3D printing in brachytherapy

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Point of Care event – 3D systems
Munich, 7 March 2024

3D printing in brachytherapy

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- ❑ How it started
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What is brachytherapy?

External

What is brachytherapy?

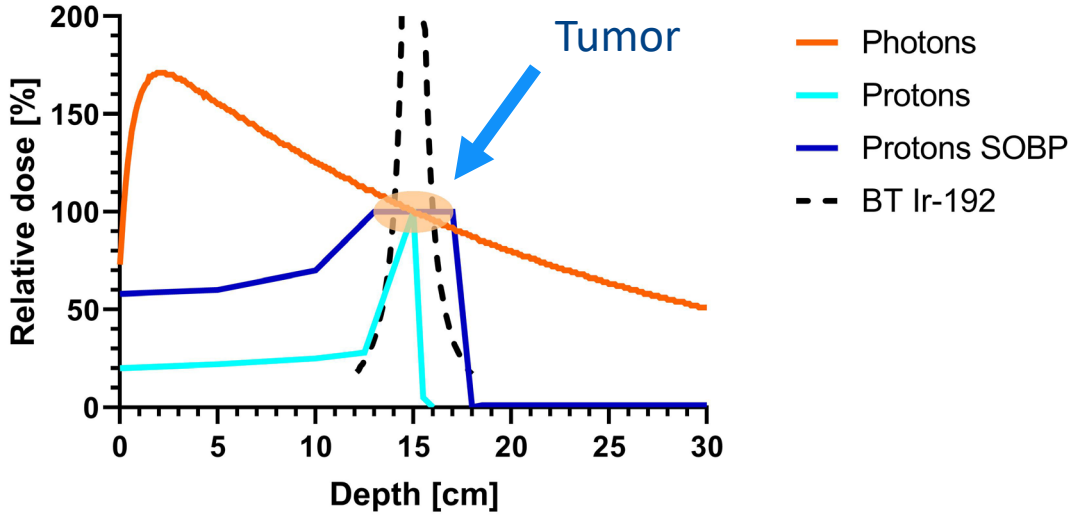
6 MeV
10 MeV

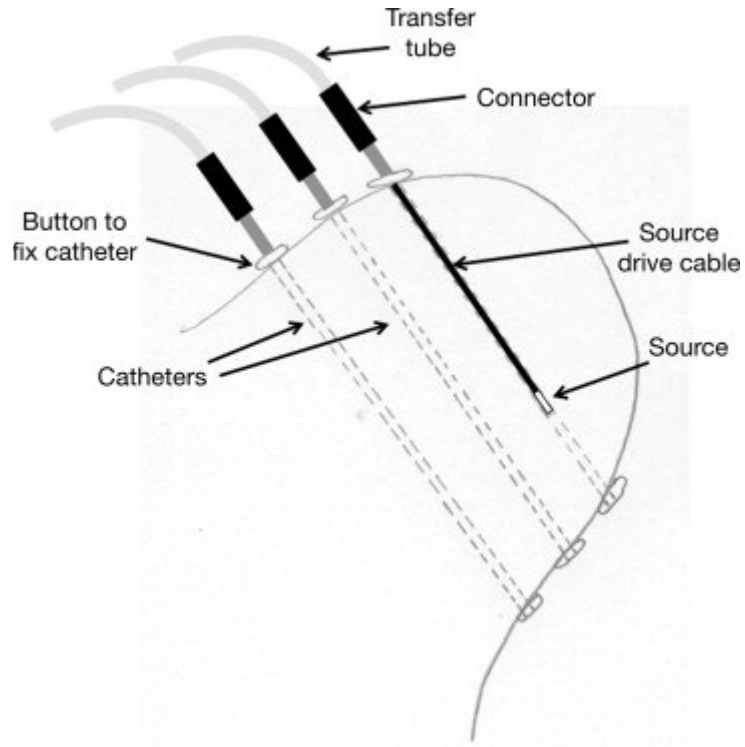
External

Ir-192
Mean photon energy
350 keV

Internal

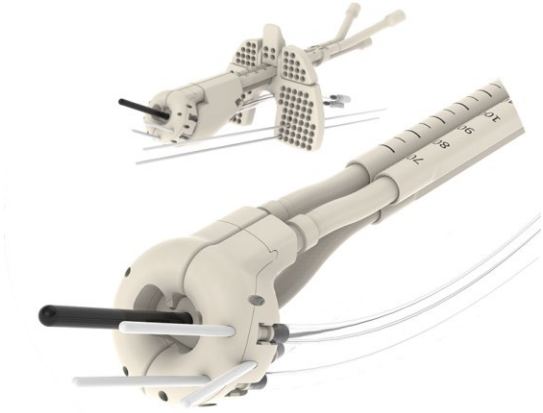
What is brachytherapy?

