MEDICAL AMRC

The University Of Sheffield.

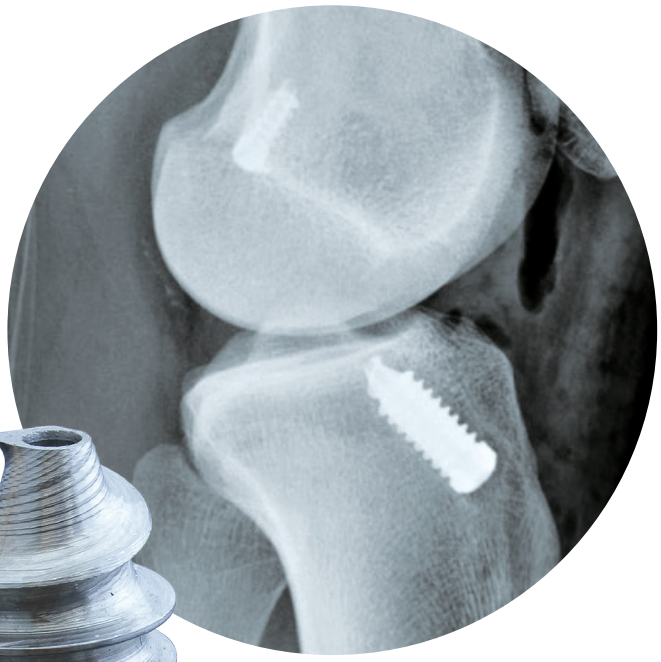
Advanced Manufacturing Research Centre

BOEING

Collaboration Case Study
Innovate Orthopaedics Ltd

Orthopaedic Screw

Innovate Orthopaedics Ltd (IO) is a start-up company, based in Yorkshire, with ambitions to introduce innovation to the global orthopaedics market. Founder Alex Gutteridge, says the business intends to "challenge the status quo of the orthopaedic sports medicine market" and believes that introducing high quality products does not mean a high cost for the customer.



X-ray of implanted screw.

The development process from 3D printed parts to machined brass prototypes.

Precision engineered titanium screw prototype with variable thread.

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INNOVATE ORTHOPAEDICS

Sheffield Precision Medical

star

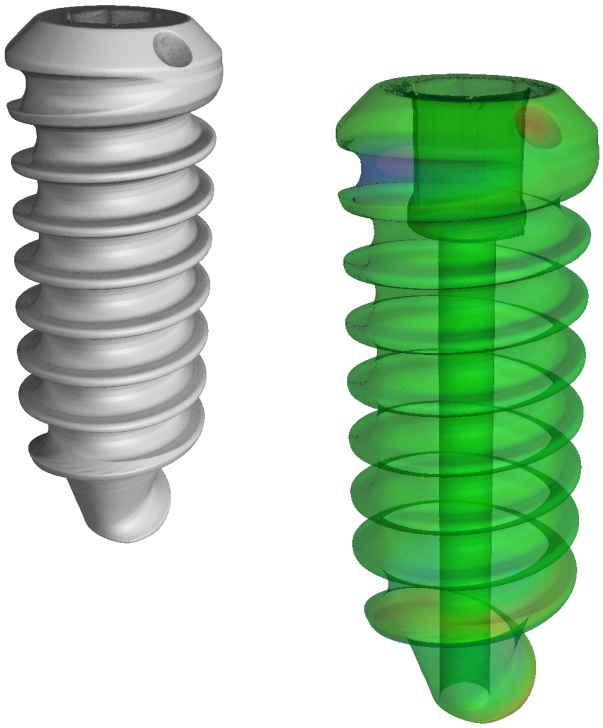
IO asked the Medical AMRC (MAMRC) to evaluate two new orthopaedic screw concepts it had created for use in surgical procedures such as anterior cruciate ligament surgery. The concepts had been developed in collaboration with eminent orthopaedic surgeons to ensure they incorporated the insights and experience of potential users.

