

Case Study

JRI Orthopaedics Ltd

Orthopaedic Surgical Assembly Device

JRI Orthopaedics approached the AMRC with Boeing's Medical Advanced Manufacturing Research Centre (MAMRC) for assistance developing a device that will be part of the surgical kit for a new orthopaedic system.

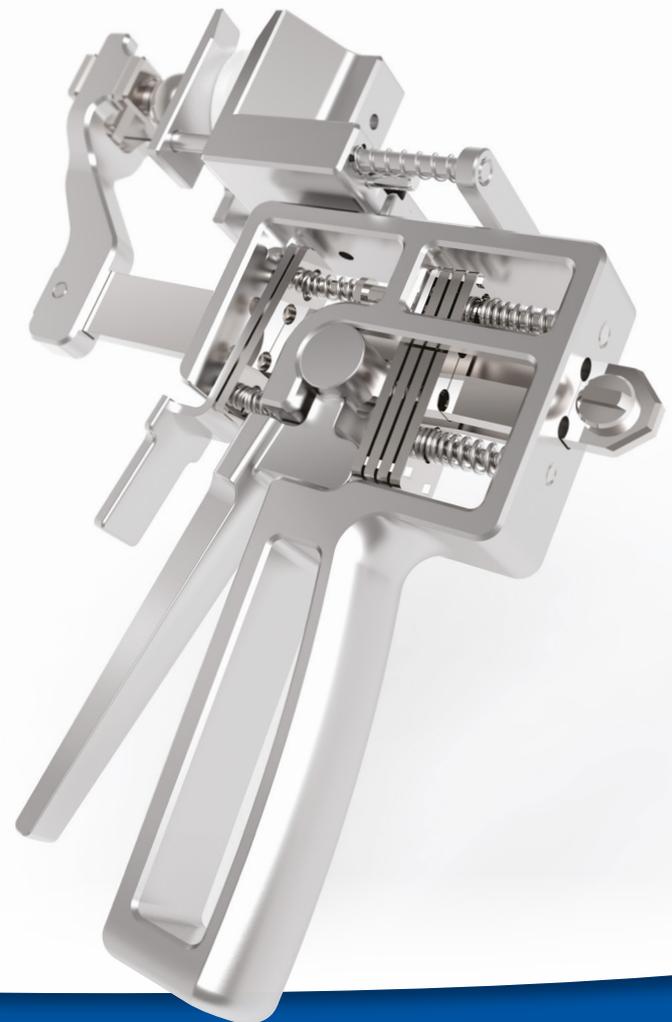
The device will be used by surgeons to quickly construct implant assemblies in an operating theatre, during surgery. JRI asked the MAMRC to take its initial idea and turn it into a light weight, ergonomic surgical device, capable of being operated using only one hand, while also being sterilisable and suitable for an operating theatre environment.

JRI Orthopaedics specified the overall technical requirements and the MAMRC began by carrying out an initial search to ensure the device would not infringe any patents and give JRI an insight into potential commercial barriers.

The MAMRC concentrated on developing a robust device, with a minimalist appearance, focusing on "design for manufacture." Priorities included selecting suitable medical grade materials, reducing machine set-up times, establishing tooling requirements and simplifying work holding methods, to allow JRI to rapidly prove the concept, without disrupting other in-house priorities or production.

Other key requirements included making the device:

- Strong enough to perform reliably during use and throughout its lifetime
- Ergonomically designed to fit in the hand of the surgeon with a balanced weight distribution.
- Able to exert high clamping forces which could be released easily, using one hand.
- Capable of assembling various sized components.

