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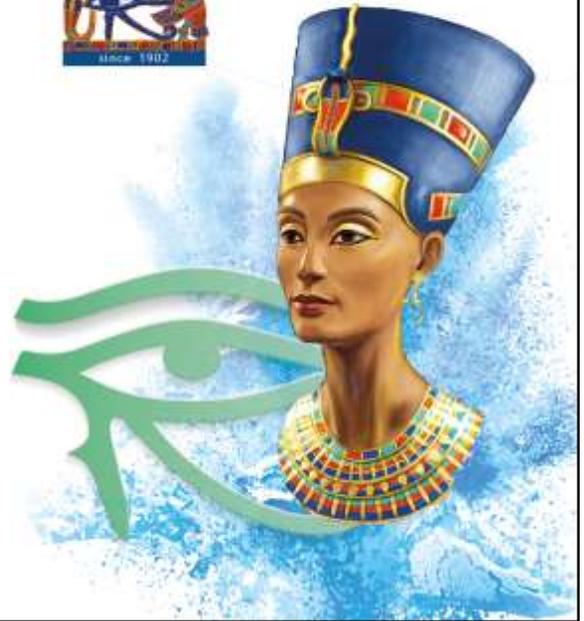
**EOS 2023**



## Ocular Prosthesis Manufacture Using Three-dimensional (3D) Printing: Outcomes in the First Ten Patients

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## Disclosures

- No financial / conflict of interest disclosures



# Introduction

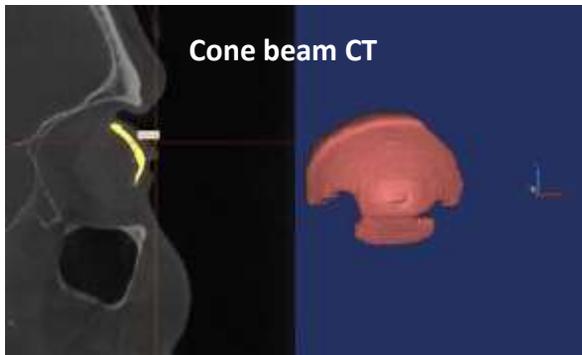


## Innovations

### Computer-aided design and three-dimensional printing in the manufacturing of an ocular prosthesis

Sébastien Ruiters,<sup>1</sup> Yi Sun,<sup>2</sup> Stéphan de Jong,<sup>1</sup> Constantinus Politis,<sup>2</sup> Ilse Mombaerts<sup>1</sup>

Br J Ophthalmol 2016;100:879– 881.



Cone beam CT



CLINICAL RESEARCH

### An innovative method of ocular prosthesis fabrication by bio-CAD and rapid 3-D printing technology: A pilot study

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Impression wax model of socket



CT scan of wax model



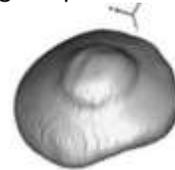
Computer assisted design of prosthesis



Iris and sclera hand painted



Converted into printable file by software



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### Semi-automated fabrication of customized ocular prosthesis with three-dimensional printing

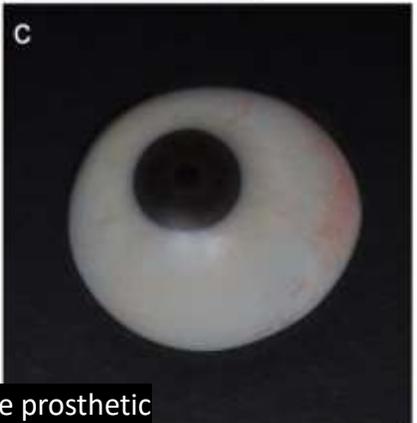
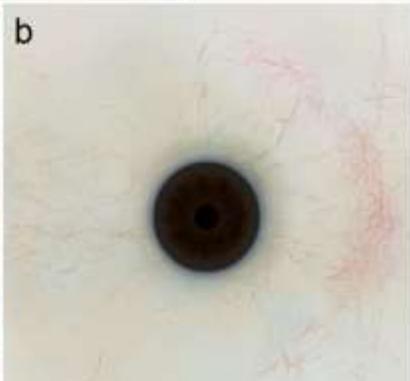
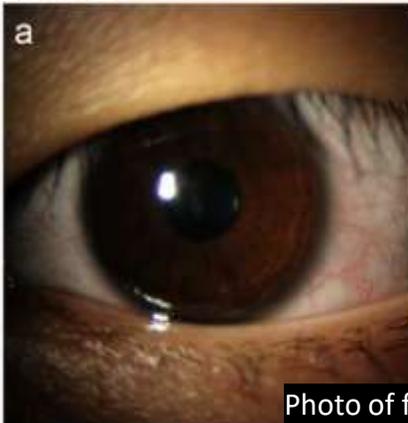


