



Orthopaedic Oncology BOOS 2025

Case Examples

Medical Devices provided in Days, not Weeks



Rapid provision of **FDA approved** **Personalised Virtual Surgical Planning,** **Surgical Guides** and **Models, Designed** and **Delivered** within a **Week** *

Manufactured in our **Oxford Cleanroom** facility.



"The fact that Insight can design and rapidly make guides within in a week is a big deal....and also get through surgery without extensive blood loss or other complications"

Dr Herrick Siegel

Specialist, Adult Reconstruction and Orthopedic
Oncology. University of Alabama Birmingham Medicine

SPECIALITIES (ADULT & PAEDIATRIC)

- **Upper limb**
- **Lower limb**
- **Pelvis**
- **VSP with Partner Implants**
- **Surgical Guides**
- **Allograft guides**

<https://www.insightsurgery.com/oncology-solutions/>

CASE STUDY:

Enchondroma Resection & Allograft Reconstruction

SUMMARY

A surgeon made a request for customized surgical guides to facilitate the resection of a distal femoral enchondroma in a 43-year-old female patient.

The surgery involved a shark-bite technique to remove the enchondroma via a medial subvastus approach, and utilizing a bone scalpel and curved osteotomes. The request included a patient matched femur for reconstruction

DESCRIPTION

Preoperative planning began with a CT-based 3D model of the patient's femur, enabling accurate mapping of the tumor and resection area. Dimensions were taken to find an appropriately sized allograft for the reconstruction.

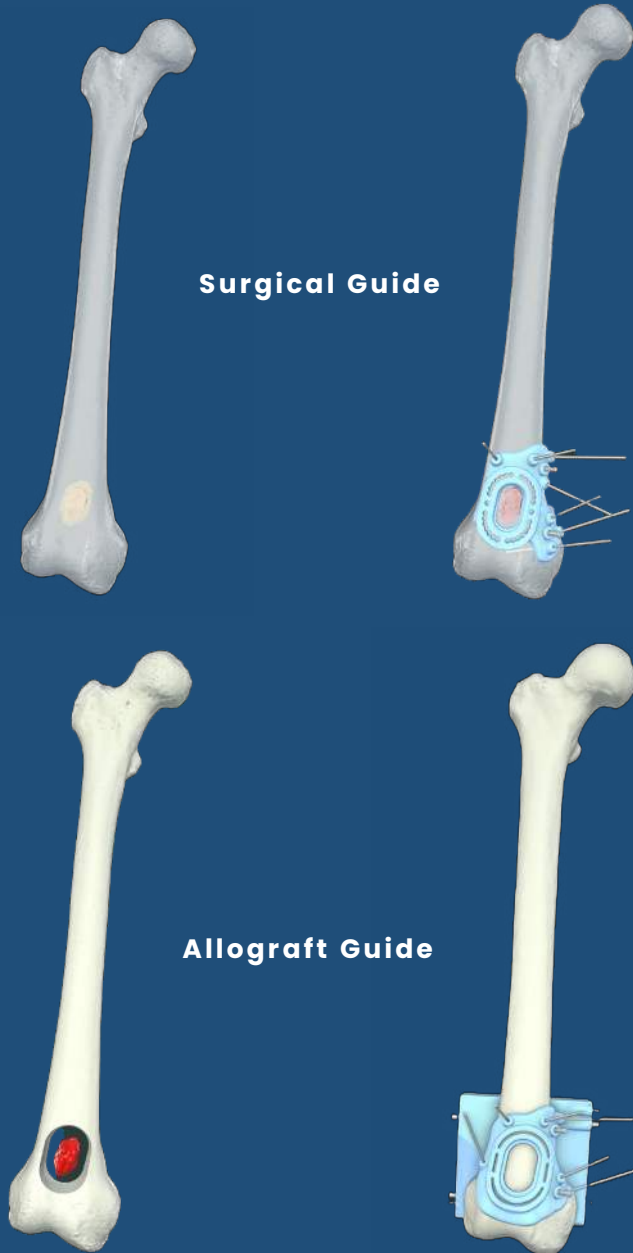
Two patient surgical guides were created to assist with precise resection using a bone scalpel for the anterior cortex and a third guide to guide a drill bit to the far cortex. Complementary guides along with an allograft cradle were then used to shape the graft to match the resected segment with a compression fit.

OUTCOME / BENEFITS

The predetermined drilling depths helped to simplify this stage of the highly complex procedure, thereby reducing the surgical stress, and was greatly appreciated by the surgeon intraoperatively.

The implanted allograft segment docked tightly into the patient suggesting good stability and compression.

The interface at the allograft-bone interface ran congruently when viewed on the intraoperative x-rays, further supporting this stable fixation



CASE STUDY:

Tibia Reconstruction with Allograft and Custom Plating

SUMMARY

This adolescent female patient presented with recurrent osteofibrous dysplasia (OFD) of the left tibia. This caused a complex deformity with posterior tilt of the proximal joint surface and a significant discrepancy in length when compared to the contralateral anatomy. The surgical team requested surgical guides, a patient-matched allograft, and custom tibial plates to provide secure fixation and an adequate reconstruction.

DESCRIPTION

The surgeon defined the resection planes based on measurements from the proximal and distal joint surfaces. Surgical guides were designed to facilitate accurate osteotomies, particularly a proximal step cut which would provide rotational stability and to increase the surface area of the bone-allograft interface.