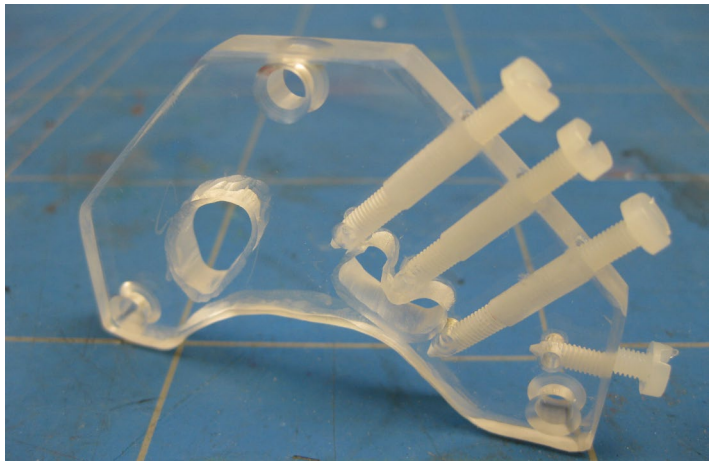




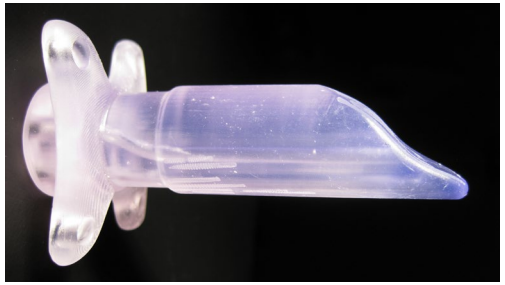
What is brachytherapy?

What is brachytherapy?



