



A NEW TECHNIQUE FOR SEPTAL BUTTONS: THE SWANSEA MOULDABLE SILICONE TECHNIQUE

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INTRODUCTION

Nasal septal perforations can be the result of various causes, including previous nasal surgery, external nasal trauma, digital trauma, cocaine use, infections, malignancy and vasculitis. Septal perforations can cause symptoms that range in severity, and they can significantly impact patient's quality of life. The most common symptoms are crusting, epistaxis, whistling, and the perception of nasal obstruction.

Various surgical and non-surgical closures have been used for more than 60 years¹. One non-surgical technique is the use of a septal obturator known as a septal button. These are generally well tolerated and can remain in-situ for more than 10 years². Commercial available septal buttons do not offer a custom fit³. Larger defects usually cause greater discomfort to the patient⁴. We propose a new technique using High Consistency (HC) silicone for the construction of septal buttons, which has been developed by the team at Morrison Hospital, Swansea using the 3d model technique first described by Barraclough et al⁷.

PROBLEM

The complexity of achieving an impression of the nasal septum defect is well known; previously, in order to manufacture a custom-fitting button, an intra-nasal impression would be performed – possibly under general anaesthesia due to poor tolerance to impression taking and safety in the event that the casting material spreading uncontrollably within the nasopharyngeal space.

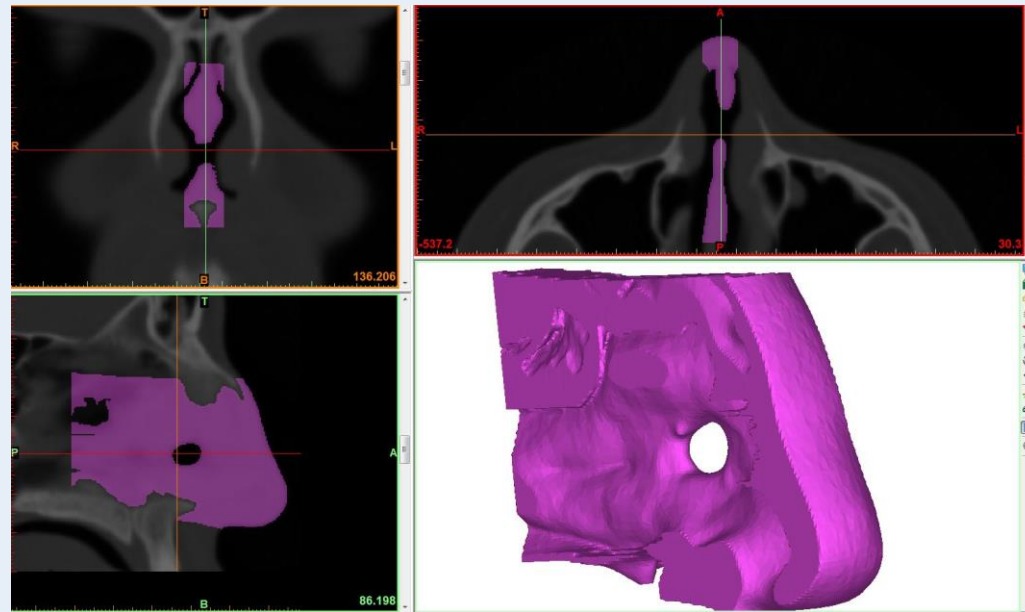


Fig 1.

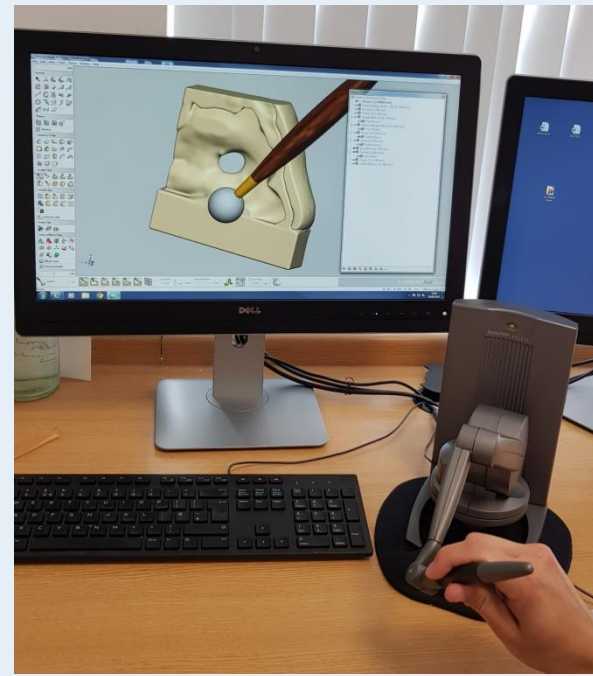


Fig 2.

