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Industrial Keynote

Personalization of radiotherapy with VSP Bolus

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Radiotherapy is a treatment modality used in approximately half of all cancer cases to target and kill cancerous cells [1,2]. Many treatment options require the use of a bolus which attenuates the radiation beam to alter the dose at desired tissue depths. A common clinical solution is a silicone slab, which is placed on the patient's targeted treatment anatomy to act as a bolus. However, patient-specific boluses have shown in improvement in patient conformality and have shown improved radiotherapy plan dose conformity [3]. As such, 3D Systems developed VSP® Bolus to offer an FDA-cleared, elastomeric, 3D-printed, and patient-specific solution for radiation oncology.

The VSP Bolus workflow begins with the submission of patient CT data through a physician-facing portal. Using, DICOM-to-Print (D2P®) software, the patient's skin tissue is segmented into a 3D model. Biomedical engineers use information from the radiotherapy treatment plan and the patient 3D model to create a uniform thickness bolus using Geomagic® Freeform®, a volumetric modeling software tool specializing in non-parametric patient contours. The patient-specific bolus is optimized for 3D printing in 3D Sprint®, 3D Systems' build preparation software. The boluses are manufactured in an elastomeric material, VisiJet® M2E-BK70, on the ProJet® MJP 2500 Plus, a MultiJet system leveraging wax supports and picolitre quantities of jetted material resulting in high accuracy prints.

VisiJet M2E-BK70 is the chosen material for the bolus application because of the material's biocompatibility and elasticity (Shore A hardness of 70). Because the device is in contact with patient tissue, VSP Bolus was evaluated for biocompatibility against ISO 10993-1:2018, Biological evaluation of medical device – Part 1: Evaluation and testing within a risk management process. The elastomeric, patient-matched, and biocompatible bolus is designed to improve patient treatment and set-up.

As a healthcare solutions provider, 3D Systems leveraged expertise in patient-specific device manufacturing workflows, materials, 3D printing processes, and medical regulatory requirements to develop a physician-centric service. The service model enables clinicians to use an FDA-cleared patient-specific bolus for their oncology cases with limited device design burden.

AUTHOR'S STATEMENT

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