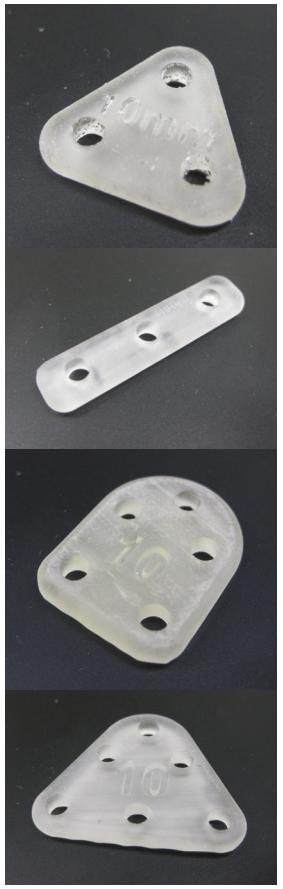


How it started

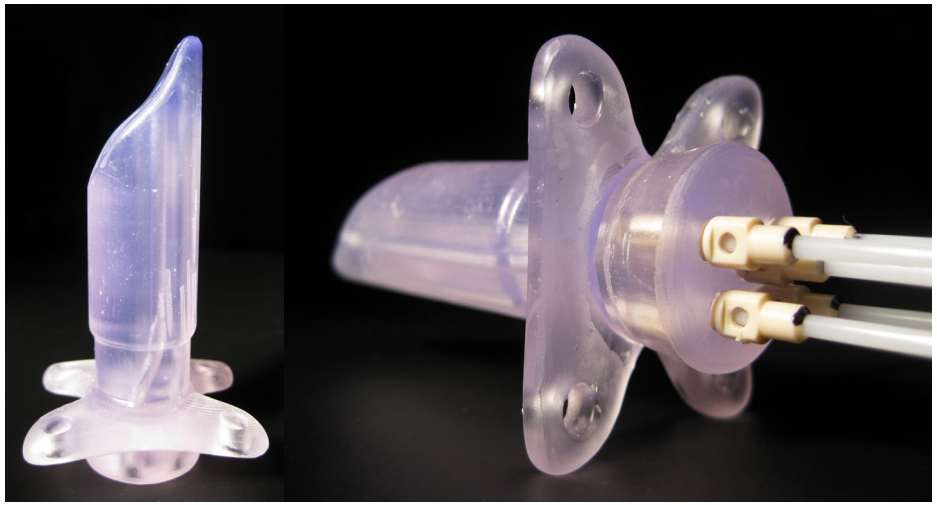


EU-MDR

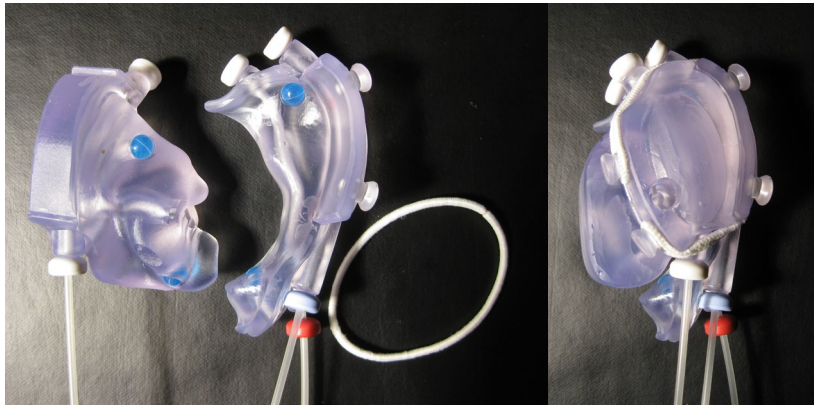
How it started



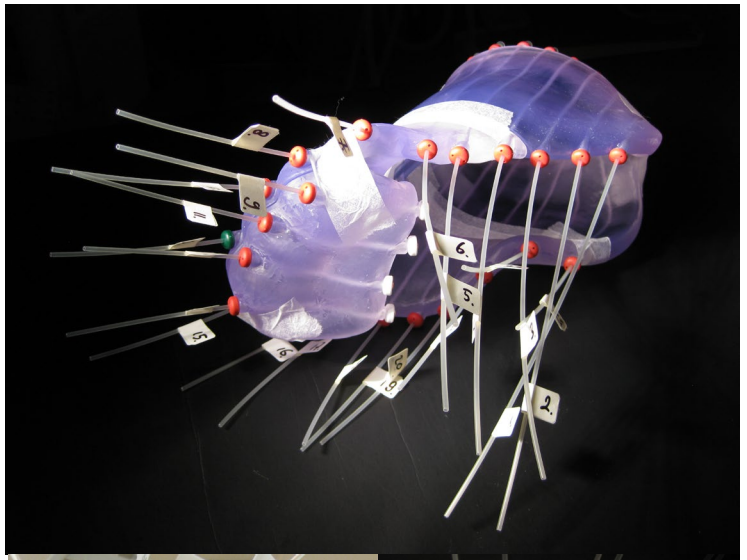
Lip

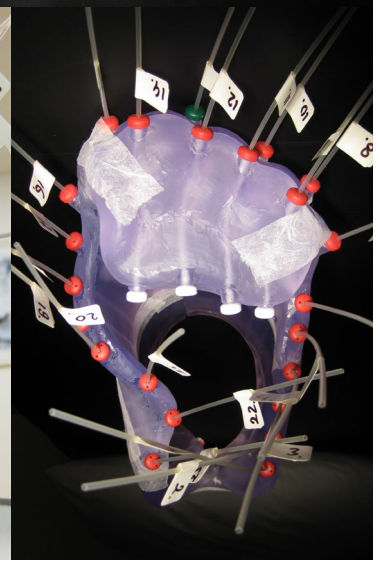


Vagina



Ear





Foot

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How it started

AMORE technique

Ablative surgery, **MO**uld technique after loading brachytherapy, and surgical **Re**construction

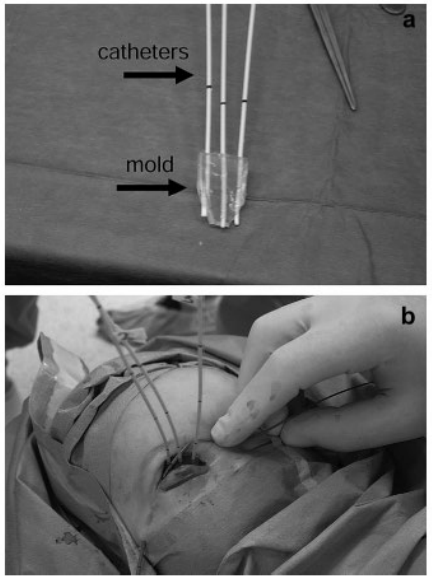