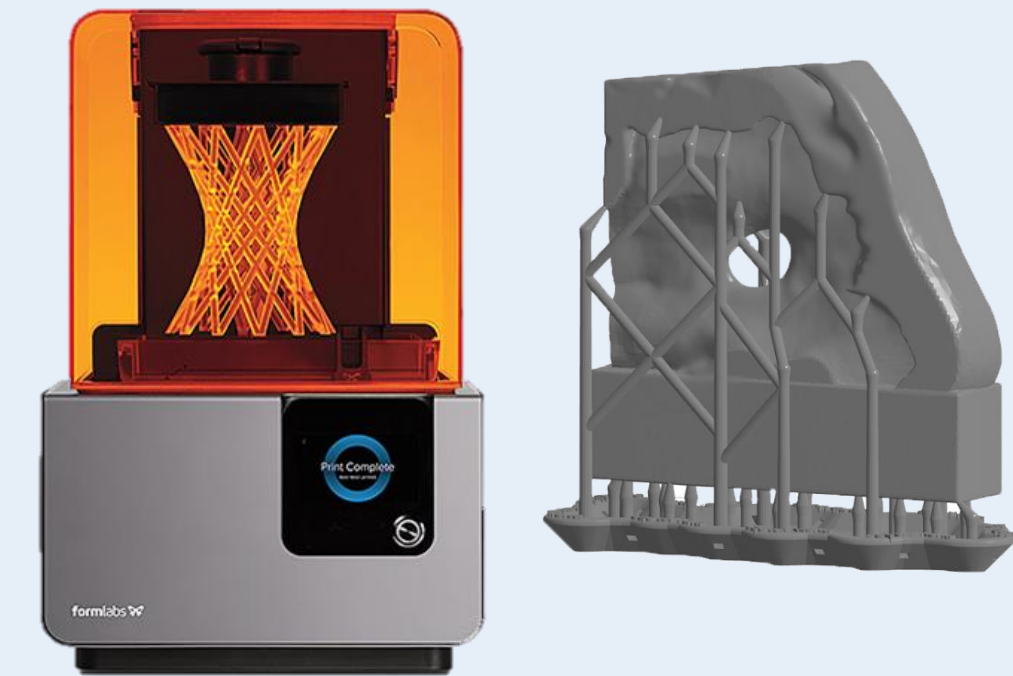


Fig 3.

METHOD IN STAGES

- A CT (Computer Tomography) scan of the patient is obtained and the DICOM data is imported into Mimics Medical 18 (Materialise Belgium software) for segmentation. This software enables sectioning of the imported data to create a 3D virtual model of the septum. [Fig 1].

- The 3D virtual model is exported from Mimics as an STL file and imported into Geomagic Freeform Plus software (3D Systems, USA) for final refinement. [Fig 2].

- The SLA Resin working model is prepared for printing using Preform software and printed using the Form2 3D printer (Formlabs, USA).

- Nusil Polymer Systems Med-4770-2LB, implantable grade transparent HC silicone elastomer, is used to make the septal button. Parts A and B are milled together in a 1:1 ratio. On the working model, the defect is filled with HC silicone, incorporating the directional arrow and radio opaque marker, before thin (0.1-0.5 mm) flanges are added to provide retention for the button [Fig.4,5,6].