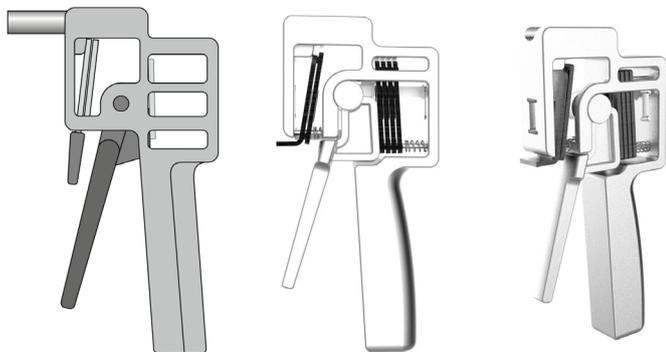
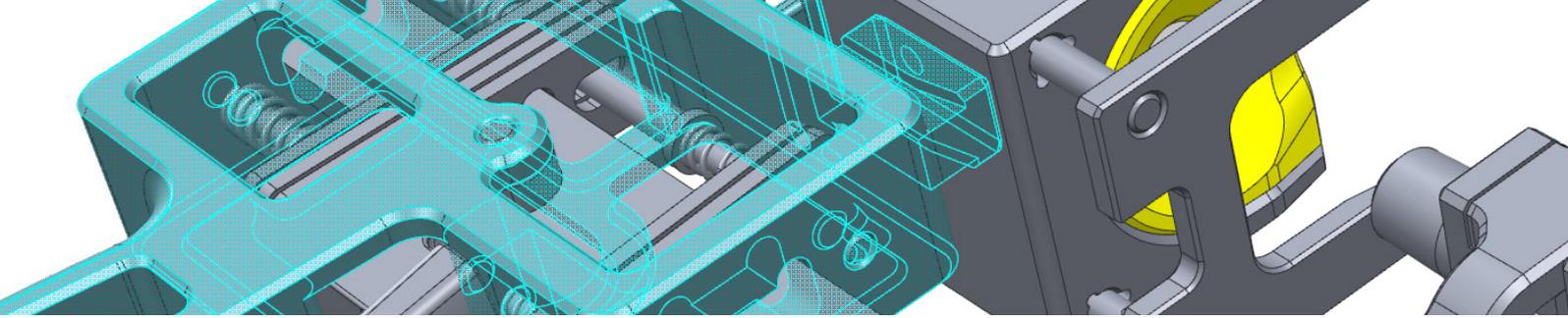


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MAMRC development engineers created initial concept designs using PTC Creo 3D CAD software. The MAMRC team worked collaboratively with JRI on design ideas and project progress to ensure development took place within an industrial acceptable timescale. The team also took ISO13485 medical device quality management system requirements into account throughout the project, to enable JRI to bring the device to market as quickly as possible.

Finite element analysis was used to ensure the materials and shapes used could withstand the forces the device would have to cope with in an operating theatre. Other

components were sourced and tested to ensure they met the project's specific requirements. A number of spring designs had to be tested before ones that met the device specifications could be found.

The refined prototype design was optimised to match JRI's manufacturing capabilities and minimise production set up times and work holding requirements, by enabling the device's main component block to be predominantly machined from just one side.

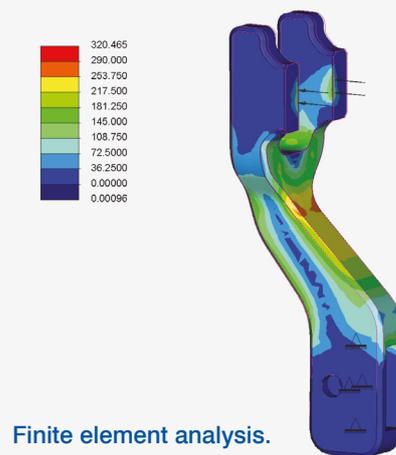
Realistic images of the final design concept were produced using the KeyShot rendering package.

Following detailed refining of the components, a final physical concept prototype was produced from parts made by SLA printing and machined from stainless steel. JRI used the prototype during consultative meetings to give surgeons an extremely realistic feel for what it would be like to use the device without the need for expensive and time consuming manufacturing procedures.

JRI was able to make efficient use of its internal resources to make small design changes rapidly in response to the surgeons' feedback and reduce the weight of the device even further.



FDM 3D printers were used to rapidly produce prototype from early CAD models, allowing fast, iterative design changes to be made.



Finite element analysis.

“ The Medical AMRC team were great to work with. They listened in detail to our requirements and understood the issues quickly. Using their range of skills and experience, they delivered a design that fit the brief perfectly. We will be more than happy to work with them again on further projects, and look forward to it. ”

Joel Treen, Project Engineer, JRI Orthopaedics.