Photo of fellow eye transferred to the white prosthetic

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## Purpose

- To report the technique and outcomes of
  - non-invasive
  - fully digital
  - end to end “no touch” process
- Design and manufacture of 3D printed ocular prostheses
- 10 patients



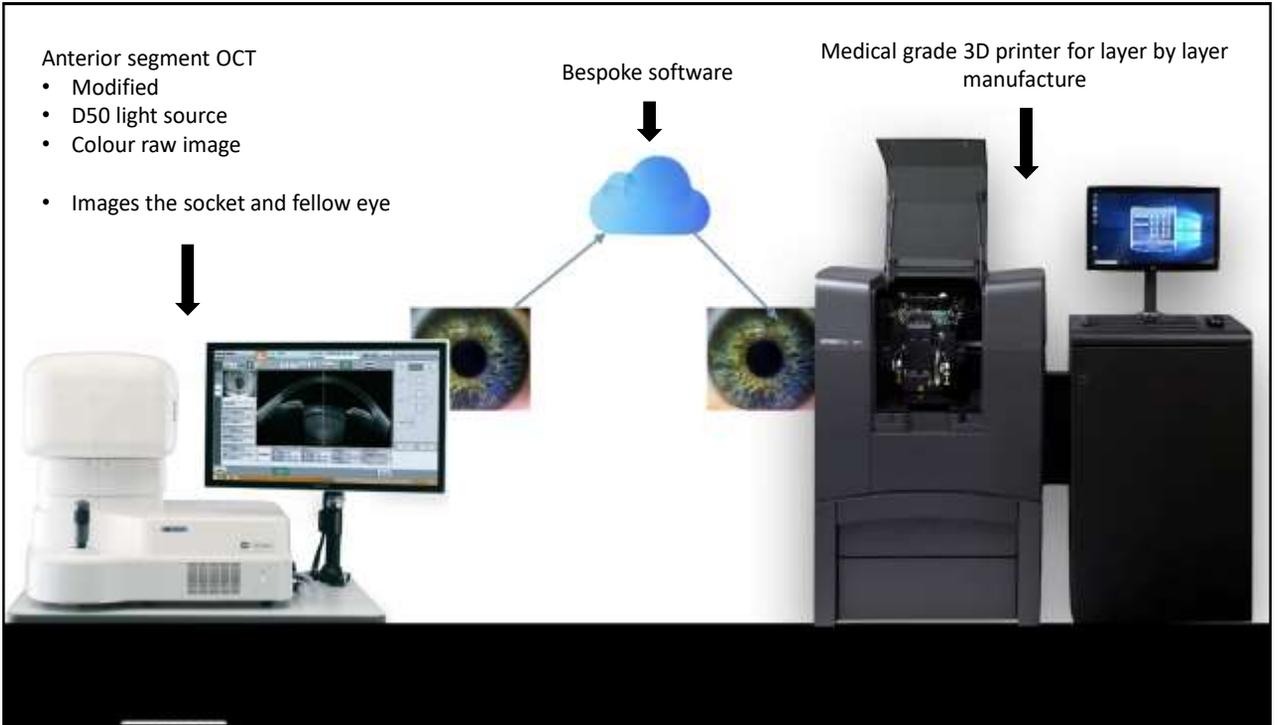
## Methods

### The digital process is:

1. Anterior segment optical coherence tomography scans (AS-OCT; Tomey Cassia II, Japan) of
  - anophthalmic socket
  - AS-OCT and colour image of the fellow eye
2. Software to generate a 3D printed file
3. 3D printed ocular prosthesis

