

# Patient specific parts

## Overcoming previous limitations to improve patient outcome

Nottingham University Hospitals **NHS**  
NHS Trust

Queen's Medical Centre in Nottingham have successfully used a customised titanium mandibular implant.

A patient at Queen's Medical Centre in Nottingham had significant facial asymmetry leading to functional problems and aesthetic issues. The surgical team wanted to improve both areas and looked to produce an implant (alloplastic facial implant). In the past, a number of materials and techniques have been used for such implants, however all have limitations.

The Consultant Maxillofacial Prosthetist Healthcare Scientist, Jason Watson, was aware of the benefits of Metal Additive Manufacturing (AM) for the production of customised implants and discussed the options with Consultant Maxillofacial Surgeon Dilip Srinivasan. Both agreed that a titanium metal AM implant could overcome some of the problems associated with existing implant materials (including extrusion, migration, foreign body reaction and infection) whilst giving a superior aesthetic outcome.

“Metal AM offers surgeons the ability to truly customise implants and make them solely patient specific”

Jason Watson,  
Consultant Maxillofacial  
Prosthetist Healthcare  
Scientist



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A computerised tomography (CT) scan was performed on the patient and this data was converted into a 3D CAD file. The CT showed that the bone in the area of the deformity was of poor quality due to previous radiotherapy. A model of the patient's skull was built using Plastic AM.

3T-am produced the initial, functional design for the implant and worked with the QMC team to refine the onlay to ensure that it met not only the aesthetic requirements but also that it avoided key nerves, had good fixation to the patient's jaw bone and allowed for possible future placement of dental implants.

The implant was initially produced in plastic and, working with the plastic skull model, demonstrated fit and allowed the surgeon to plan the surgery. The team could immediately see that if produced in titanium, the onlay was a significant improvement on models made in the past from titanium plate. This gave the team the confidence to commission the part in medical implant grade titanium alloy (Ti6Al4V) and the surgeon signed off the design ready to undertake the surgery.

The mandibular onlay has been successfully implanted into the patient and during surgery, the part gave a very accurate operative fit. It has corrected the bone deformity and post-operatively has shown a good correction leading to improved facial symmetry. The surgery has the potential to improve both self-confidence and self-esteem within the patient. The surgery has been deemed a success with no reported complications (6 months post-operative) and the QMC team is now looking to use Additive Manufacturing technology in future prosthetics.

Speaking about the technology, QMC's Jason Watson said "Metal Additive Manufacturing is one of those technologies that offer surgeons the ability to truly customise implants and make them solely patient specific. Working in partnership with 3T-am, we have demonstrated that the future is not mass manufactured cheaper parts but cost-effective, custom made parts. Metal AM allows total customisation from physical shape to physical properties to match the surrounding bone".

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