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Abstract

# Image Guided Radiosurgery for Trigeminal Neuralgia

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## Abstract

Objectives: To share our initial clinical experiences for the treatment of trigeminal neuralgia (TN) on a novel image-guided stereotactic linear accelerator.

Methods: The latest LINAC-based SRS platform (the EdgeTM, Varian Medical Systems, Palo Alto, CA) has features including high intensity mode (6 MV flattening filter free mode with a maximum dose rate of 1400 MU/minute), a head frame system, a 6 DoF robotic couch, and conical cones. The diameters of the conical cones range from 4 to 17.5 mm. The system also has an advanced imaging package for treatment localization, including Cone Beam Computed Tomography (CBCT) for volumetric assessment, stereoscopic x-ray imaging and an optical surface monitoring system (OSMS) for monitoring patients via 3D surface imaging. The end-to-end hidden target test was performed using a Rando head phantom that was attached to the treatment table via a head frame and localized with CBCT. The planar dose distribution from arc delivery with a 4mm cone was verified using the Lucy phantom (Standard Imaging) with Gafchromic EBT3 films. The patient was simulated in a Philips Brilliance big bore CT scanner (1 mm slice thickness; Matrix 512x512, 120kVp, 501mAs). A high resolution MR simulation (BFFE, 0.5 mm slice thickness) was also acquired for contouring purpose. The treatment plan was done in the Eclipse cone planning system. 14 partial arcs with 4 mm cone were included in the treatment plan for a dose of 85-90 Gy at isocenter. In the treatment room, the patient was first aligned with OSMS. CBCT (full fan, full rotation, 1 mm slice thickness) was used for patient localization and 6 DoF corrections were applied subsequently. A second CBCT was acquired afterwards for verification. Intra-fraction CBCT was acquired mid-treatment at couch zero to evaluate intra-fractional motion. The OSMS was used to monitor patient motion throughout the treatment with 1mm/1° tolerance.

Results: The overall system accuracy using 15 mm cone was 0.34±0.11 mm based on End-to-End test. The 4 mm cone was concentric with the 15 mm cone within 0.15 mm. The output of a single 160° arc in 4 mm cone measured with EBT3 film was consistent with that from the initial commissioning measurement. Two patients with TN have been treated and both experienced favorable outcome. Pre-treatment verification CBCT matched well with reference planning CT within 0.2 mm/1°. The patient movement was within 0.5 mm/1° based on the intra-fraction CBCT and under 1mm/1° from real time surface imaging.

Conclusions: CBCT imaging coupled with 6 DoF robotic couch has been shown to be accurate

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and reproducible through end-to-end phantom measurements. Frame-based patient immobilization minimize intra-fraction motion as demonstrated by the intra-fraction CBCT from the patient treatments. Therefore, the Edge platform combines the gold-standard of patient immobilization and the most advanced online image-guidance. Our initial experience has shown that Edge radiosurgical system is effective for treating TN patients.