**Outcomes assessed included fit, function (prosthesis motility), cosmesis and socket complications.**



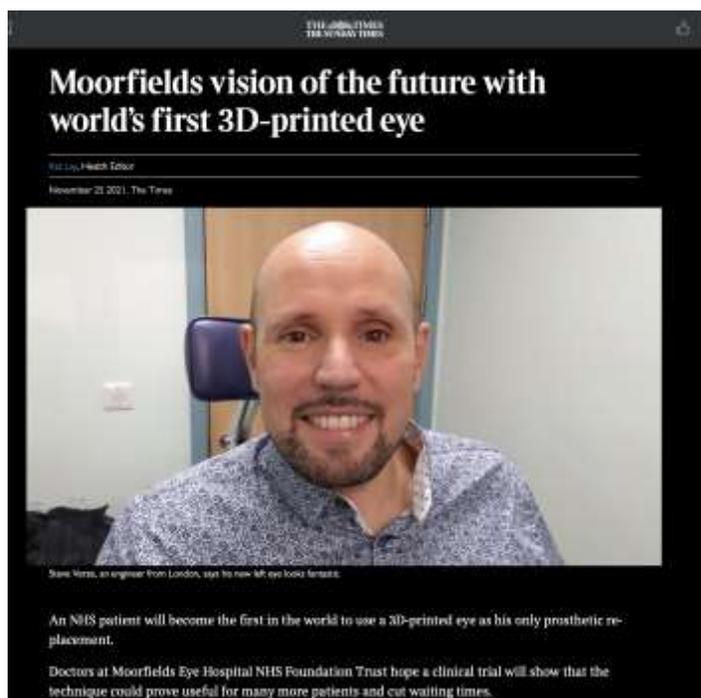


## Results



## Results

- November 2021 to June 2022
- 10 patients have received the fully digitally manufactured 3D printed prosthetic
- AS-OCT imaged the sockets successfully in all 10
- No adverse events in 9/10 patients
- 1/10 discomfort with the fit, eyelid swelling for 1 day and mild eye socket inflammation
- No implant extrusion, exposure or infections
- All 10 patients reported prosthesis motility and cosmesis were acceptable



## Conclusion

- A fully digital end to end “no touch” 3D printed artificial eye can be made with AS-OCT as the template of the socket and fellow eye
- Mimics the fellow eye
  - Colour match
  - Size, shape and position of the iris and pupil
  - Conjunctival vessel pattern
- No serious adverse events – only 1 mild socket inflammation
- Acceptable ocular prosthetic motility and cosmesis.
- Click2Print Artificial Eyes (Click2Print)
- ClinicalTrials.gov
- NCT05093348



## References

- Tsui, J.K.S., et al., Applications of three-dimensional printing in ophthalmology. *Surv Ophthalmol*, 2022.
- Tengroth, B., [The history of the artificial eye]. *Nord Medicinhist Arsb*, 1992: p. 121-5.
- Martin, O. and L. Clodius, The history of the artificial eye. *Ann Plast Surg*, 1979. 3(2): p. 168-71.
- Lubkin, V. and S. Sloan, Enucleation and psychic trauma. *Advances in ophthalmic plastic and reconstructive surgery*, 1990. 8: p. 259-262.
- Ruiters, S., et al., Computer-aided design and three-dimensional printing in the manufacturing of an ocular prosthesis. *British Journal of Ophthalmology*, 2016. 100(7): p. 879-881.
- Alam, M.S., et al., An innovative method of ocular prosthesis fabrication by bio-CAD and rapid 3-D printing technology: A pilot study. *Orbit*, 2017. 36(4): p. 223-227.
- Ko, J.S., et al., Semi-automated fabrication of customized ocular prosthesis with three-dimensional printing and sublimation transfer printing technology. *Scientific Reports*, (2019) 9:2968



# Thank You