Fig. 1. (a) Silicon mold with three catheters inserted. (b) Mold containing catheters positioned in the surgical defect. Incision will be carefully closed over the mold.

Blank *et al.*, IJROBP, 2010

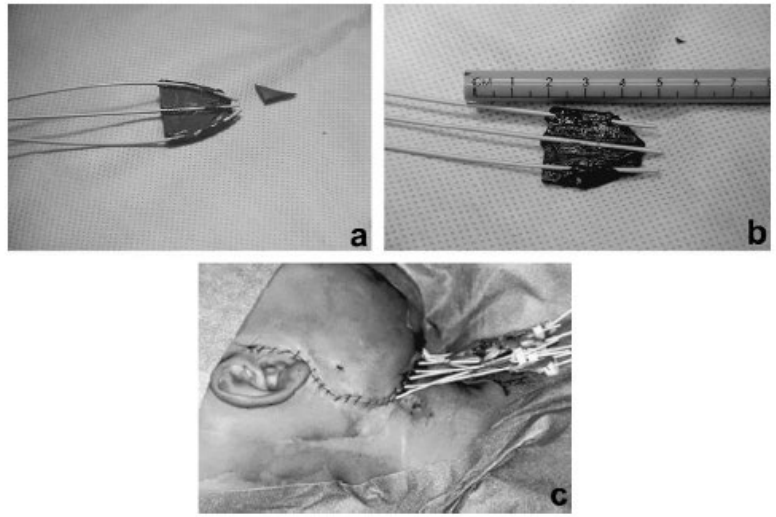
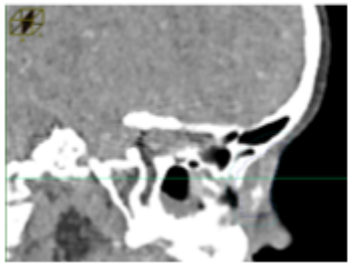
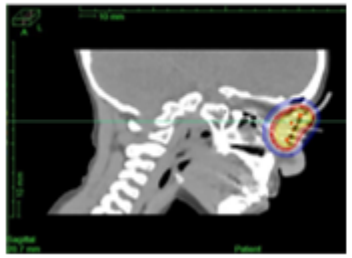


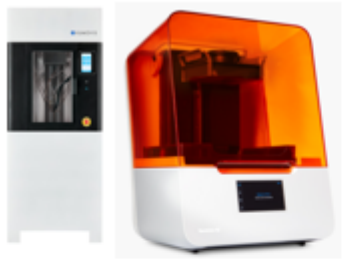
Fig. 1. Gutta Percha molds, cut into the desired shape, (a, b) containing flexible catheters for brachytherapy and (c) catheters protruding from a closed wound.

