The BrainLAB Novalis stereotactic radiosurgery system translates the lesion/target to the treatment center of the machine via a stereotactic method with a pair of infrared cameras. The ExacTrac patient positioning system tracks skin affixed retro-reflective markers and the geometric relationship of the treatment isocenter relative to the markers to provide necessary and sufficient data to position the target at the linac isocenter. The accuracy of this approach is dependent on the slice separation and thickness of the image data set, the number and dimensions of the body markers on the patient and the overall accuracy of the treatment unit.

Initial treatments were applied to small metastatic lung & liver lesions. Organ motion was minimized through the use of relaxed exhaled breath-hold technique. The net tumor registration error (TRE) was calculated theoretically as a function of the number and geometry of the markers, the localization error of the fiducials (FRE) and the position of the tumor relative to the markers with the assumption that the patient is a rigid body. The added uncertainty from this assumption was estimated by repeated CT Scans which were obtained during the course of treatment and registered to the original treatment plan CT data set by matching the skin-affixed marker pairs in the respective scan sets. Iso-TRE contours were superimposed upon the images. We observed that the theoretical TRE is comparable to the measured tumor position reproducibility. The tumor margins were selected based on the magnitude of the TRE.

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