

STRIVE

3D Print Lab

The Challenge

Mr F has a problem with both his elbows - they are both severely painful and stiff. In fact, he has an unknown rheumatological condition which has destroyed most of his joints. This has led to some loss of bone and very abnormal anatomy.

Standard "off the shelf" elbow joint replacements rely on having some normal anatomy and costs £2k. If the anatomy is too deformed then the only other option is a custom made elbow hinge which costs between £20-30k and is usually manufactured in Europe.

When a surgeon assesses the elbow imaging, they often err on the side of caution if they are in doubt and choose the custom elbow to avoid the situation of being left without a workable implant after starting surgery. This adds delays to the waiting list and extra expense for the health service.

Similar problems also occur in the trauma setting, especially in major trauma patients, with the added complexity of a more urgent timescale for decision making and getting patient to theatre.

Action

A 3D printer was purchased in September 2020 at a cost of £7,500 and along with some further requirements to make the lab suitable, a total of £12,000 was invested using innovation funding, with the aim of facilitating a new stream of project work at James Cook University Hospital.

It has been used to print over 50 anatomic models ranging from ankles, feet, knees, elbows, hands, femurs and even a whole pelvis. Four staff, which make up the Clinical Measurement Section of Medical Physics, have all been trained in the use of the software and hardware to provide the service alongside Dave Ferguson and the kit is used on a regular basis for both training and service purposes. A further £3,500 funding has been made available in November 2021 to upgrade the CE marked and FDA approved software.



Benefit

These examples show the benefit to patient, staff and the economics of healthcare. The patients were provided with a further aspect around the care and treatment provided, which allowed for shared decision making and interest which was not available previously.

Staff were provided with new opportunities and confidence to pursue options with access to the models and collaborate with industry partners to look at potential outcomes.

The Trust was able to save money in purchasing a suitable alternative to what could have been an expensive alternative and developed new skills for staff.

Outcome

An elderly lady with polytrauma was admitted to hospital with a complex distal femur fracture. As part of her emergency care, she received a CT scan and her case was discussed in the trauma meeting. It was felt that a model to show the patient would be helpful to talk about her treatment.

Due to other injuries, she was bedbound, and it was not possible to show her any images of her injuries. A 3D model was computer generated using her CT scans and scheduled for printing in Polylactic acid (PLA) material. The model was successfully used to show the patient on the ward to assist with shared decision making and consent.

A gentleman with severe inflammatory arthropathy of both elbows was in need of an elbow replacement but consultant upper limb surgeon Mr McVie was unsure whether the elbow was too deformed to be able to insert a standard elbow replacement. We printed out his elbow joint to test the implants with our colleagues at Zimmer Biomet and answer this clinical question.

After making the necessary cuts to the model bone, we were able to show not only that the £2k implant would work, but also the best way to insert it for maximum function and longevity. The gentleman proceeded with successful surgery and was delighted with the results. He is now waiting for the same procedure on his left elbow.

The gentleman was shown his model before surgery and it was used as part of his informed consent process. Mr McVie fed back stating, "The case went well and the model was really cool. It gave me confidence to use the generic elbow replacement".

The saving for the NHS with this one case was in the magnitude of tens of thousands of pounds.

Plans for the future/spread and adoption

We are currently offering the 3D printing service to the Trauma and Orthopaedics Department within the Trust with the intention to offer to further specialities.

We have been approached by South Tyneside and Sunderland Trauma department to provide some models. We are currently process mapping the service and also looking at branding.