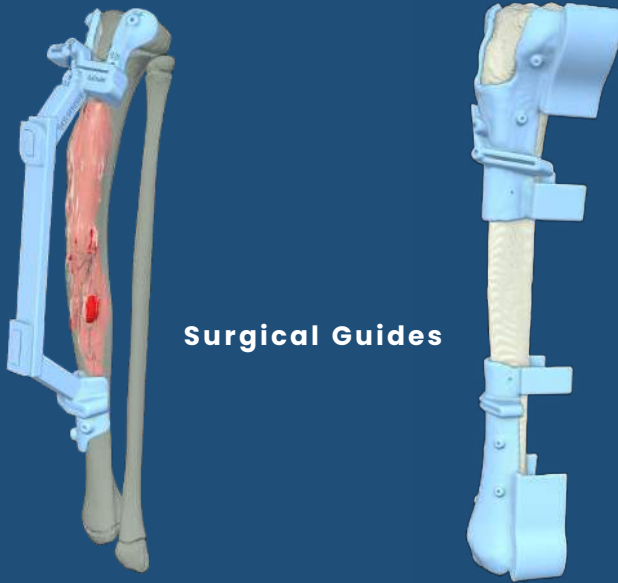
A patient-matched allograft was sourced using anatomical measurements from the patient CT scans. Complementary clam-shell style allograft guides were designed to ensure a stable reconstruction. Post-resection there remained only a small proximal tibial fragment. Custom tibial plates were designed to capture this fragment and ensure a stable final reconstruction.

OUTCOME / BENEFITS

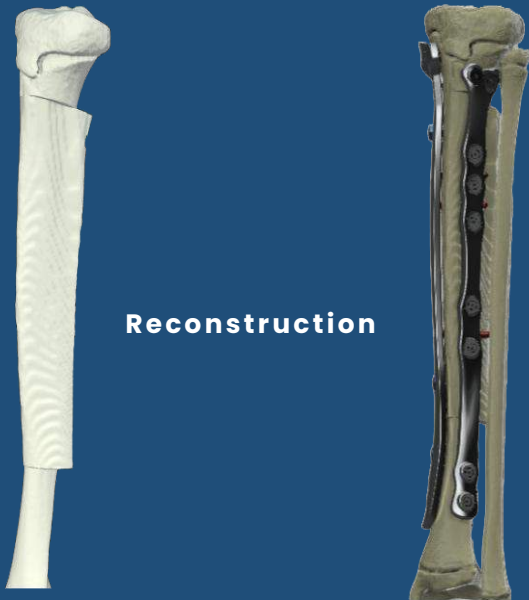
The use of patient-specific surgical guides and implants enabled a highly accurate resection and reconstruction, minimizing intraoperative guesswork and maximizing structural integrity.

The step-cut design and custom fixation improved rotational control and fixation when compared to off-the-shelf plating options, while the matched allograft allowed for a more anatomical restoration.

This tailored approach supports a functional recovery and reduces the risk of recurrence or graft failure.



Surgical Guides



Reconstruction

CASE STUDY:

Sacral & Iliac Tumour Resection

SUMMARY

This patient presented with an aggressive tumour invading both the ilium and sacrum where the growth had begun to compromise a number of sacral roots.

The surgeon planned to resect the tumour with safe margins while attempting to preserve as much bone and neurovascular structures as possible, for optimum recovery and function post-operation.

DESCRIPTION

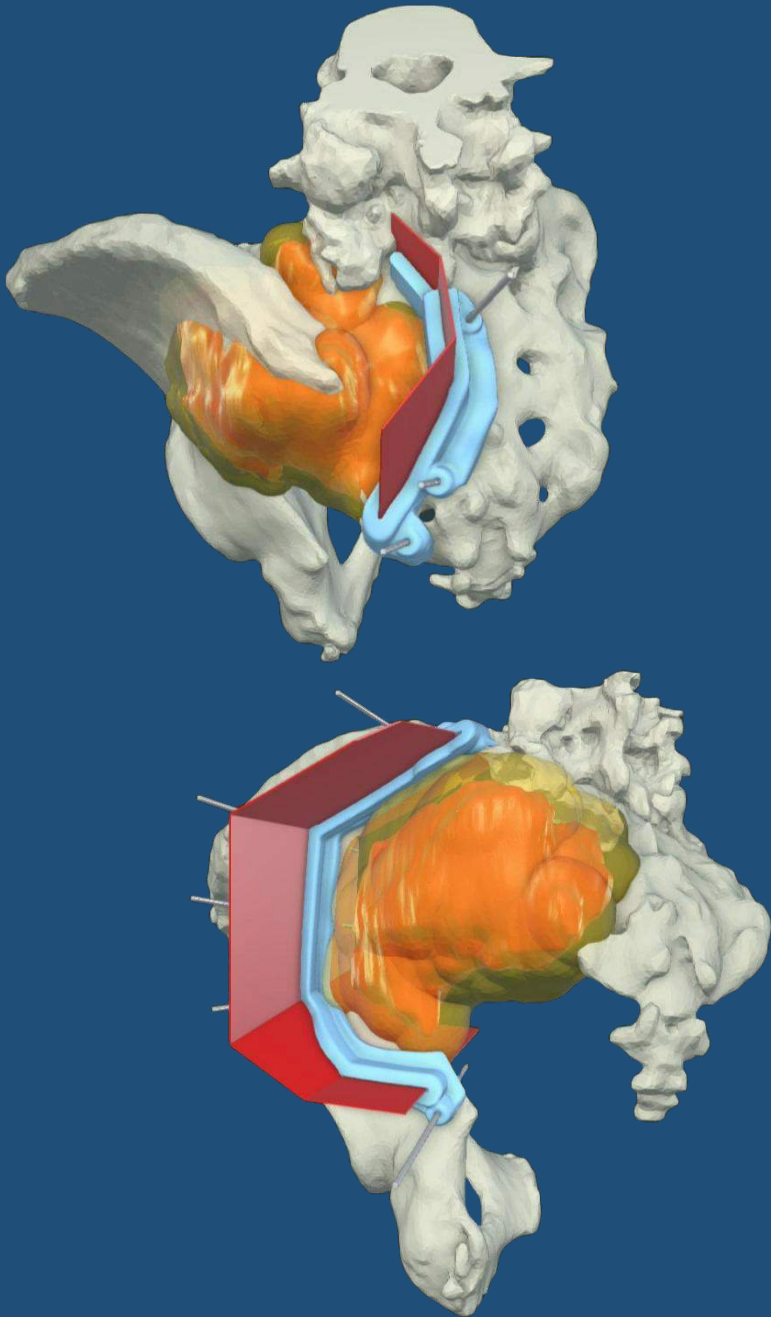
Following the creation of a 3D anatomical model from the CT and MRI scans, three guides were proposed. Two for the sacrum - one anterior guide and one posterior guide. This allowed for maximum bone and nerve conservation whilst also ensuring adequate margins. These two guides would join up distally to allow for the complete resection of the affected region of the sacrum.

