Introduction: Recent advances in frameless stereotaxy, and image guidance enables us to treat most if not all SRS procedures with frameless IGRS system. The aim is to dispense the invasiveness of the stereotactic frame fixation to the skull without losing the inherent accuracy of the frame based stereotactic approach.

Purpose/Objective(s): The purpose of this study is to evaluate in a phantom study the accuracy of the Novalis ExacTrac image guided frameless system. Furthermore, we report our initial experience with 44 patients who underwent frameless IGRS of trigeminal neuralgia.

Materials/Methods: A BrainLab frameless mask was made for a Lucite phantom with an EDR film sandwiched between the two parts of the phantom with a target defined by a 1.5 mm diameter spherical BB marker taped on the film. A CT scan of the phantom was performed using 1.25mm slice thickness, and 512x512 matrix, and the head and neck localizer. The marker was defined as the target in the BrainScan software. The same protocol used in our institution for the treatment of trigeminal neuralgia was used (7 non-coplanar circular arcs with a 4mm cone) to plan and treat the marker using the stereoscopic image guidance. The phantom was imaged at each couch angle, and the images were fused with the DRR’s using the autofusion option of the ExacTrac software. ExacTrac x-ray correction was applied until the phantom was within an acceptance criterion of 0.5mm, and 0.5 degree. The EDR film was developed, and scanned in high resolution using Vidar Dosimetry-Pro scanner, and RIT Technology software. The same technique was repeated for a second target. The displacement of the centroid of the optical density on the film, and the position of the marker was calculated using the RIT Technology software, and averaged for the 2 targets. Furthermore, retrospective study of 44 patients who underwent frameless image guided radiosurgery of the trigeminal neuralgia since October 2007 was performed. 514 stereoscopic images (Ave. 12 images/patient), and their shifts were reviewed, and reported.

Results: Geometric accuracy of 0.48±0.55mm was achieved on 2 different targets with the 4mm cone. The geometric accuracy of the target depends significantly on the landmarks used for autofusion of the images. The average 3-D movement of the isocenter in the 44 patients post imaging, and autofusion of the DRR, and the stereoscopic images was 0.49±0.44mm.

Conclusions: Accuracy of target localization achieved with the BrainLab frameless technique approaches that attainable with invasive stereotactic frames. However, since the ExacTrac autofusion software heavily relies on the bony landmarks, special care must be made with the frameless system by taking at least one image per bed position to ensure accurate treatment of the trigeminal nerve.

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