Patient Case Study:
SCC of Right Index Fingernail

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Overview

Adaptiiv Medical Technologies Inc. (Adaptiiv) provides cancer centers with the hardware, software, and materials to design and 3D print custom radiotherapy accessories.

The following patient case demonstrates the application of Adaptiiv's technology used in clinical radiation oncology through the design and fabrication of customized bolus to improve the efficacy of treating complex target volumes with electron beams. This case is a great example of how a custom modulated electron bolus (MEB) allowed for a uniform dose distribution of a complex treatment volume, while sparing underlying critical structures.

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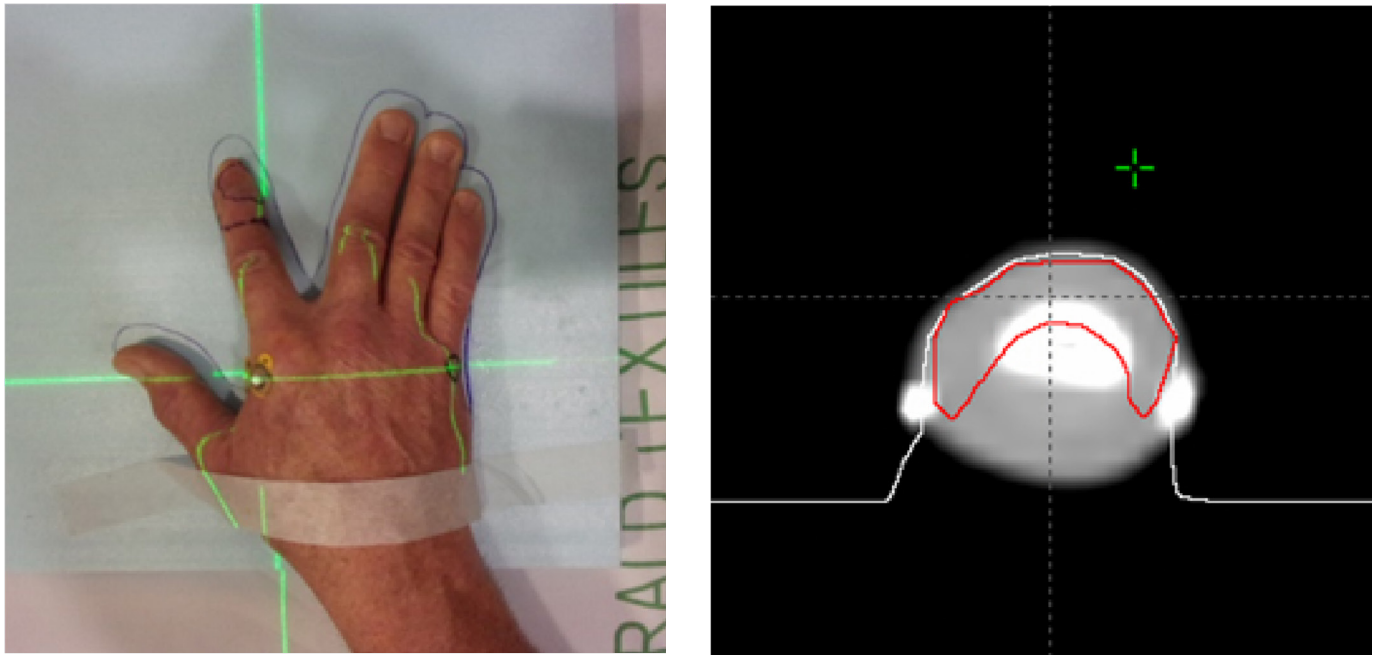
Description

60 year old male who presented with a recurrent squamous cell carcinoma of the right index fingernail bed.

Fabrication and Treatment

The goal for the patient was to deliver a uniform dose to the tumor volume contoured by the physician, while sparing the underlying bone of the finger as much as possible. The solution chosen was to design a customized MEB. The use of standard bolus would have been able to treat the tumor volume, however, would result in treating the entire underlying bone to full dose.

An additional challenge in this case was the non-standard patient setup, which is commonly required when treating extremities. When designing the modulated bolus, the support structures were included which greatly improved the ease and reproducibility of daily treatment setup.