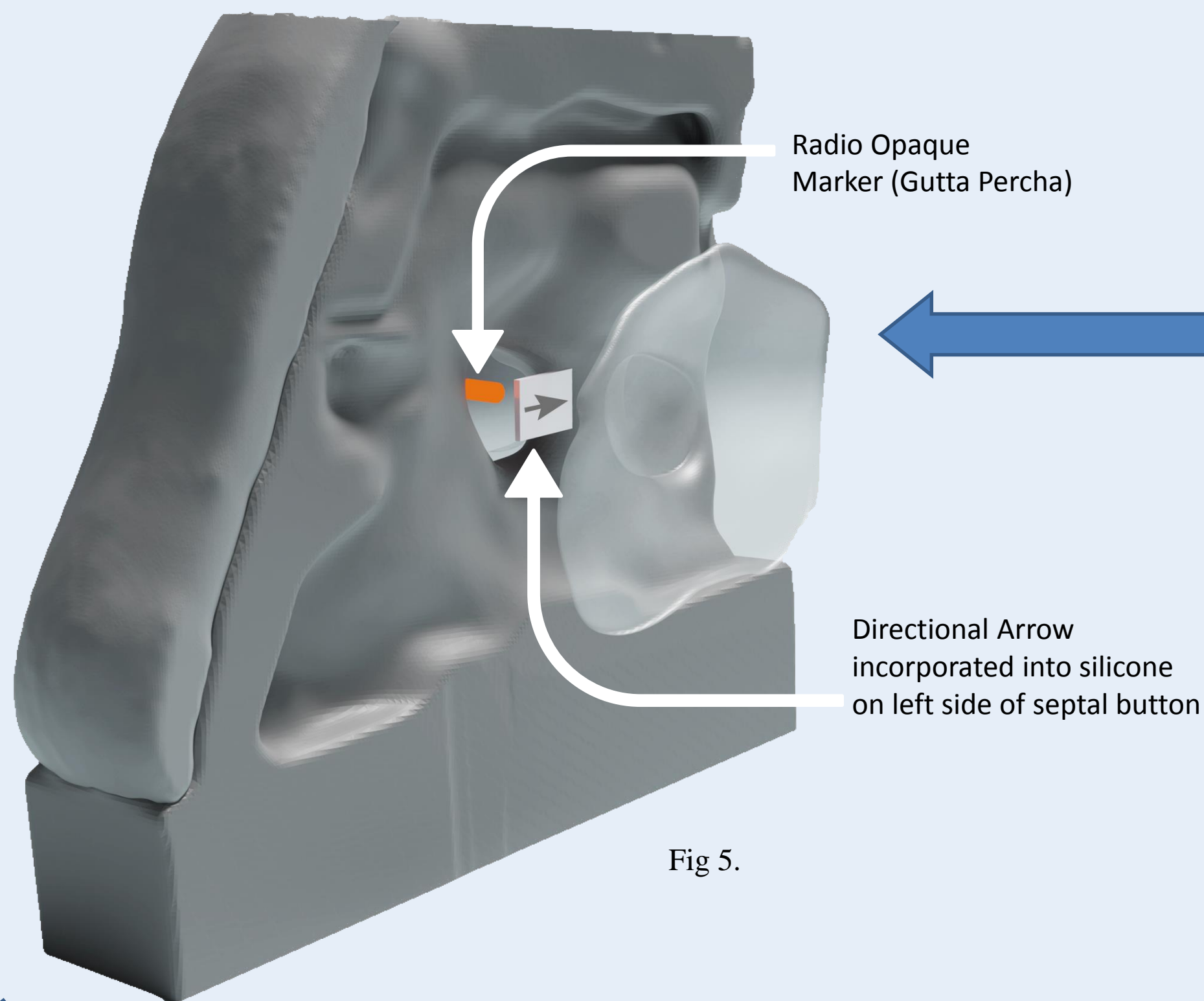


Fig 5.