Blank *et al.*, IJROBP, 2009

Workflow

	Step 1 & 2	Days to application
	Pre-treatment imaging CT/MRI Match CT/MRI Delineation targets + organs at risk	-16
	**Step 3** Pre-plan: Catheter construction Optimalization	-14

Workflow



Step 4 & 5

Production 3D print: -10

Design

Printing

Post-processing

Step 6 & 7

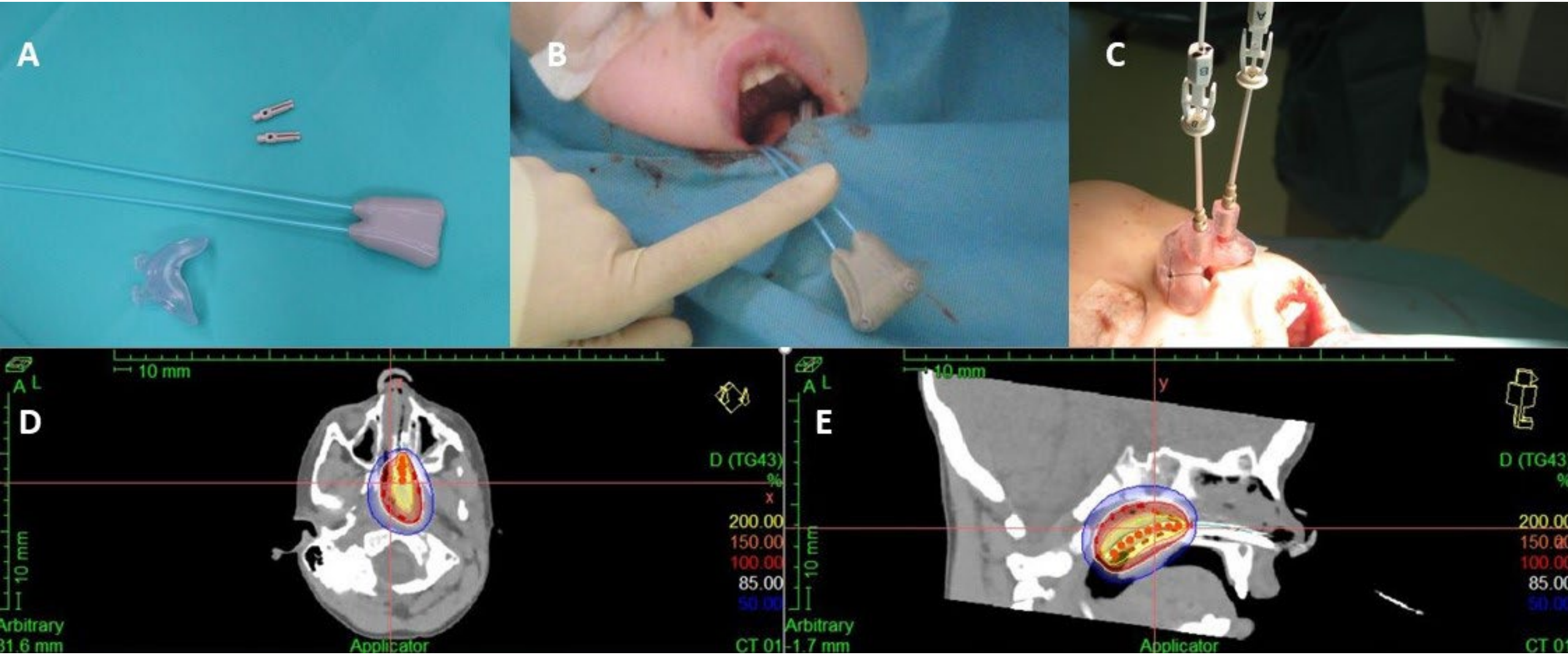
Validation 3D print -5

Sterilization

Mould ready for application -3

Case 1: Nasopharynx (6 years old)

