

A Digital Workflow to Create Patient-Specific Radiation Oral Shields for Orthovoltage

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Purpose: Improve patient care by using 3D printing technologies to prepare a patient-specific oral shield to protect teeth and gums.

Clinical context: Young patient with keloids around mouth following injury. 15 Gy by radiotherapy after surgery, planned many weeks later.

Methods: Dental impression done with orfit. 3D model obtained with an optical scanner. Model refined to allow addition of lead. Printed in biocompatible resin and lead molded onto it. Thin layer of resin added on top of lead. A similar flat shield prepared for measurements with a PTW soft x-ray ionization chamber.

Results: Flat shield with same construction as oral shield attenuated 99.5% of a 100 kVp beam and backscatter quantified at 0.1%. Once in position, it covered all teeth and gums and did not move. Negligible dose to teeth and gums when compared with VMAT or electrons.

Conclusion: A successful clinical process was developed to produce an oral shield using 3D printing. Clinical team feedback: preparing shield before treatment saved time on day of treatment and reduced manipulations post operation, more secure setup with teeth imprint and easier to clean when compared with our previous technique.



Dental impression

- Mold room
- Dummy model in Orfit



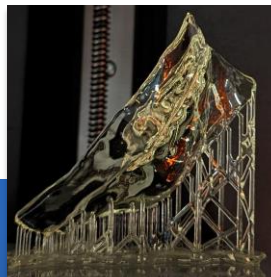
Digital reconstruction

- Scanning the dummy model
- Artec Space Spider
- Artec Studio 16



Device conception

- Smoothing, trimming
- Adding features
- Autodesk Meshmixer



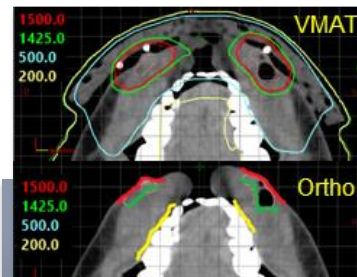
Device 3D printing

- Slicing the final model
- Formlabs Form 3B
- Biomed Amber resin



Device assembly

- 1 mm lead sheet shaped onto imprint
- Coating and Tegaderm Film



Dosimetry

- Notice dose to teeth in VMAT plan.
- Ortho: Artistic interpretation of isodoses based on PDD from two 100 kVp fields considering a oral shield in place (not visible on CT).