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Patient Case Study:

Adaptiiv On Demand TrueFlex Bolus for a Malignant Neoplasm of Nasal Cavity Treatment for a Nose

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Overview

Adaptiiv Medical Technologies Inc. (Adaptiiv) empowers cancer centers with regulatory-cleared software for designing and 3D printing patient-specific radiotherapy accessories.

This case study serves as a compelling demonstration of how Adaptiiv's software can be efficiently used in clinical radiation oncology. It highlights how the software addresses complex anatomical challenges through the creation of a custom 3D-printed TrueFlex bolus for malignant neoplasm of the nasal cavity. By employing a uniform-thickness bolus, this case underscores the achievement of a uniform dose distribution while prioritizing patient comfort.



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Patient History

A 61-year-old male diagnosed with a malignant neoplasm of the nasal cavity was referred for radiation therapy treatment. After careful consideration of the target area, a flexible bolus was chosen to better accommodate the patient's unique anatomy.

Because of the significant nature of surgery causing loss of tissue-volumes, a special bolus was required to adequately cover the skin margins plus the area at risk inside the nasal cavity.

Design & Fabrication

The patient underwent an initial simulation in an open face head and neck mask.



Figure 1 : Showing CT simulation setup.

3D Bolus Creation

- The DICOM CT scan and structure set were exported and sent to Adaptiiv's 3D Bolus software. This software converted the DICOM images of the desired bolus shape into a stereolithography file.
- The structure set was then exported to the TPS for final verification of the plan with the 3D bolus design. Once verified, the design was submitted to Adaptiiv's On Demand (AOD) service for mold creation.

TrueFlex Bolus Manufacturing

- The AOD service automatically forwarded the mold design to Adaptiiv's manufacturing partner, HP. HP utilizes Multi Jet Fusion technology to 3D print the mold using a rigid PA12 material.
- The printed mold was then filled with EcoFlex 00-30 silicone to create the final TrueFlex bolus. This silicone material offers a soft touch and high flexibility, prioritizing patient comfort while conforming to a treatment area. It serves as a valuable solution to address open wound sites with a protective cover (e.g. food wrap) in place.

Quality Assurance

To ensure the quality of the TrueFlex bolus, the AOD service performed thorough quality assurance checks. These checks verified that the physical density and spatial accuracy of the bolus met all specified tolerances.

Dose Calculation & Verification

Upon receiving the custom bolus, the patient underwent a repeat simulation using the original mask in place. To ensure a comfortable and consistent fit for daily treatment, sections of the mask were strategically removed. The patient was then rescanned with this modified setup.



Figure 2. Final planning CT setup with custom bolus.

The newly acquired CT scan data was incorporated into the final treatment plan, which included the custom bolus within the body contour. The patient received a total dose of 60 Gy delivered in 30 fractions using a VMAT technique with 6 MV photons and three treatment arcs. This approach achieved excellent dose conformity to the targeted area.