Davila *et al*., 2023, submitted



Case 1: Nasopharynx

Case 1: Nasopharynx

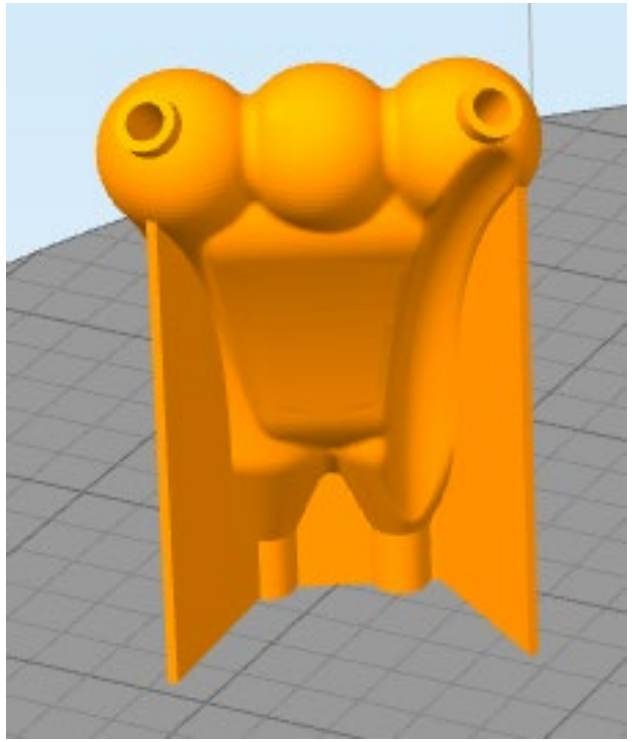
Material: Biomed Clear

Material: PEEK

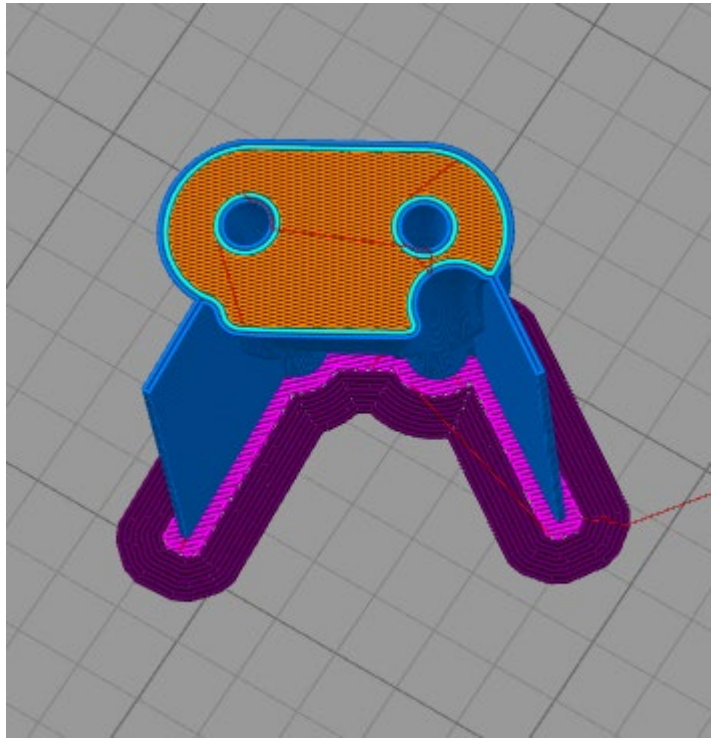
Material: Biomed Clear

Software: Fusion Autodesk 360

Case 1: Nasopharynx

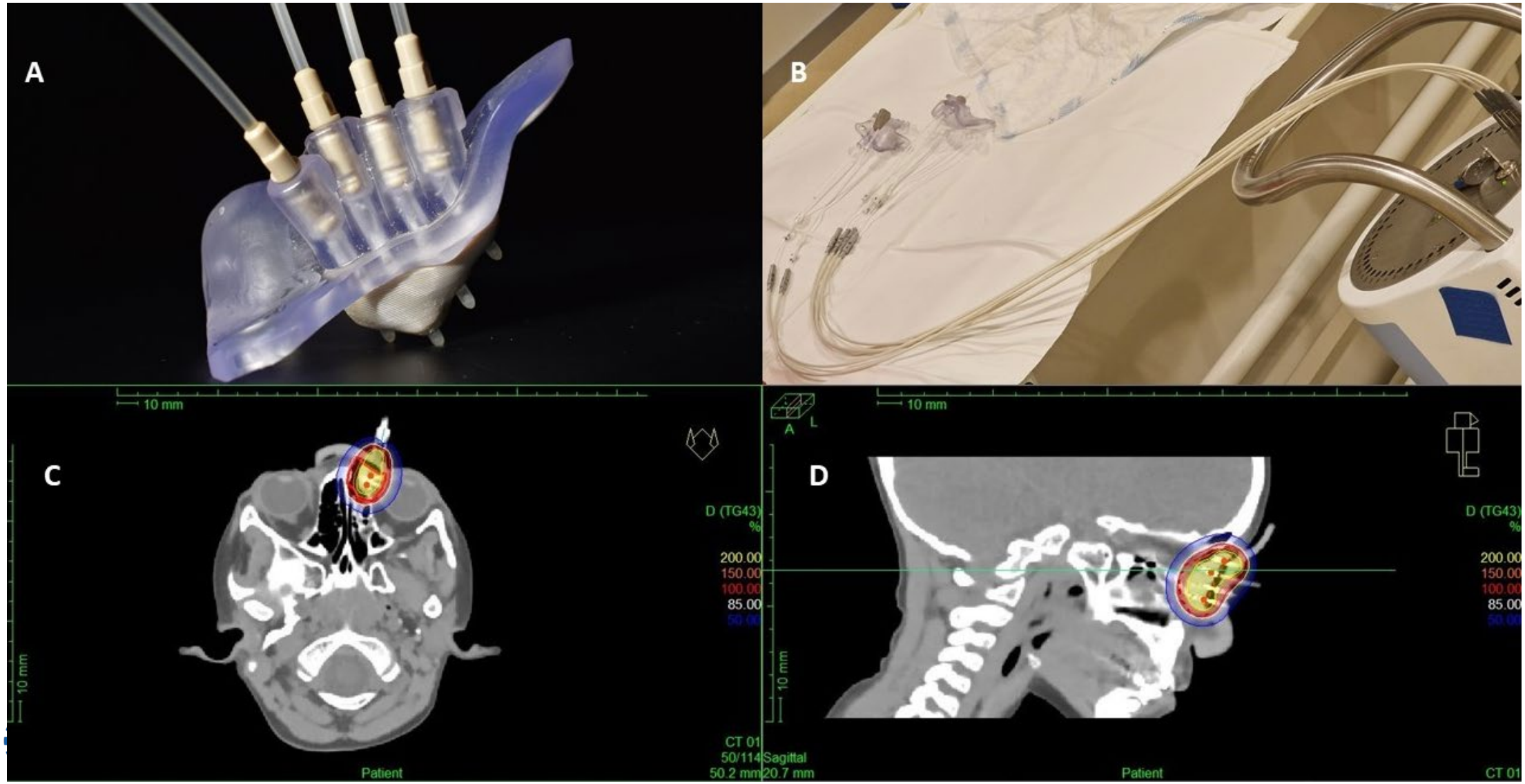


Material: PEEK



Material: PEEK

Case 2: left eye corner (9 years old)



