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Optical Guidance System vs. CBCT for Phantom and Patient Setup

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Purpose

To quantify the discrepancy between Varian optical guidance (OG) frameless localization system and Varian Trilogy on board imaging (OBI) system for setting up phantom and SRS patient.

Materials and Methods

Two different phantoms were used in this study. One is a custom-made phantom; the other is Penta-Guide phantom. The bite-tray used for frameless SRS localization is fixed on both phantoms. After CT scan, images were exported to Pinnacle and FastPlan treatment planning systems, where the same isocenter was identified and then the images were exported to Mosaik and OG systems respectively.

On the Varian Trilogy, OG was used to position phantom. Then kV-kV, conebeam CT (CBCT) and portal imager were used to image the phantom and calculate the isocenter shift. The same method has been used for four SRS frameless patients to check the OG setup, two patients' shifts were recorded and one patient's planning CT and CBCT images were fused and analyzed.

Results & Discussion

For both phantom studies, the shift performed by CBCT, kV-kV and MV were all within 1 mm. However, for actual patient setup, the shifts were greater than 2mm between OG and CBCT for two patients. The impact of bite-tray fixation was studied by changing the angle of bite-tray slightly; significant shift up to several mm was observed by OBI system. The isocenter change with the angle has been calculated based on a real patient's geometry.

Conclusion

The discrepancy between CBCT and OG for setting up phantoms is less than 1mm, but can be greater for setting up SRS patients. The bite-tray repositioning in patient's mouth is the major factor to cause this discrepancy.