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**Improving patient and surgeon experience with additive manufacturing**

Additive manufacturing is a burgeoning technology in hospital environments. In order for the technology to take off fully, pioneering hospitals and surgeons are working to demonstrate the positive impacts 3D printed implants can have on the NHS, surgeons and patients. Here, Amy Davey, Reconstructive Scientist at North Bristol NHS Trust in the UK, explains recent changes she has seen in implant technology and discusses her experiences of the impact that additively manufactured implants have had on patients and surgeons in hospitals.

**In the last few years, there has been a significant shift towards patient specific implants (PSIs), which previously would have only been used for complex cases. They are slowly being used in everyday practise. PSIs can be produced by additive manufacturing (AM), also known as metal 3D printing, in several different materials for medical applications. AM is still a relatively new technology in the medical sector.**

**AM offers several benefits over traditionally made implants, including fewer geometric limitations on implant design. Implants created using AM technology are built in layers from powdered metal resulting in fewer restrictions on what can be manufactured. Even complex cases can be straightforward to manufacture with this method.**

**Adopting AM implants**

**AM implants are now commonly used in Southmead Hospital, Bristol for craniomaxillofacial (CMF) procedures.**

**Prior to adopting the AM implant technology, the prosthetics team would produce a 3D model of the patient skull from a mould made of dental plaster and stone. This would be used to press a sheet of titanium to form the implant.**

**Additive manufacturing eliminates the need to make a mould as the implant is produced on an AM machine using digital data, speeding up both the design and manufacture processes.**

**Models required for surgical planning can also be printed from a patient’s CT data and can be integrated with surgical planning software to produce a digital 3D visualisation.**

**From my experience, I have found it very straightforward to adapt to the new technology. However, it is important that work continues to develop more advanced software packages, as current options require highly trained and experienced members of staff to do the design. In Southmead Hospital, we use a platform called Geomagic® Freeform Plus to design the implants.**

**In future, software packages such as** [ADEPT](http://www.renishaw.com/go/en/craniomaxillofacial-implants-and-software--42111)**, available from Renishaw, will make the design process even more straightforward.** ADEPT is computer-aided design software which has been specifically created for the rapid design of craniomaxillofacial, patient specific implants (PSIs) by metal 3D printing.

**Once an implant has been designed, the hospital can send the design to a third-party company, such as Renishaw, for manufacture. Additive manufacturing produces precise guides, models and implants to the surgeon’s specification, which can improve the outcome for the patient as it allows for a quicker procedure, less surgery time and an accurate fit with good aesthetics.**

**Opening doors**

**Additively manufactured implants are helping to improve treatment processes and decrease procedure revision numbers and times, which can also reduce costs for the NHS and provide better patient outcomes.**

**There can be greater benefits in more complex cases, however AM technology can still help to streamline surgery for less complex procedures. Surgeons are able to carry out careful pre-planning, which means they have reduced spans of problem solving during surgery.**

**The implants offer improved treatment processes for patients. One major advantage is the reduction in the number of procedures a patient may need. Traditionally, if a patient had a particular cranium tumour, a surgeon would first have to remove the tumour and close the wound. The patient would then require further CT scans to determine the size of the cranial plate needed. The surgeon would then perform a second procedure to insert the implant.**

**By using surgical planning software and AM technology, the surgeon can pre-plan before surgery. Custom AM surgical guides and implants are also created before surgery. The guides allow the surgeon to remove the tumour and place the cranial plate, in one surgical procedure, with precision.**

**Improved surgical planning streamlines the surgery process leading to a reduction in theatre time, which in turn can reduce NHS costs.**

**In order for the technology to reach its potential, industry and healthcare need to work together to progress it further by developing a body of evidence demonstrating the efficacy and benefits both to the hospital and patients.**

**It is also important that early adopters of the technology, such as the team in Southmead Hospital, apply their knowledge to drive the technology forward to also reinforce that the additive manufacturing of implants could improve not just patient care but could also be of financial benefit to health services.**

**For more information visit** [www.renishaw.com/cmf](http://www.renishaw.com/cmf)**.**

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Notes to editors

UK-based Renishaw is a world leading engineering technologies company, supplying products used for applications as diverse as jet engine and wind turbine manufacture, through to dentistry and brain surgery. It has over 4,000 employees located in the 35 countries where it has wholly owned subsidiary operations.

For the year ended June 2017 Renishaw recorded sales of £536.8 million of which 95% was due to exports. The company’s largest markets are China, the USA, Japan and Germany.

Throughout its history Renishaw has made a significant commitment to research and development, with historically between 14 and 18% of annual sales invested in R&D and engineering. The majority of this R&D and manufacturing of the company’s products is carried out in the UK.

The Company’s success has been recognised with numerous international awards, including eighteen Queen’s Awards recognising achievements in technology, export and innovation.

Further information at [www.renishaw.com](http://www.renishaw.com)