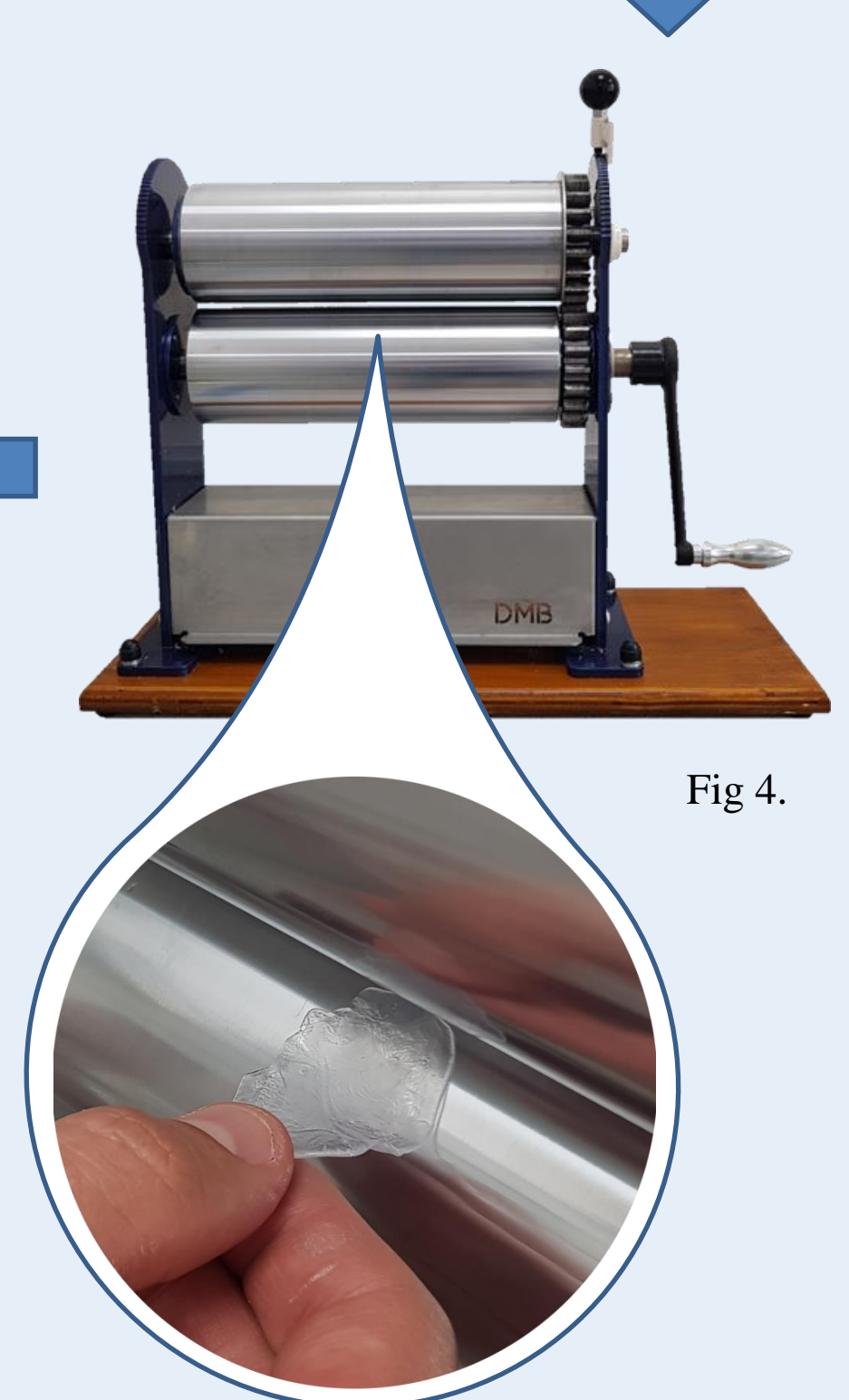


Fig 4.

