Healthcare Innovations
How practice has changed

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3D printing of personalized radiation shielding for treatment of skin cancers

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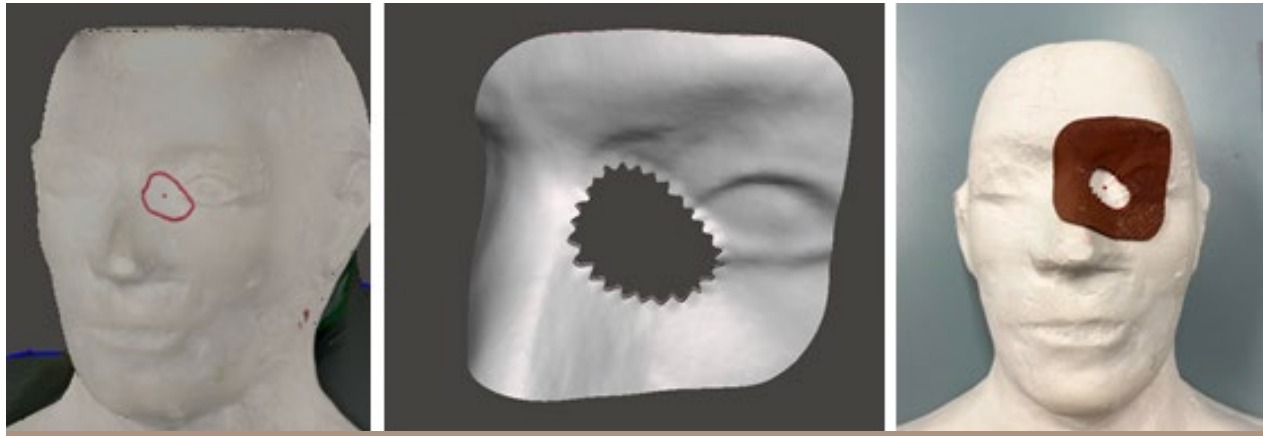
Purpose

Kilovoltage (kV) radiotherapy is used for treating superficial cancers, e.g. basal and squamous cell carcinomas. kV treatments require shielding to be used to conform the radiation beam to the target tissue, and this may need to be patient-matched for sites around ears, nose and eyes.

Historically these have been made by moulding lead sheeting to the patient anatomy. Many departments want to remove lead handling due to material toxicity. One alternative to lead is the use of 3D-printed high-density plastic-metal composites.

Method

Two 3D-printable composites were investigated: PLA/tungsten and PLA/copper. The thicknesses required for shielding were calculated using open source radiation modelling software, and verified with radiation detectors. To demonstrate potential clinical use, a shield was prepared for an anthropomorphic phantom, based on both computed tomography (CT) images and 3D scans.



Results and conclusion

The thicknesses of shielding of the composite materials for energies used in superficial radiotherapy ranged from 0.3 to 0.8 mm of PLA/tungsten and 2 to 8 mm of PLA/copper. Shields of these thicknesses can be 3D printed efficiently. An example shield is shown above. This work is described in more detail in "Predicting the required thickness of custom shielding materials in kilovoltage radiotherapy beams", Physica Medica vol. 81, pp 94-101.