Novel Localization Box with 3D printing for Frameless Linac-Radiosurgery for Uveal Melanoma

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INTRODUCTION

Design and fabrication of one 3D-printed localization box (Fig 1) achieved flexible positioning of the camera and LED lights in both lateral and longitudinal directions, that provided gaze focus point for patient and video monitoring of eye position for uveal melanoma with existing LINAC based SRS and SRT platform.

AIM

Stereotactic RadioSurgery (SRS) and Stereotactic RadioTherapy (SRT) are the options to treat uveal melanoma. However, they usually require frame based approach with retro-bulbar anesthesia and surgical fixation of the eye. As a result, the availability is very limited.

A 3D-printed localization box compatible with BrainLAB frameless SRS and SRT system (Fig 2) was developed to provide non-invasive SRS and SRT treatment at our institution.

METHOD

➢Fabrication Equipment: Ultimaker-S5 printer

➢Printing Material: Polylactic Acid (PLA)

※ **Electron density: 1.06** ※ **Attenuation factor: 0.95**

➢The localization box was attached to the existing BrainLAB frameless SRS and SRT system on the 6-DOF robotic couch.

➢The localization box also accommodated a LED light for gaze focus point for patient, as well as a CCD camera for real time monitoring of the patient eye position.

RESULTS

The box consisted of upper and lower layer brackets.

The lower layer bracket was secured to the couch. The upper layer bracket hosted a small LED light and a CCD camera.

They were equipped with the nested bracket to achieve free translation in the lateral direction along the convex edge, and locked with small plastic screws(Fig 3).

The movement of longitudinal direction could be freely translated through the slide groove and the convex rail between upper and lower layer bracket, and locked with small plastic screws(Fig 4).

The scale on upper layer bracket was used to mark the unique position for each patient.

The localization box was tested in clinical setting and have been successfully used over 10 patients.

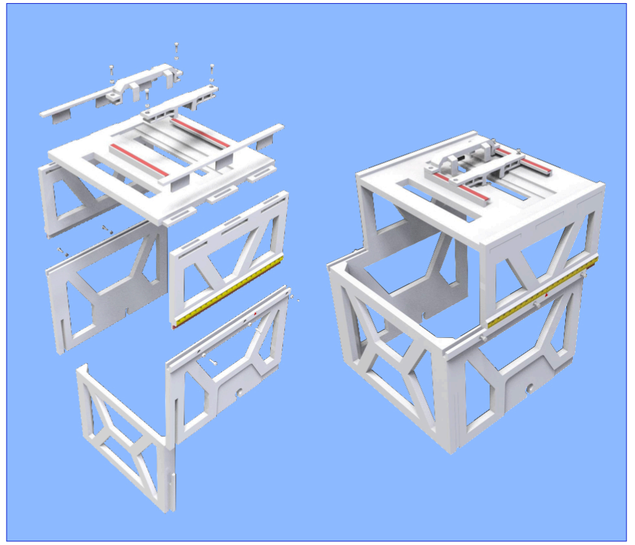

Fig 1. Design and fabrication of one 3D-printed localization box

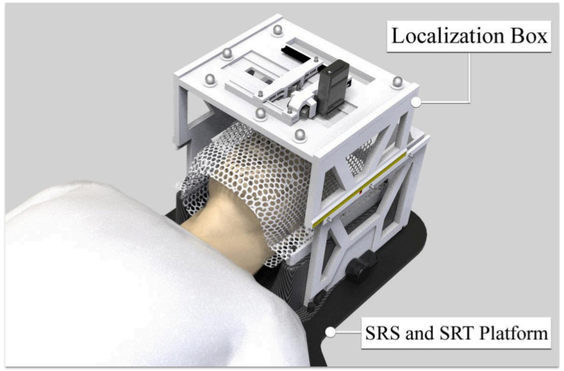

Fig 2. Localization box compatible with BrainLAB frameless SRS and SRT system

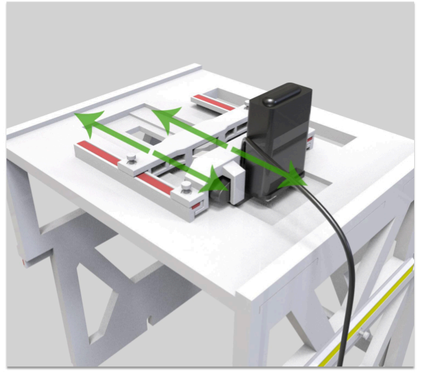

Fig 3. Translation and lock of LED and camera in the lateral direction

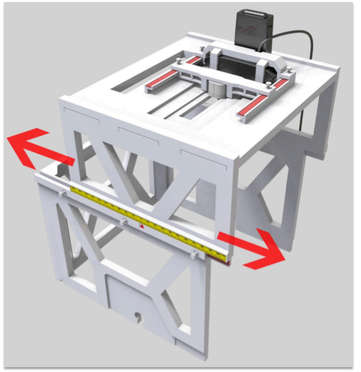

Fig 4. The movement and lock of longitudinal direction

CONCLUSIONS

A novel localization box for frameless LINAC-SRS for uveal melanoma was made with 3D printing.

It was fully secured to LINAC couch, with a gaze focus point for patient's eye position and real time video monitoring of eye position during treatment.

It enabled treatment for uveal melanoma with our existing frameless SRS and SRT platform.

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