The third guide allowed for resection of the tumour affecting the hemipelvis and used wider margins to those used for the sacrum..

OUTCOME / BENEFITS

Due to soft tissue obstruction the guides were used to define the initial location and angles of the cutting planes, after which the surgeon completed the cuts freehand.

Negative margins were successfully achieved, and intra-operative efficiency was enhanced for both surgeon and patient.



CASE STUDY:

Distal Femoral Osteosarcoma Resection & Allograft Guides

SUMMARY

This patient required a resection of a distal femoral osteosarcoma and a subsequent allograft reconstruction. The osteosarcoma was particularly invasive meaning the surgeon would have to remove a significant section distally. Additionally, it was important to keep as much of the articular surface of the lateral epicondyle intact to help maintain function at the knee joint for the patient. The surgeon also wanted to reconstruct the defect with an allograft that came with lateral collateral ligament for a better outcome.

DESCRIPTION

Following the 3D model generation from CT and MRI scans, Insight Surgery worked with the surgeon to establish the varying margins that would be needed for a successful resection; 10mm for the inferior/superior margins, and 12 mm medially.

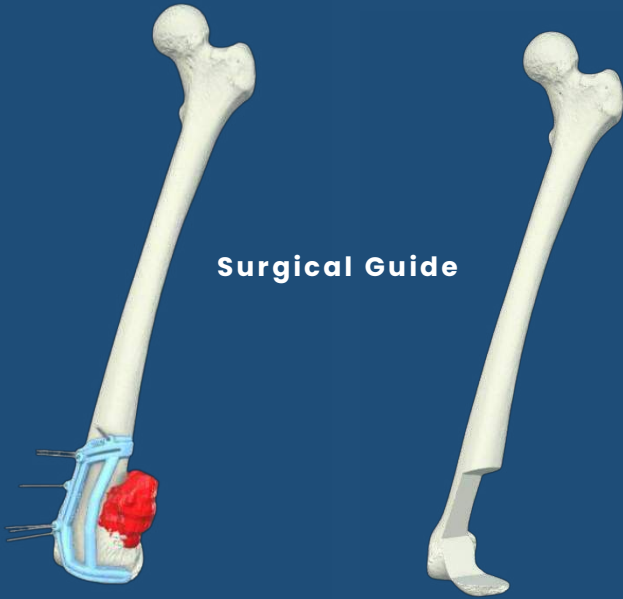
The guides for the tumour also kept the lateral/articular surface intact to a sufficient degree.

Matching guides were then designed and manufactured for the allograft so the defect could be reconstructed. It also accounted for LCL tissue reconstruction.

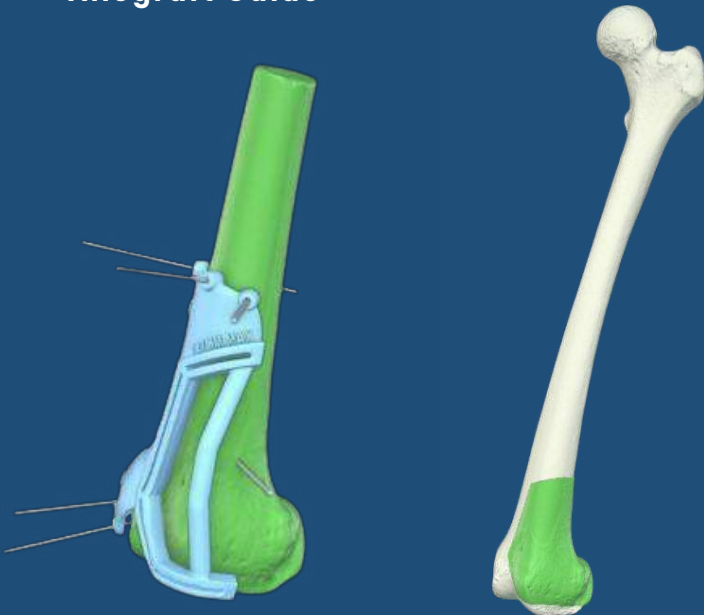
OUTCOME / BENEFITS

The surgery went well with clear margins achieved and a successfully transferred allograft which fit well with the patient's anatomy.