The MAMRC reviewed IO's designs and worked with the company to combine different aspects to create one universal design, whose beneficial features include:

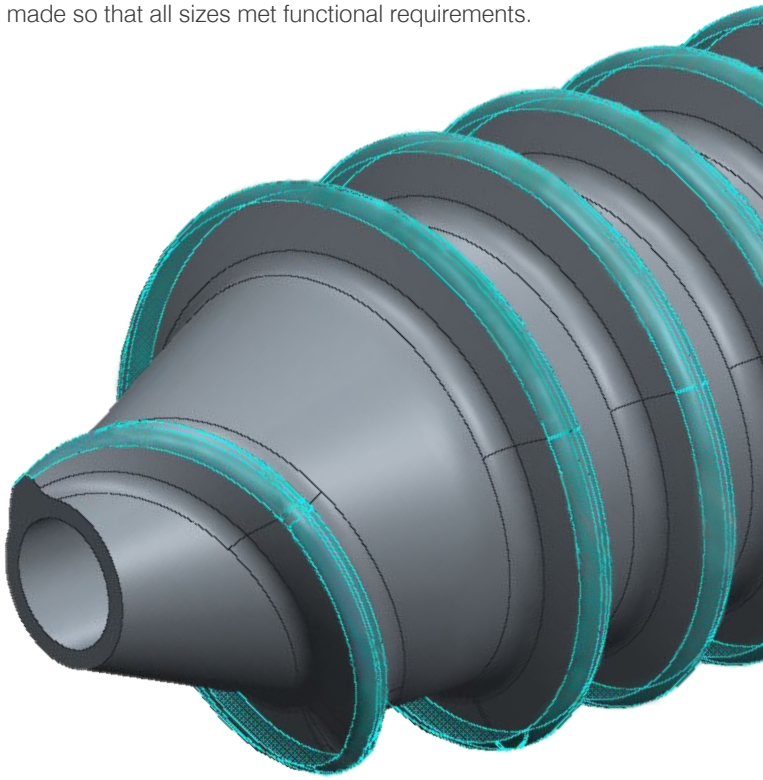
- Reducing the potential for graft damage during insertion.
- Assisting surgeons by ensuring the screw engages more rapidly with the ligament and bone, when it is inserted.
- Improving on current ligament fixation forces.

The final form and functional aspects created by the MAMRC has provided IO with patentable technology and the opportunity for design registration.

The MAMRC used Creo CAD software to show how the design could be applied across a wide range of screw sizes, taking into consideration manufacturing processes and possible compromises to features that would have to be made so that all sizes met functional requirements.

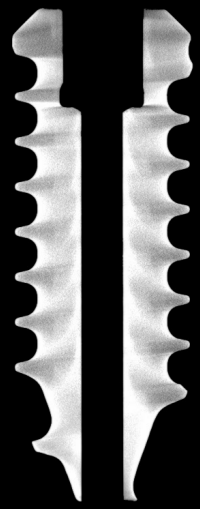


CAD geometry of the final screw design and a CT scan of the machined prototype.



Machining the unique variable pitch thread was particularly challenging.

> The Medical AMRC didn't only help us refine our designs and take them into production. It also helped us to create patentable technology which can be further protected by design registration and enabled us to quickly gain ISO 13485 medical devices quality approval and European CE marking.
>
> **Alex Gutteridge, Innovate Orthopaedics founder**



SPM and Star engineers worked closely at the AMRC KTC to refine the screw features and MAMRC used in-house Nikon CT scanning capabilities to carry out accurate comparisons with the original CAD data.

AMRC Tier 1 partner **Star Micronics** provided specialist engineer support to help the MAMRC team develop the complex CNC programming required to produce fixation forms that allowed brass prototypes of the screws to be made in the most cost efficient way on the **Star Micronics GB ST Series CNC sliding head lathe** in the AMRC Knowledge Training Centre (KTC), using a technique known as 'Thread Whirling.'

Tooling was predominantly supplied by another AMRC Tier 1 partner, **Sandvik Coromant UK**, with additional tooling coming from **HORN Cutting Tools Ltd** and **Mollart**.

The MAMRC used its knowledge of local manufacturing capabilities to find a production partner for IO with expertise in the chosen processes, introducing the company to **Sheffield Precision Medical Ltd (SPM)**, which is highly respected for its expertise in producing high quality orthopaedic fixation devices.

MAMRC undertook in-house functional comparative testing with IO and their surgeons to ensure the design met specification requirements, using feedback to guide changes in screw thread production programming.

Star Micronics GB ST Series CNC sliding head lathe.

> Clinical tests have produced extremely positive results and we are already seeing demand rising among British and international surgeons, who see the benefit of using these innovative, new designs.
>
> **Alex Gutteridge, Innovate Orthopaedics founder**