

Dosimetric Plan Comparison Between The Novel ZAP-X Radiosurgery Device And The CyberKnife System For Vestibular Schwannomas

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Cristina Picardi¹, Christoph Weber², Boris Dettinger³, Dirk Weltz³, Karolina Klucznik⁴, Andreas Mack⁵, Ethan Taub⁶, Raphael Guzman⁷, Luigi Mariani⁸

1. Radiation Oncology, Swiss Neuro Radiosurgery Center, Zurich, CHE 2. Neurosurgery, Swiss Neuro Radiosurgery Center, Zurich, CHE 3. Physics, Swiss Neuro Radiosurgery Center, Zurich, CHE 4. Radio Oncology, Hirslanden Klinik Zürich, Zurich, CHE 5. Radiosurgery, Swiss Neuro Radiosurgery Center, Zurich, CHE 6. University Hospital of Basel, Switzerland, Basel, CHE 7. Neurosurgery, University Hospital Basel, Basel, CHE 8. Neurosurgery, Universitätsspital Basel, Basel, CHE

Corresponding author: Cristina Picardi, c.picardi@snrc.ch

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Abstract

Objectives:

Stereotactic Radiosurgery is a well-established treatment modality for vestibular schwannomas. Its excellent local control rate and the low toxicity profile were proven by several clinical trials. Nevertheless, an increased risk of hearing loss was reported for single fraction SRS for patients receiving more than 4 Gy to the cochlea. Especially in the case of intrameatal lesions located close to the inner ear, achieving the proposed constraints for the cochlea might be challenging. ZAP-X is a novel radiosurgery device using 3 MV X-rays for the treatment of intracranial lesions. Although the ZAP-X is becoming increasingly popular in radiosurgery, robust dosimetric comparative data with other established dedicated radiosurgery devices is still lacking. In our study we aim to perform a dosimetric plan comparison between CyberKnife (CK) Robotic Radiosurgery and the ZAP-X for 5 vestibular schwannomas and report on the differences concerning the most important plan parameters.

Methods:

Five intrameatal vestibular schwannoma lesions of Koos grade 1 and grade 2 within a volume range between 0.06 ccm and 1.21 ccm were chosen for the dosimetric comparison. The treatment planning was carried out independently, based on the same structure sets including the PTV and the OARs, by trained medical physicists on the CK System and on the ZAP-X. Since the conventional chosen prescription isodose varies significantly between the two devices - typically 70-80 % for CK and 40-60 % for ZAP-X - planners were free to choose the prescription isodose, which ensured optimal target coverage with the given prescribed dose while respecting the OARs constraints. For the comparison of the plans the target-specific parameters (Coverage, New Conformity Index (nCI), gradient index (GI)) and the doses received by the OARs were evaluated.

Results:

The most significant difference between ZAP-X (average 3.33) and CK (average 5.51) showed up in the GI. The nCI varied between 1.17 and 1.53 for ZAP-X and 1.07 and 1.55 for CK. An excellent coverage above 99 % for all cases was achieved by both modalities. The cochlea maximum dose was significantly better for ZAP-X (average 3.2 Gy) than for CK (average 6.3 Gy), as well as the cochlea mean dose (1.63 Gy vs 3 Gy)

Conclusion(s):

The novel ZAP-X radiosurgery device convinces with a high conformity and steep dose fall off, which is at least comparable to the plan parameters published for the CK. In terms of sparing the OAR, the ZAP-X plans delivered better results compared to the CK.