Surgical Guide



Allograft Guide



CASE STUDY:

Giant Cell Tumour Guided Resection

SUMMARY

This patient presented with a giant cell tumour of the right ischium in need of resection. Due to the tumour's close proximity to the acetabulum, care would be needed in margin and osteotomy planning, in order to preserve as much bone as possible.

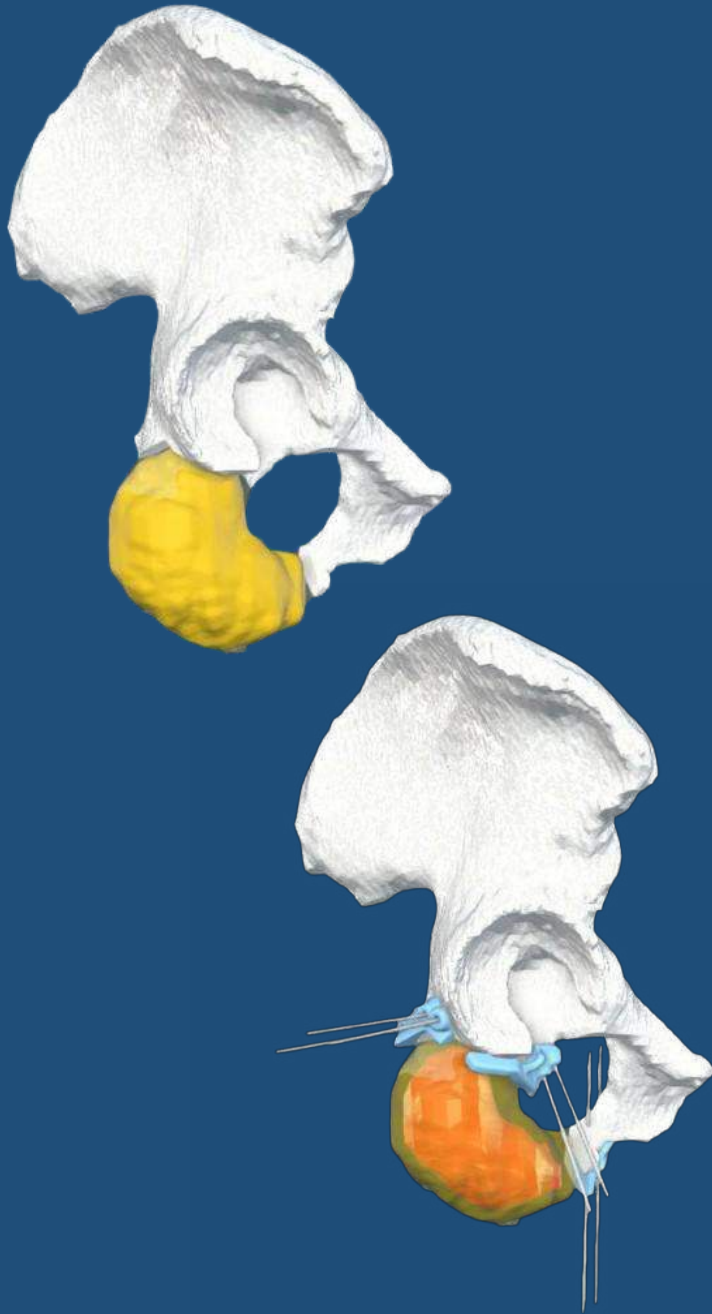
DESCRIPTION

The patient's anatomy was segmented and 3D modelled from the combination of CT and MRI scans. The surgeon then worked with Insight Surgery in calculating their desired margins for bone preservation. With the whole region hard to access, the surgeon would use a high lithotomy approach for increased surgical access to be able to use guides

Three guides were designed in total. One to resect the tumour along the inferior pubic ramus. The anterosuperior and the posterosuperior ischial guides resected around the acetabulum in order to preserve joint anatomy and function. Design emphasized small guide footprints and open flanges due to limited surgical access and the smaller margins.

OUTCOME / BENEFITS

The surgery went well, with the guides proving useful for the surgeon given how close the tumour was to the acetabulum, with the anterosuperior guide being of particular importance in marking the cutting for that area of bone.



CASE STUDY:

Tibial Osteosarcoma Resection & Allograft Reconstruction

SUMMARY

This patient presented with a low-grade osteosarcoma of the right proximal tibia. The surgeon elected to resect the tumour and follow up with an allograft reconstruction

DESCRIPTION

After building the anatomical model Insight Surgery worked closely with the surgeon to develop guides that would allow for negative margins in resection while allowing variable tolerances throughout the footprint to account for soft tissue in different locations. A support bridge in the guide was used to help achieve this low profile.