Case 2: left eye corner

Case 2: left eye corner

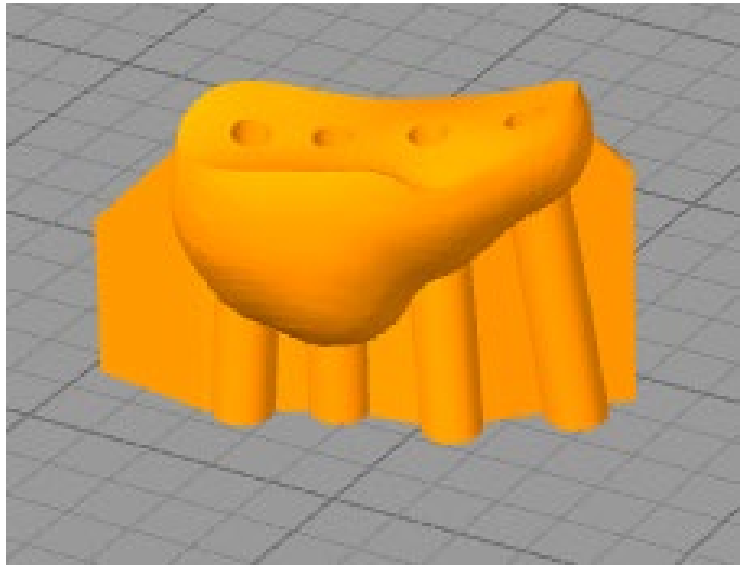
Material: Biomed Clear

Material: PEEK

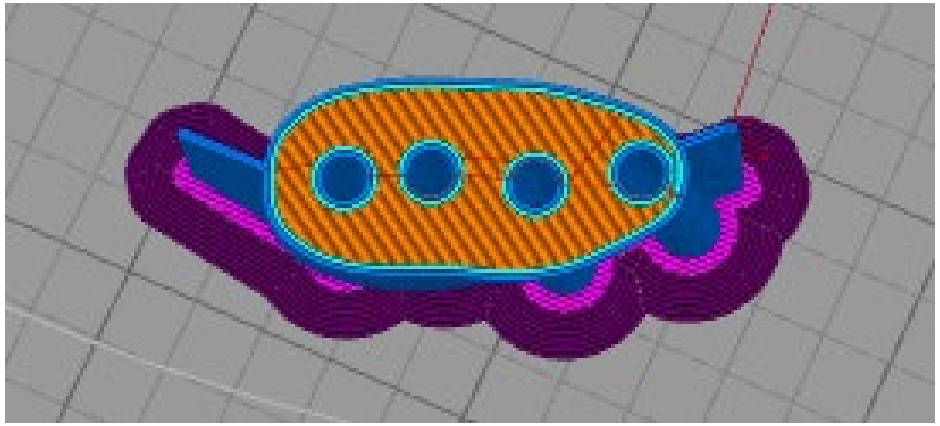
Material: Biomed Clear

Software: Fusion Autodesk 360

Case 2: left eye corner



Material: PEEK

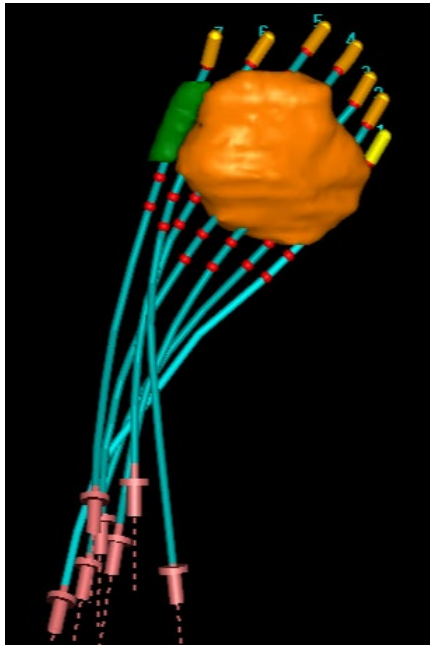


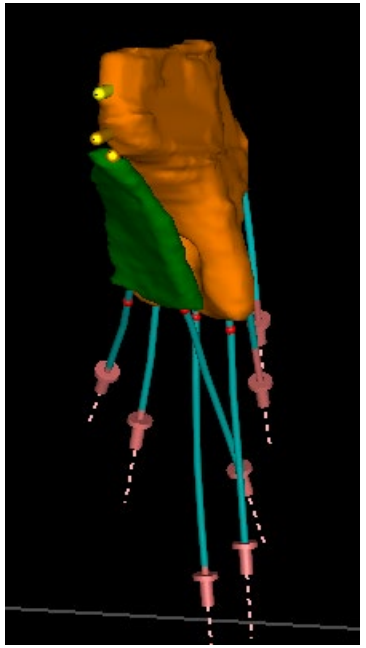
Material: PEEK

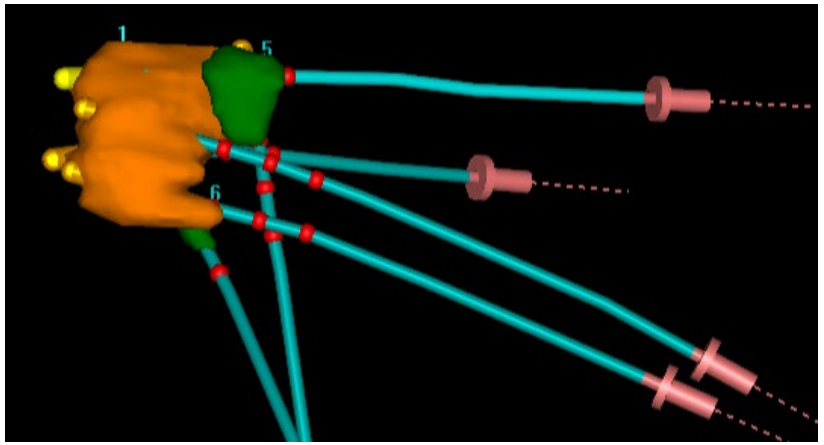
Software: Simplify3D

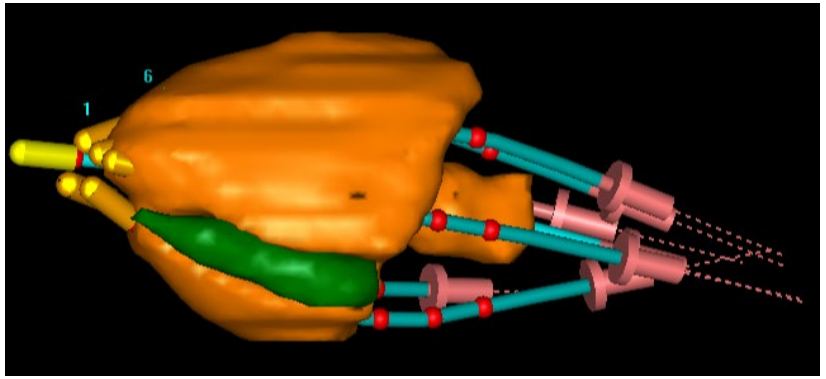
Future developments

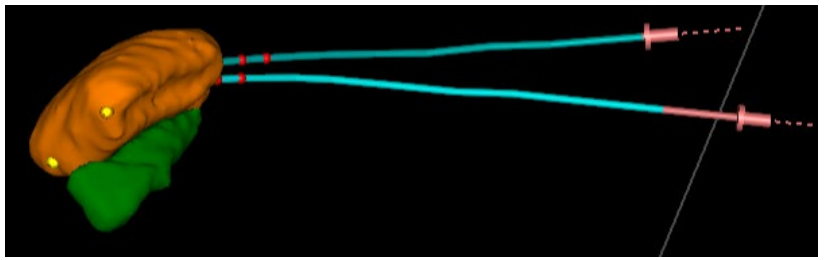
- **Research to add-ons**
- **Flexibility during operation**