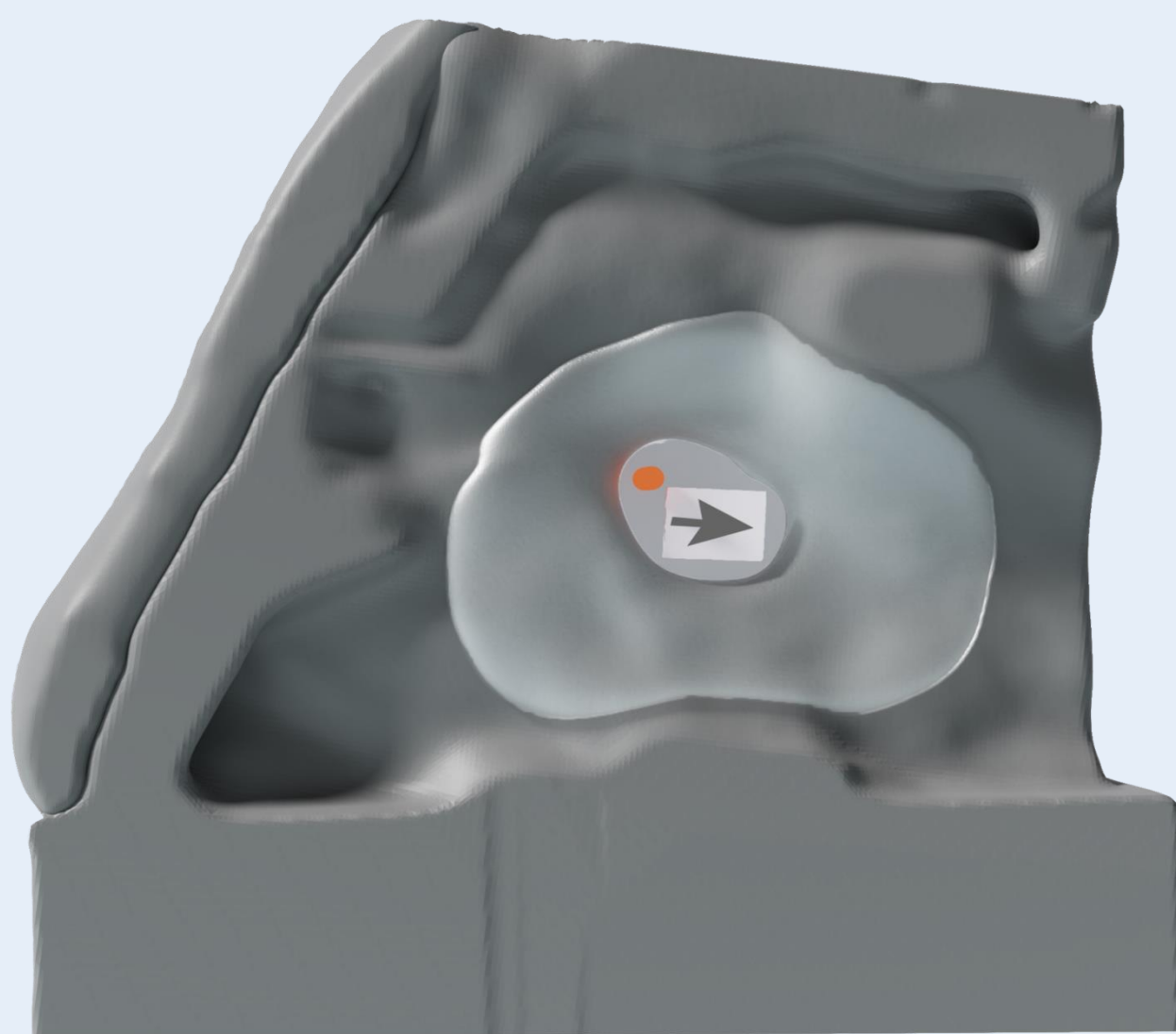
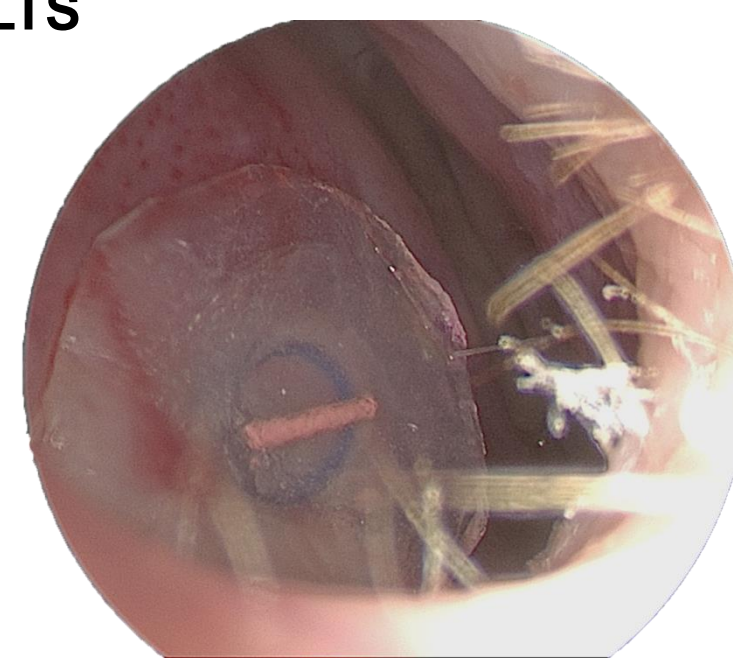
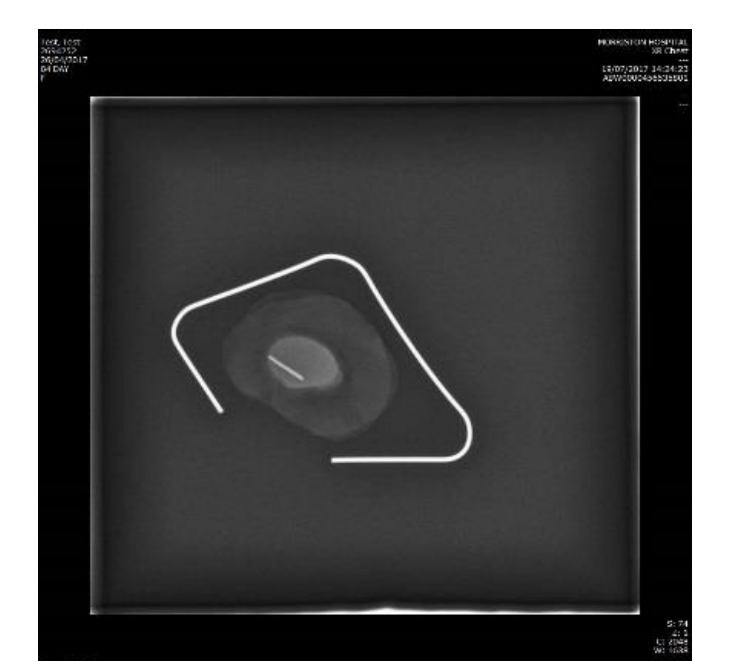