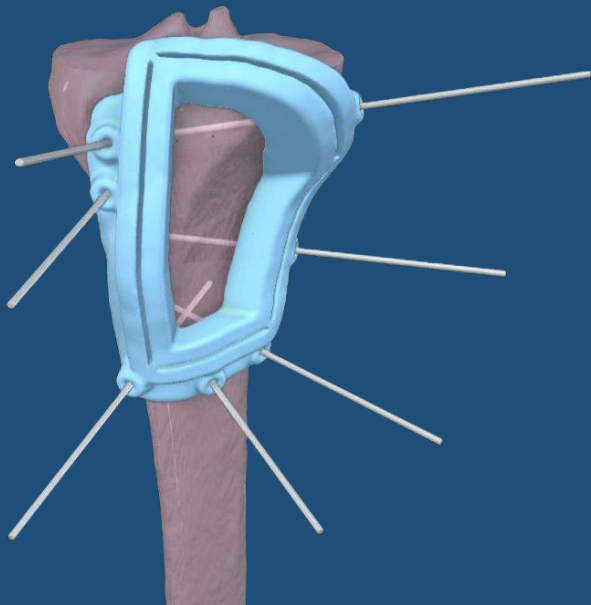
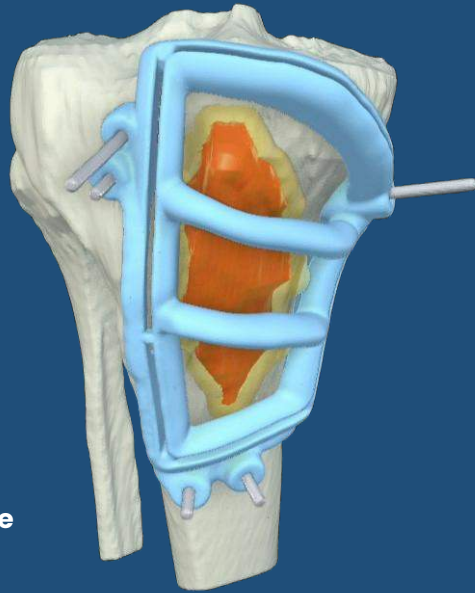
One of the priorities for resection was preserving tibial tuberosity to maintain function of the knee extensor mechanism. This objective extended to the choice of allograft; finding a good match for the tuberosity. Surgical guides were designed and manufactured for the allograft cuts to attempt good global fit around the tumour resection borders.

OUTCOME / BENEFITS

The surgeon particularly appreciated the angled cut running underneath the tibial plateau. If attempted freehand it likely would have ran horizontally, as it had in the surgeon's last case which resulted in the structure collapsing post-op.

The cut provided by this guide allowed the tibial platform more structural integrity and strength, reducing the risk of collapse and further surgery for the patient.

Surgical Guide



Allograft Guide

CASE STUDY:

Pelvic Squamous Cell Carcinoma Resection

SUMMARY

This patient had already undergone both chemotherapy and radiotherapy to treat the squamous cell carcinoma developing in their iliac wing.

However, the mass continued to enlarge, and resection was proposed by the surgeon.

DESCRIPTION

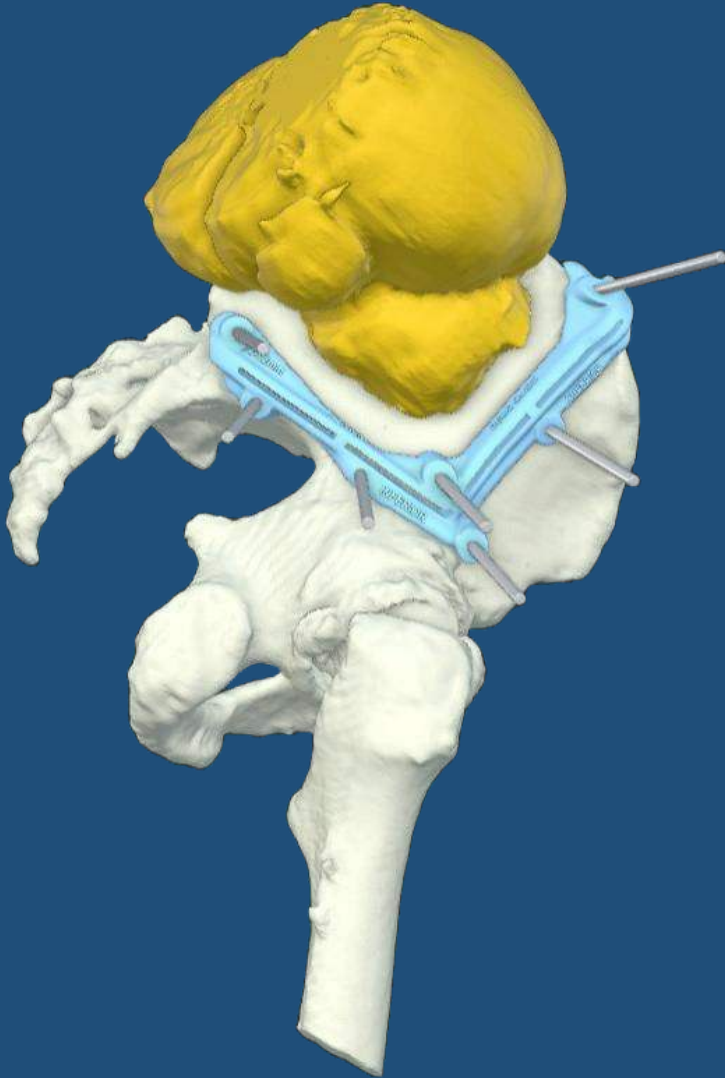
CT and MRI scans were used to construct the virtual 3D model of the patient's pelvis. The tumour was grown with a 10mm allowance to allow for negative margins.