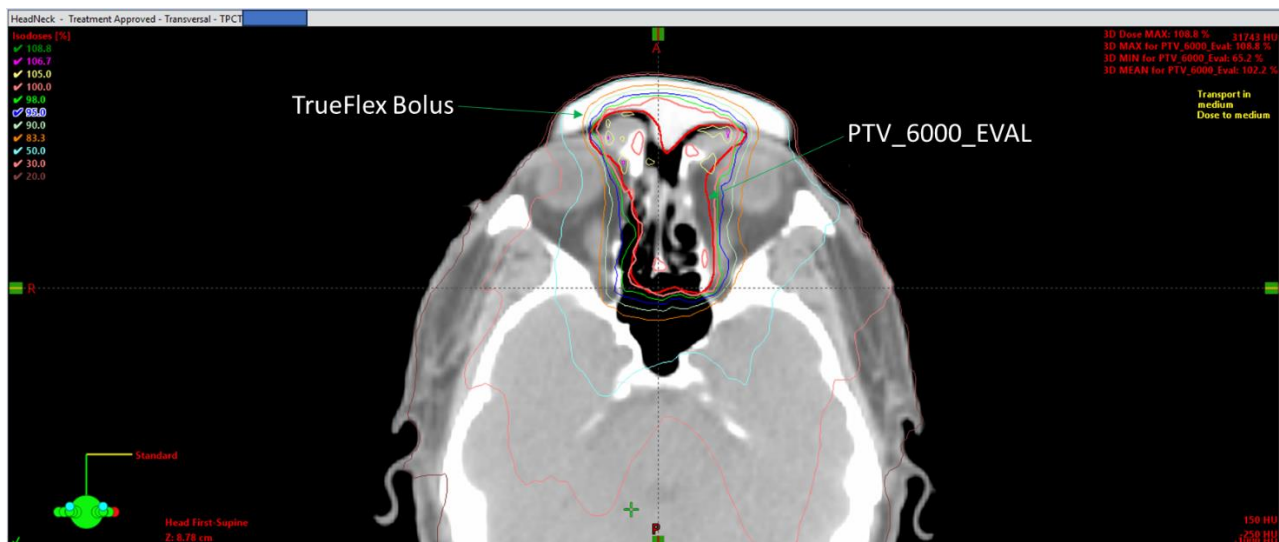


Figure 3. A screenshot illustrates the conformity between the prescribed dose line (depicted in orange) and the PTV_6000_EVAL (represented in red).

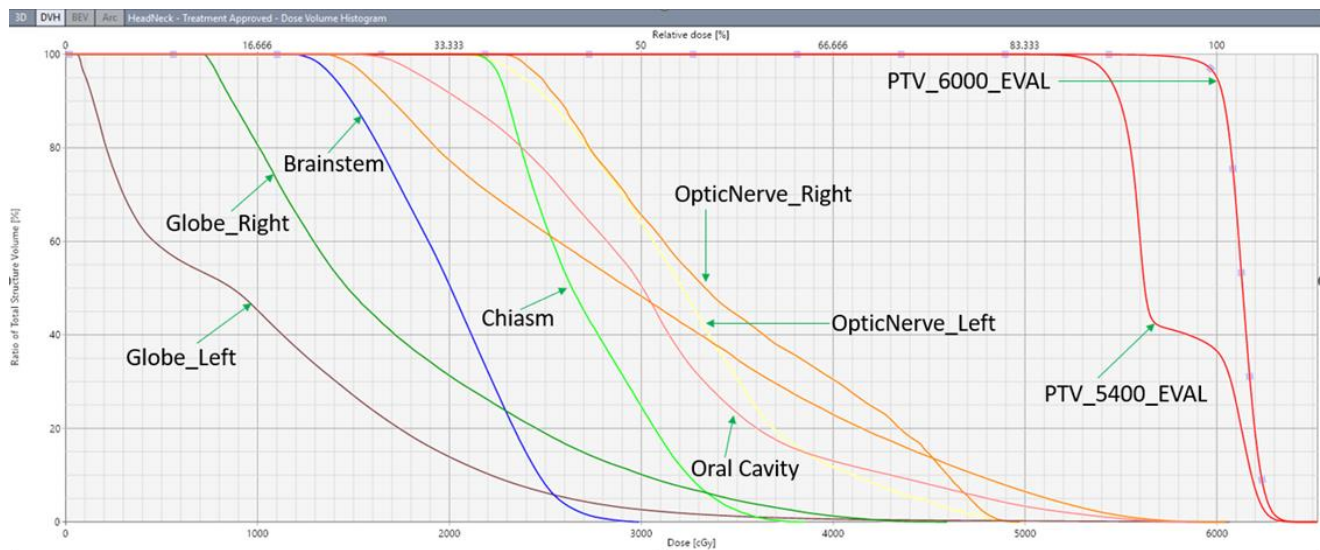


Figure 4. A screenshot of the Dose Volume Histograms (DVHs) for both the target and critical structures demonstrates excellent target coverage.