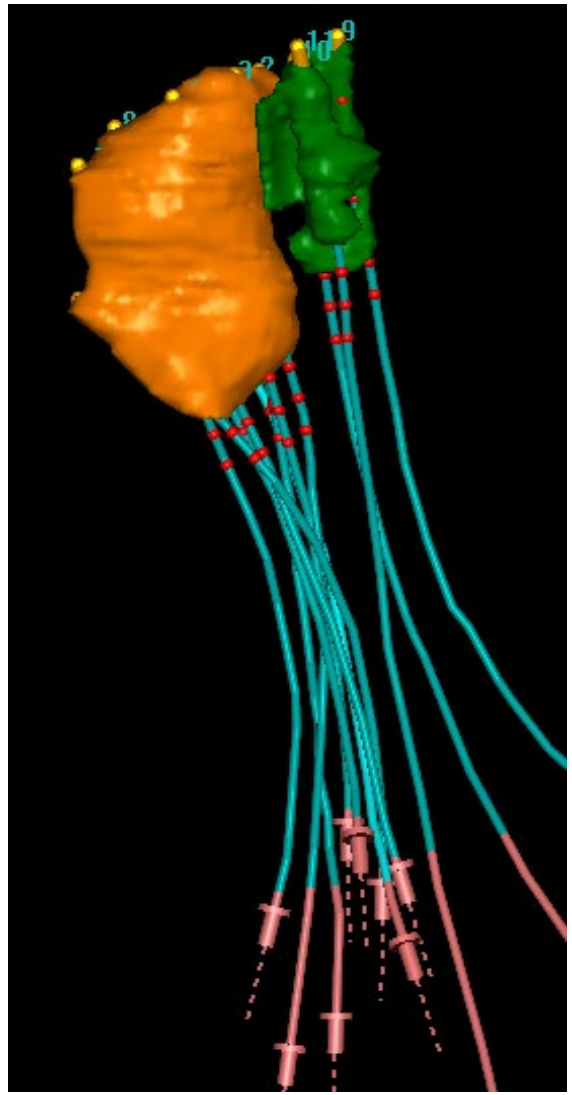








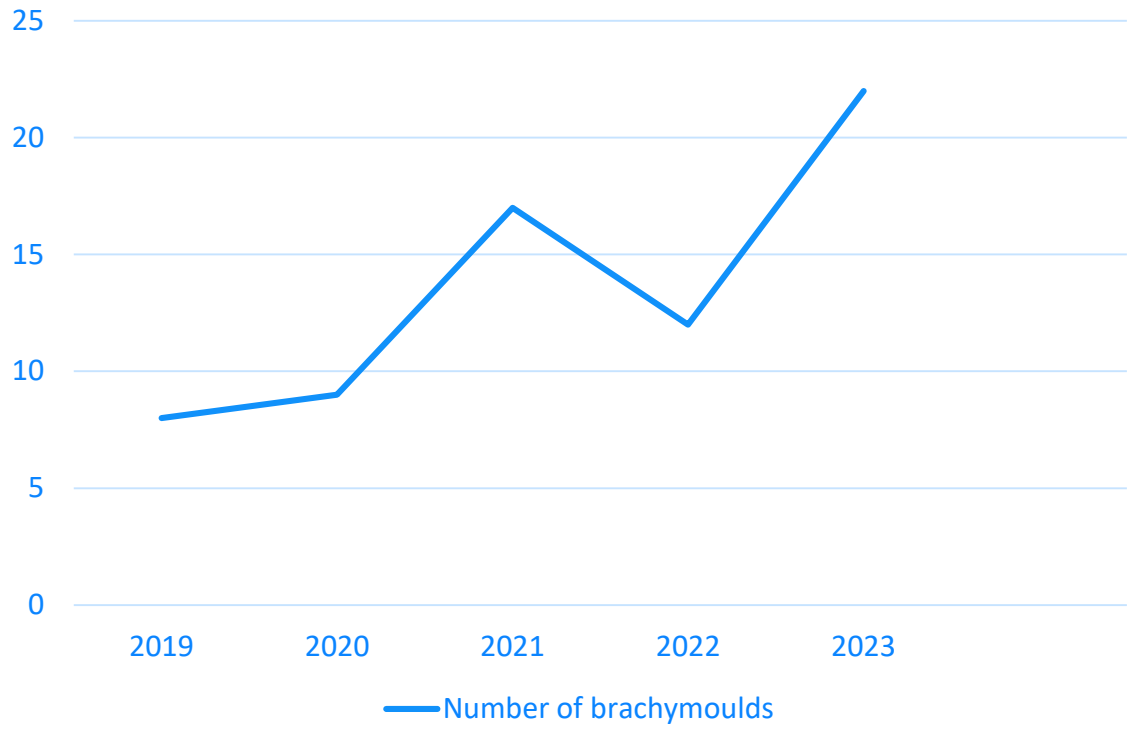




Courtesy: S. Hodes

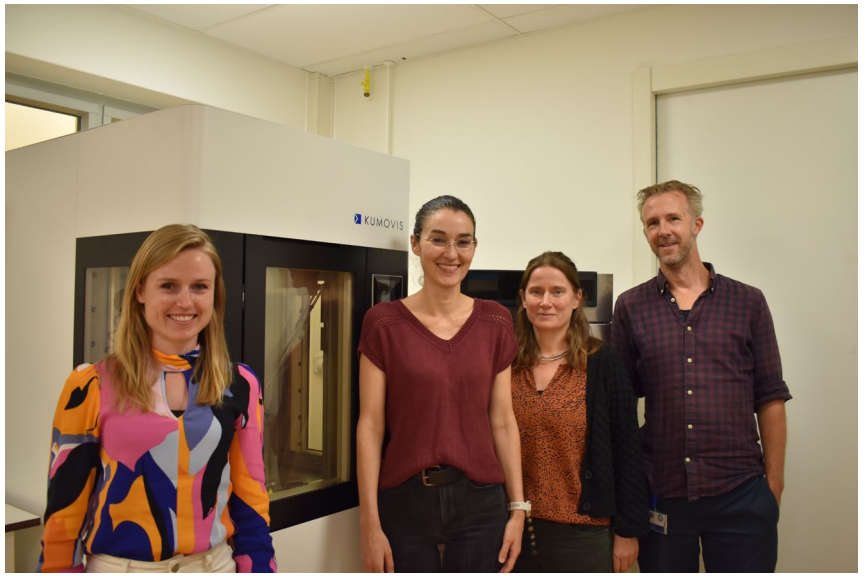
Future developments & conclusion

- **Collaboration with central 3D-lab UMCU**
- **Software**
- **Supports**



Acknowledgements

- **Brachytherapy 3D-team**
- **Kumovis team**
- **UMCU 3D-lab**



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Munich, 7 March 2024

Sites	2019	2020	2021	2022	2023
PDR/HDR HN	6 (12)	4 (11)	5 (15)	9 (14)	12 (16)
PDR Pediatrics	2 (6)	0 (4)	3 (3)	2 (3)	6 (6)
HDR Skin	0 (0)	5 (5)	9 (9)	1 (1)	4 (4)
Total 3D moulds	8	9	17	12	22