Discussions with the surgeon to plan the cuts resulted in the design of one 'mega' guide which would allow for complete resection. With consideration, Insight Surgery also designed and provided an alternative for the surgeon in the form of two individual guides which would allow the same resection in two stages if placement complications occurred. These two guides shared common K-wire placements for uniform fit.

OUTCOME / BENEFITS

The surgery *"was successful and negative margins were achieved."*

The surgeon appreciated the provision of guide options.



CASE STUDY:

Tumour Resection & Allograft Guides

SUMMARY

In this case, the surgeon needed to resect a distal femoral tumour with multiple considerations applying to the procedure. Given the tumour size and location, a complex geometric cut that maximized bone conservation was desired. It was therefore important to maintain the posterior aspect of the distal femur, and also preserve as much of the articular surface of the lateral epicondyle as they could. Preserving the ACL insertion point on the distal femur was the final requirement. Insight Surgery helped the surgeon plan margins to achieve all three directives.

DESCRIPTION

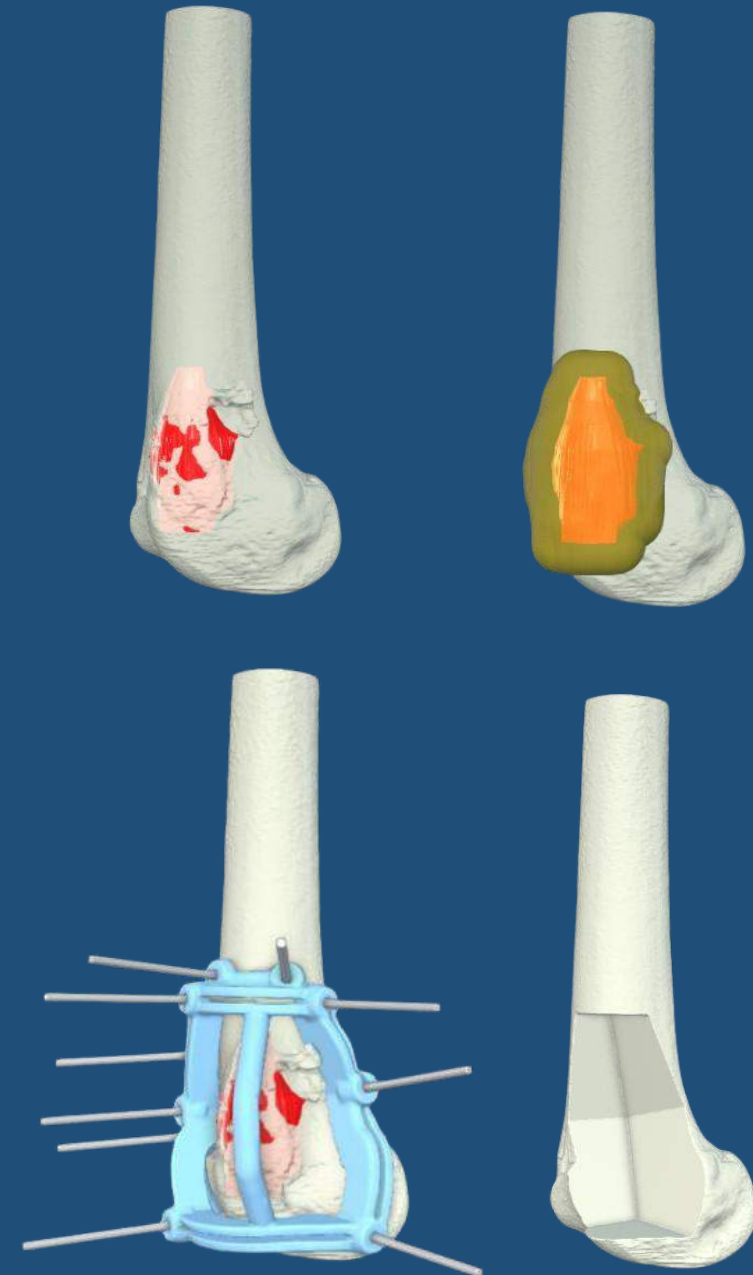
Combining CT and MRI scans, a 3D model of the patient's anatomy was segmented and virtually reconstructed.

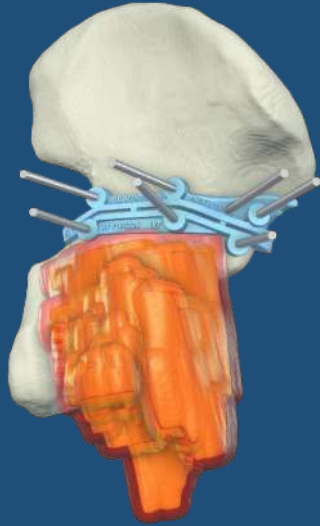
Two guides were designed and manufactured, replicating the planned cutting planes with margins for the geometric cut; one for the resection and one for the matching allograft so that the segment for the reconstruction could accurately slot into the resulting defect.

OUTCOME / BENEFITS

The surgeon was happy they were able to preserve the patient's ACL and not have to reconstruct with an allograft for that also.

"I really wanted to thank you all for the amazing work you did on putting this together, especially with such a compressed timeline. The case could not have gone more smoothly and the result was incredible ... and easy with your guides and guidance."





CASE STUDY:

Acetabular Osteosarcoma

SUMMARY

In this exemplar case, the patient presented with an osteosarcoma that had invaded the acetabulum. Insight Surgery provided personalized surgical guides to safely resect the compromised bone whilst maximising bone conservation.