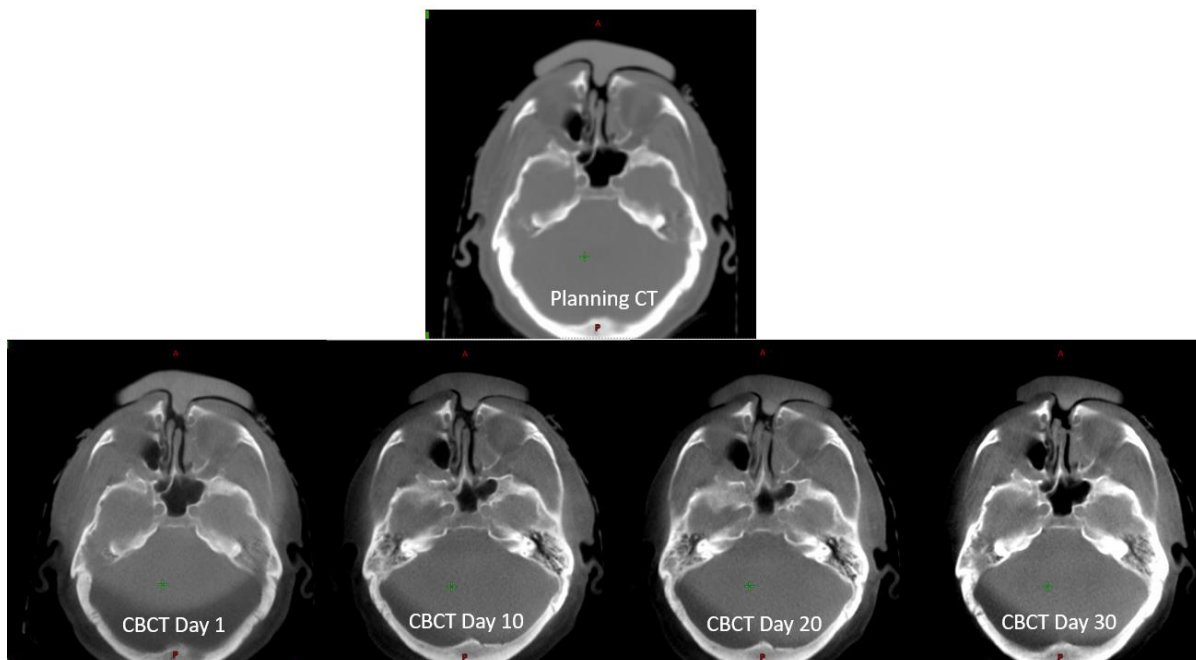


Figure 5. View of Daily Cone Beam CT (CBCT) in 10-day intervals showing good fit of the bolus and minimum air gaps, as compared to the planning CT scan.

Results & Findings

The patient tolerated the treatment regimen exceptionally well throughout the entire course. This is particularly noteworthy given the challenges of treating a cavity accurately and comfortably with conventional methods. The 3D-printed bolus significantly improved the daily setup process. Its superb fit ensured consistent treatment positioning (high reproducibility) and substantially reduced setup time.

We will be following up with a post treatment imaging for evaluation at 3 months and then continue the surveillance there after up to next 5 years.

Summary

- 1 Exceptional Conformity:** Adaptiiv's TrueFlex Bolus precisely molds to a patient's unique anatomy, ensuring optimal contact and coverage even on irregular surfaces. This superior conformity translates to improved dose distribution for targeted areas.
- 2 Enhanced Reproducibility:** The bolus facilitates consistent treatment delivery by ensuring reproducible patient setup during daily sessions. This reduces variations and streamlines the treatment process.
- 3 Improved Patient Comfort:** The bolus creates a comfortable interface between the patient's skin and the treatment beam. This enhances patient tolerance and compliance throughout the treatment course

"Adaptiiv's TrueFlex Bolus conforms precisely to a patient's unique and challenging anatomy, ensuring optimal contact with the cavity area for the best possible target coverage."

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