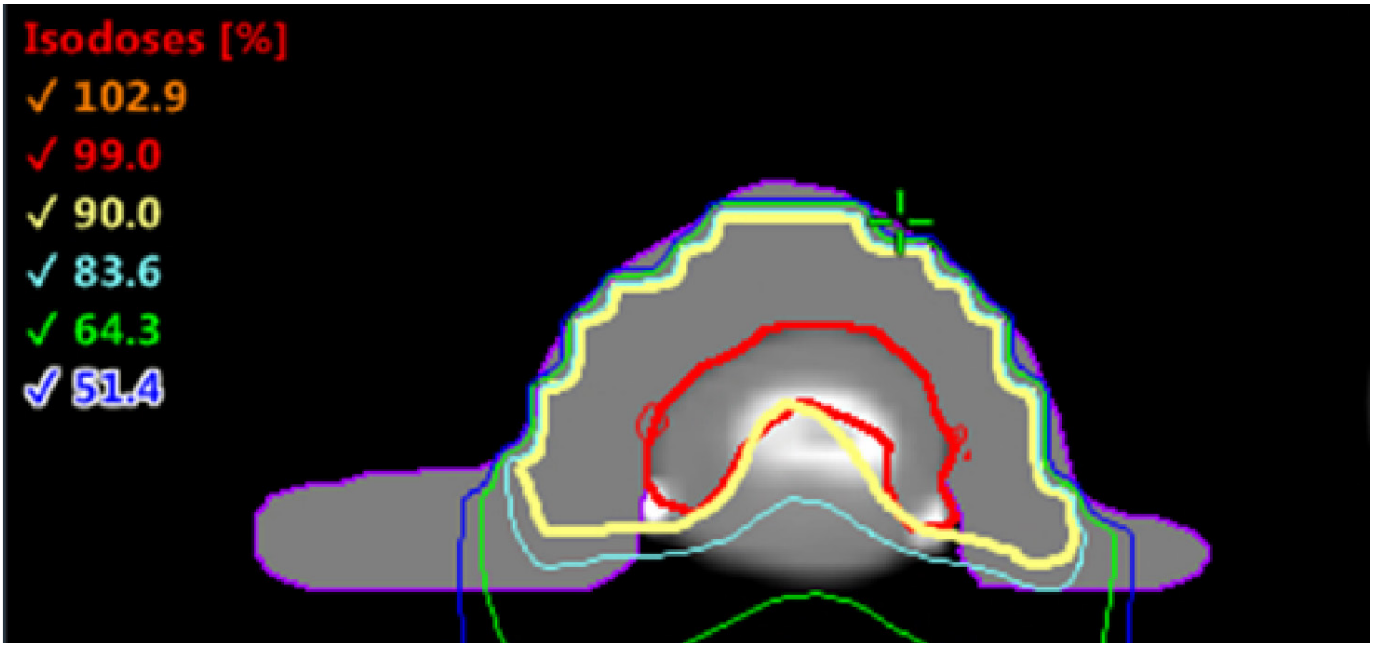
Patient was simulated with hand on a piece of foam to provide a flat surface for the bolus. The contoured treatment volume is shown on the CT image, along with the inclusion of the foam support within the body contour to allow the 3D printed bolus to fit snugly against the support.

Dose

70 Gy in 35 fractions using a 9 MeV electron beam prescribed to the 90% volume.

Results/Findings

The use of custom MEB allowed us to treat the right index fingernail bed to a uniform dose, while sparing a large amount of the underlying bone. The use of standard bolus in this case would not have allowed us to conform the dose around the underlying bone while sparing a good portion of it. The entire volume of the underlying bone would have been treated to the full prescription dose. In addition, the shaping of the uniform prescription dose would not have been possible. The custom electron bolus also allows for the reproducible setup of the patient in this unconventional position.



Isodose distribution showing how the modulated electron bolus was able to conform the prescription isodose line to the PTV while sparing the underlying bone.

Summary

The clinical advantages of the 3D printed custom modulated electron bolus are as follows:

1. Reproducible positioning for non-standard treatment techniques.
2. The bolus conforms better to the patient than standard bolus, with minimal air gaps.
3. Uniform dose with minimal hot spots can be achieved.
4. Measurements to verify bolus placement and calculated dose are easily achieved.

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