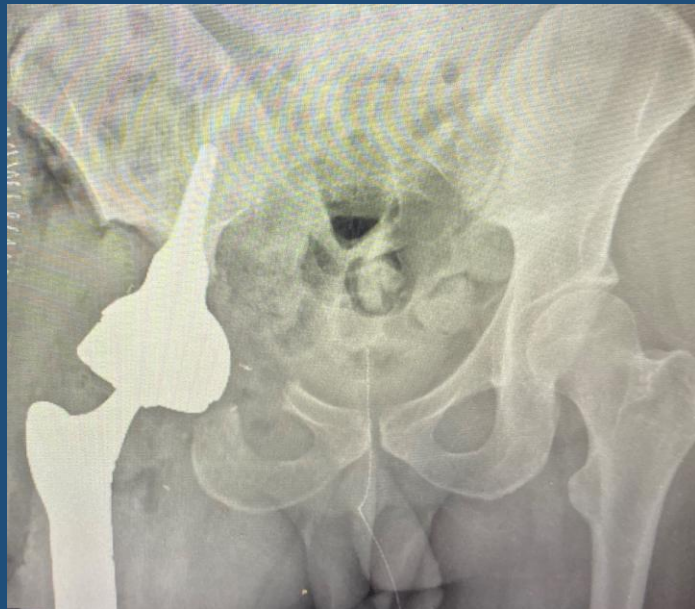
DESCRIPTION

Within 5 days of receiving the surgeon's instruction, Insight Surgery was able to rapidly design and manufacture multiple medical devices; patient-specific anatomical models for pre-surgical planning and surgical guides for optimizing the resections.

OUTCOME / BENEFITS

The surgeon commented:

"The patient had an unfortunate and significant progression of disease despite chemotherapy that necessitated a change of surgical plans with a tight window. With the expert help and a true collaborative effort from the teams at Insight and ImplantCast, we were able to implement a precise and patient-specific plan for the patient that made our surgery more efficient and optimized the outcome for the patient. I am thankful for the support and the efficiency with which this was delivered."



Postoperative X-Ray

CASE STUDY:

Osteosarcoma of the Distal Femur

SUMMARY

This young female patient presented with an unusual cartilage lesion, resembling chondrosarcoma in her posterior femur that required resection. Pre-surgical imaging showed her intra- & extra-osseous components needed to be removed, with a 5mm margin.

DESCRIPTION

The surgeon placed a request with Insight Surgery for the provision of surgical guides and a patient-matched allograft solution. A complex 6-planar osteotomy was required to remove the entire tumour, whilst preserving the continuity of the anterior, medial, and lateral cortices.

Surgical guides were designed and manufactured for the required osteotomies on both the patient and allograft. These enabled the surgeon to accurately restore a more natural anatomy for the patient.

OUTCOME / BENEFITS

The main aim of this surgical procedure was to replace the affected segment of the right distal femur with an allograft bone implant. The surgical guides allowed the surgeon to make the appropriate cuts with a higher degree of accuracy than making these osteotomies freehand and increasing the likelihood of stable fixation and osteointegration.

Using the Virtual Surgical Plan that was created prior to the surgery, it was possible for the surgeon to effectively determine the size and positioning of the required cuts. Overall, this meant less time was spent in the surgery for the procedure due to enhanced pre-surgical plans defined by the surgical team.



Patient Anatomy



Patient Guide



Allograft Guide



Final Result

CASE STUDY:

Osteosarcoma Resection & Hemipelvectomy

SUMMARY

This patient's osteosarcoma was fast growing and the surgeon had particular concerns about the growth compromising important anatomical structures at and around the sciatic notch, including the sciatic nerve.

A hemipelvectomy was planned to entirely remove the affected part of the hemipelvis, whilst safely preserving as much as bone as possible to allow for subsequent reconstruction with an implant.

