Purpose: To make use of the optical guided frameless stereotactic target localization technique to detect the interfraction and intrafraction patient positioning errors and correct the patient position for fractional intracranial therapy, therefore, to enhance the patient positioning accuracy.

Methods and Materials: Four patients who underwent fractionated intracranial intensity modulated radiation therapy (IMRT) were studied. For each patient, in addition to the thermoplastic head mask, frameless array and bite-block were used for patient positioning. Optical guided frameless planning was utilized to define the coordinates of the isocenter during the treatment planning procedure. In each treatment fraction, the patient was first set up by matching the room lasers to the BB markers attached on the mask. The optical guided frameless system then captured the patient position and reported displacements of the current patient position to the planned patient position. These displacements were called interfraction errors. The treatment plan was designed to have up to 8 non-coplanar fields. Dose delivery of the non-coplanar fields required couch rotation which introduced isocenter displacements called intrafraction errors. Population statistics of interfraction and intrafraction errors (4 patient, 110 fractions) were calculated. The optical guided frameless system monitored the patient positioning errors and provided guidance for correction prior to the dose delivery.

Results: Among all patients and radiation treatment fractions, the overall detected interfraction error was 3.6 ± 1.3 mm (mean $\pm$SD) and the intrafraction error was 1.4 ± 0.8 mm. Both types of errors were online corrected with the guidance of optical guided frameless system.

Conclusions: Conventional laser guided thermoplastic mask patient position for intracranial therapy has interfraction and intrafraction errors. The optical guided frameless target localization technique allows clinicians to dectect and correct these errors online, therefore, to enhance the patient positioning accuracy for intracranial radiation therapy.