Study reveals high accuracy of MR-guided radiotherapy for intracranial stereotactic radiosurgery

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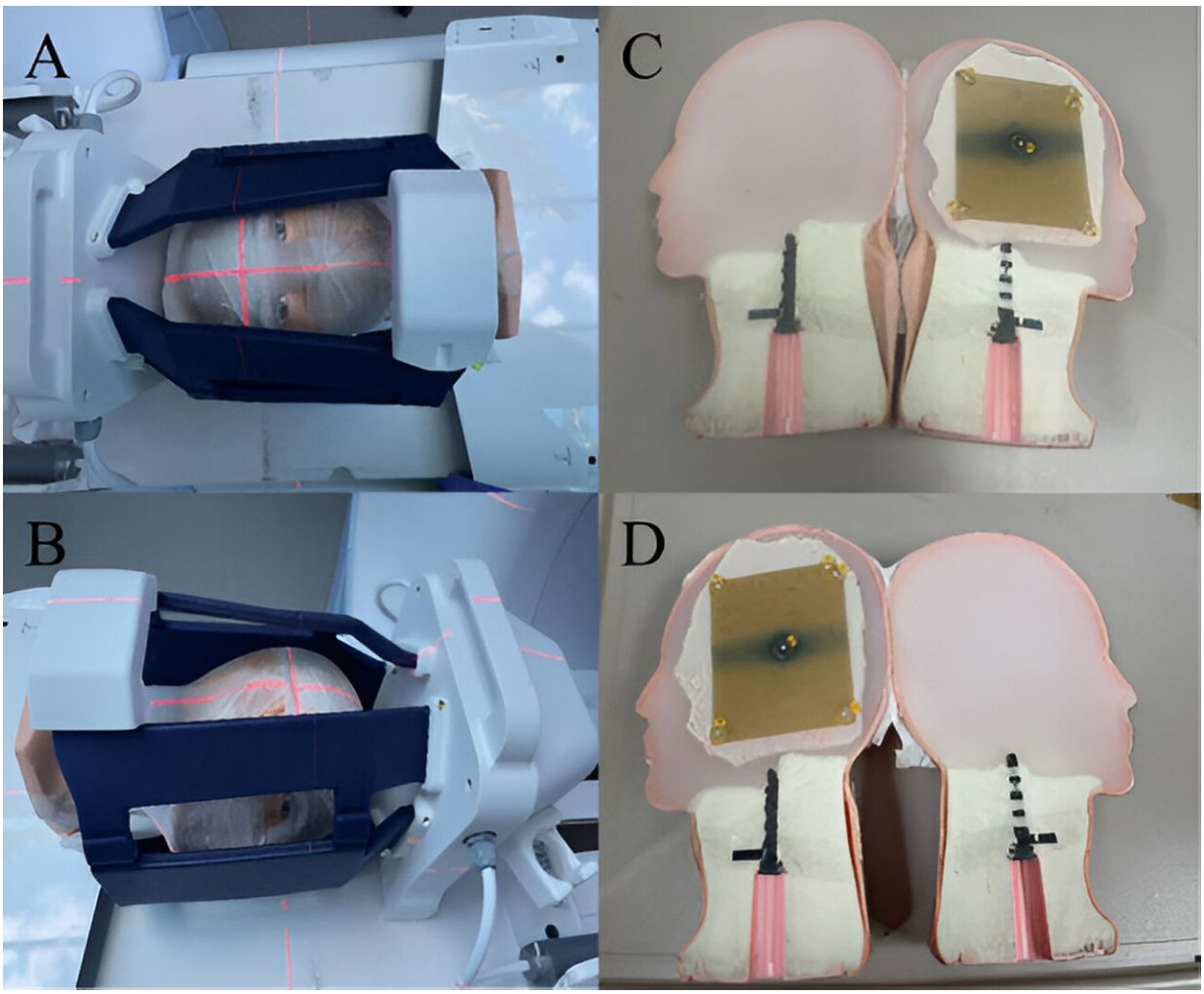

Phantom configuration in sagittal (A) and coronal (B) orientation to evaluate the accuracy of the MR-RT in the IEC-Y/IEC-Z and IEC-X/IEC-Y planes,

respectively. Placement of the film relative to CORNELIUS in the sagittal (C) and coronal (D) orientation in the treatment setups. Credit: *International Journal of Radiation Oncology*Biology*Physics* (2023). DOI: 10.1016/j.ijrobp.2023.08.043

A new study, led by radiation oncology physicists at Miami Cancer Institute, part of Baptist Health South Florida, has displayed positive results using intracranial stereotactic radiosurgery, also known as SRS, for an MR-guided radiotherapy system.

The study, "Commissioning Intracranial Stereotactic Radiosurgery (SRS) for an MR-guided Radiotherapy (MRgRT) system: MR-RT Localization and Dosimetric End-to-End Validation," is published in the *International Journal of Radiation Oncology—Biology—Physics (IJROBP)*. It highlights positive accuracy through an end-to-end hidden target test to quantify the imaging, planning, and delivery coincidence of an MR Linac system, ViewRay MRIdian.

Kathryn Mittauer, Ph.D., lead physicist for the MR-guided radiation therapy program with Miami Cancer Institute, was the first author of this study. Mittauer explains that the team developed an in-house MR head phantom to simulate stereotactic radiosurgery for brain tumors. Specifically, the study simulated intracranial spherical targets, an irregularly shaped target, and a target abutting brainstem.

Nema Bassiri, Ph.D., radiation oncology physicist with Miami Cancer Institute, and senior author of this study, explains that this delivery was successful with up to 99% accuracy. Bassiri adds that "this work enables the utilization of novel MR-guided radiotherapy technology for intracranial SRS, which has not been used with MR Linac systems." MRI is the gold standard to evaluate and localize brain tumors due to soft

tissue visualization capabilities.

"Since we demonstrated the accuracy of ViewRay MRIdian's capability to deliver within a 1 mm setup margin in this work, we have now deployed this novel technique to our brain cancer patients at Miami Cancer Institute," adds Mittauer. The team has observed that the volume of a patient's tumor changed during a 3-fraction radiosurgery course through using the onboard MR image guidance of the MR Linac system.

"What's most impressive is that we are able to visualize how the tumor volume changes day to day, even throughout a short 3-fraction treatment. This research will help us better understand how these tumors change (including tumor progression), and the role of adaptive radiotherapy which adjusts the radiation to account for these changes to enable more precision," shared Mittauer. "In the field of radiation oncology, this is revolutionary as we assess the frequency of these anatomical changes and how this will inform us for even other radiation choices."

"In the future, we will see more studies that investigate the benefit of using MRIdian for stereotactic radiosurgery. This study will help advance the community by providing a blueprint to implement MR-guided SRS program for anyone who is interested in utilizing this treatment technique," shared Bassiri.

More information: Kathryn E. Mittauer et al, Commissioning Intracranial Stereotactic Radiosurgery (SRS) for an MR-guided Radiotherapy (MRgRT) system: MR-RT Localization and Dosimetric End-to-End Validation, *International Journal of Radiation Oncology*Biology*Physics* (2023). DOI: 10.1016/j.ijrobp.2023.08.043

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