DESCRIPTION

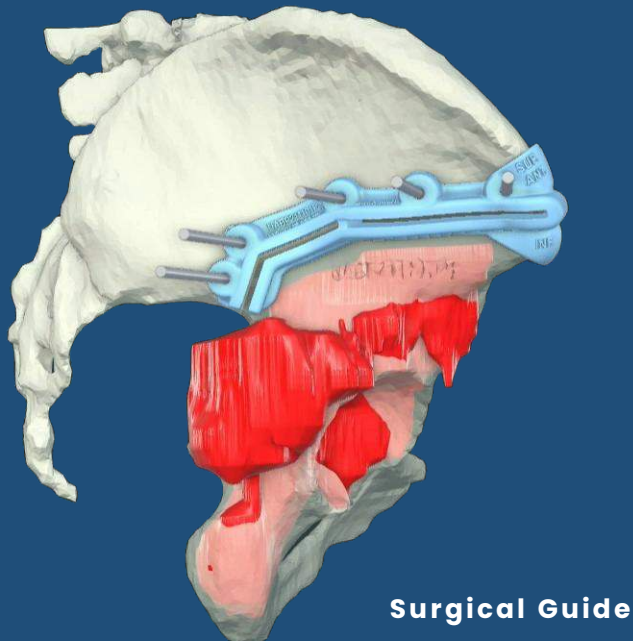
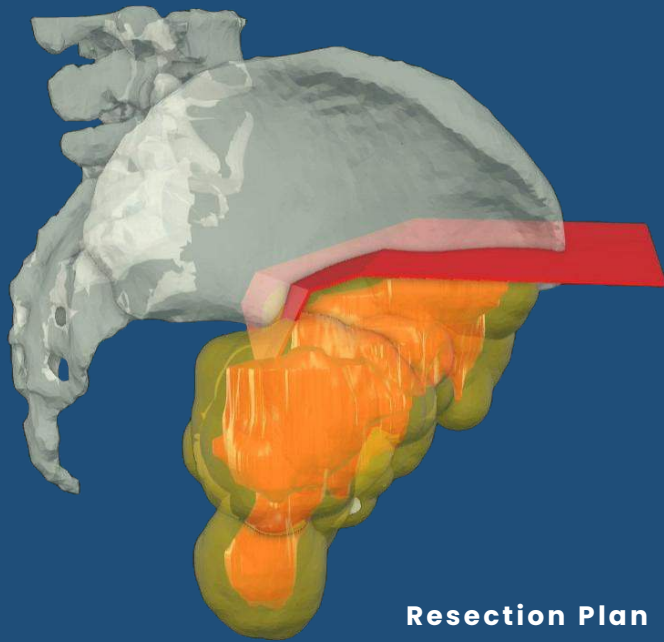
A 3D model was built through a combination of CT and MRI. Two different tumour margins, wider anteriorly and narrower posteriorly, were agreed upon with the surgeon and used to set the resection plane locations and angles. Using the narrower margin posteriorly helped the surgeon to avoid critical neurovascular structures at the sciatic notch and preserve as much bone as possible for reconstruction.

Notably, this case demonstrated Insight Surgery's capability for extremely quick turnaround. Owing to the urgency of the growth, it took less than five days from receiving the scans to delivery of the guides for sterilisation prior to use in theater.

OUTCOME / BENEFITS

Virtual planning and intra-operative surgical guide use resulted in a successful hemipelvectomy procedure in 90 minutes. This meant less time in theater for both patient and surgeons compared to a procedure without.

Negative margins were achieved and this resection formed the basis on which the surgeon would reconstruct the joint with a custom implant.



FASTER RECOVERY

Less time in ICU, faster rehabilitation. On average patients stayed 3 less days overall and 1.5 days less in ICU.

FEWER POSITIVE MARGINS

In our study with the UK NHS over 26 real world cases, 13 of the cases that did not use guides had 3 positive margins as opposed to 0 positive margins where guides were used.

INCREASED SURGICAL LISTS

Significant time savings in surgery by using digital planning and guides means more procedures can be added to future surgical lists.

FEWER MAJOR ISSUES

By the use of surgical guides in complex orthopedic oncology cases, an ~18% reduction in major complications during and after was observed.

REDUCED THEATER TIME

Overall, between a 10% to 30% reduction in theater time was observed brought about by the use of digital planning and surgical guides.

REDUCED BLOOD LOSS

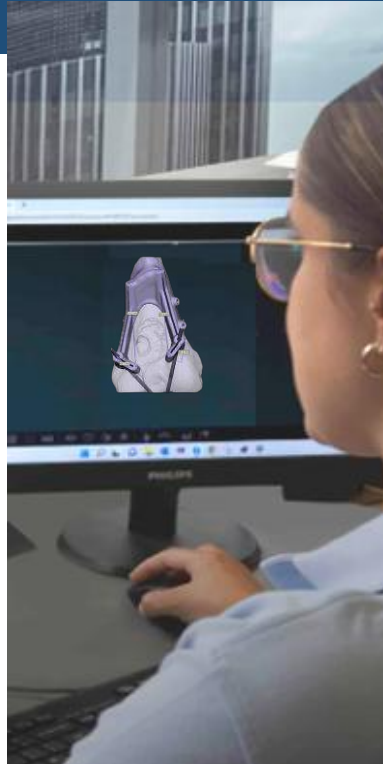
In our studies with the NHS, an overall decrease of ~13% in blood loss was seen which improved the patient outcomes and lowered operational theater costs.

Benefits of Personalized Surgical Solutions

Workflow for Guided Orthopaedic Oncology Resection



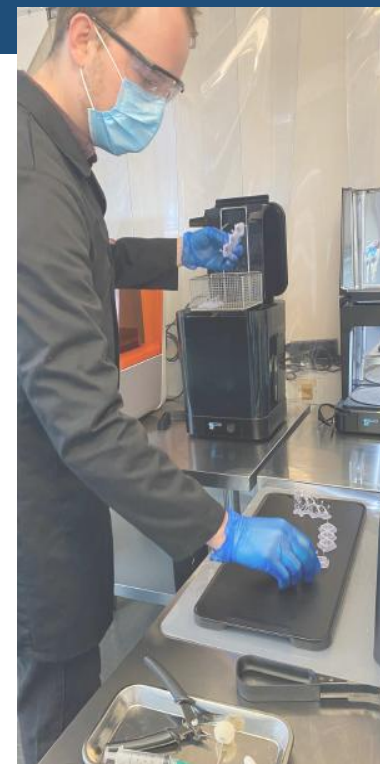
Patient scan & surgeon case instructions received



Virtual Surgical Plan (VSP) defined with 3D model and Surgical Guide



Final review & approval of VSP and devices by surgeon



3D printing of medical devices in our in-house cleanrooms



Surgery is performed



Digital Planning. Personalised Solutions

Medical Devices provided in Days, not Weeks

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