Fig 6.

RESULTS



A well-fitting custom HC Silicone septal button in-situ, filling perforation in patient's septum. [Fig 7].



Radio opaque marker shown in test x-ray. [Fig 8].

DISCUSSION

CT means that we no longer need to take impressions of the nasal septum⁵. This means surgical time is not required, which results in reduced overall cost and lower risk to the patient in undergoing an anaesthetic.

The use of 3-D printing for sizing of nasal septal perforation has allowed fitting of some large and irregular perforations that would otherwise be difficult or impossible to size precisely. The results in this study showed that more precise fitting improved patient outcomes with successful prosthetic obturation⁶.

Eight of nine patients had an improvement in total symptom scores comparing old obturators to new CT obturators and this was significant with a *P*-value of 0.018 using Student's paired *t*-test⁷.

The Swansea High Consistency HC Mouldable Silicone technique has fewer stages of construction when compared to traditional wax-loss method. Impressions are no longer required as CT data can be used to print a model of the septum. HCR silicone is directly applied to that printed model. The final prosthesis is quick to make, resilient to damage, and very well-fitting.

CONCLUSION

HC silicone offers unique benefits:

- It is easily manipulated onto the anatomical resin printed model, which saves time;
- It gives a very predictable outcome, in terms of shape, size, and resilience;
- It can be bonded to itself, so we can make modifications to the prosthesis at a later date.

Some disadvantages should be noted:

- The material cost is high: an A and B pack of Nusil 4770 starts at £1000⁸. Software, 3D printing hardware and rolling mill are also required.
- As with all new techniques and materials, there is a learning curve.
- To reduce radiation dosage, the CT data can be obtained from the scan performed for clinical investigations and the radiation is reduced by using Cone Beam Computed Tomography (CBCT).

Regular clinical review should be part of the ongoing care scheme. More than fifty HC silicone septal buttons have been placed, with very positive feedback from the clinical staff as well as patients at Morrison Hospital.

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