiasm; mean=9.60Gy, median=9.89Gy (std=5.53), optic nerve left maximum; mean=5.52Gy, median=2.55Gy (std=5.64), optic nerve right maximum; mean=4.45Gy, median=3.33Gy (std=3.49) were found. For isodoses prescribed to 80% : GI; mean= 4.75, median=4.64 (std=0.96), CI; mean=1.24, median=1.23 (std=0.07), nCI; mean=1.30, median=1.29 (std=0.08), coverage; mean=95.76, median=95.62 (std=0.63), Brain stem maximum ; mean=6.17Gy, median=4.58Gy (std=4.37), optic chiasm; mean=11.10Gy, median=10.59Gy (std=5.81), optic nerve left maximum; mean=6.13Gy, median=2.73Gy (std=5.44), optic nerve right maximum; mean=5.47Gy, median=4.55Gy (std=4.02) were obtained. There is not any significant difference between V10, V12 and V14 doses.

**Conclusions:** The aforesaid results indicated that the best therapy planning was performed on isodoses prescribed to 65% for patients with pituitary adenoma.