



Crushed Calcaneus Reconstruction

The use of an Axial3D model to aid the diagnosis and surgical planning of a patient with extensive crush injuries to calcaneus.

Abstract

A physical 3D printed planning model was created to aid in preoperative planning and osteotomy selection for open reduction and internal fixation for a patient with complex calcaneal fracture.

Clinician

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Healthcare Provider

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I was provided with a 3D physical model of a complex calcaneal fracture which allowed me to understand the complexity of the fracture and plan open reduction and internal fixation. The model was of a high standard and was extremely useful in pre-operative planning and educating medical staff.



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Case

The male patient was admitted to the Ulster Hospital with extensive crush injuries to the left calcaneus. Due to the amorphous arrangement and close proximal anatomy of the foot, a comprehensive understanding of the extent of the patient's injuries was difficult to ascertain using CT scans alone.

Solution

The surgeon was provided with a 1:1 scale 3D printed model of the complex calcaneal fracture with the surrounding anatomy of the foot (including distal aspects of tibia and fibular, talus, navicular and cuboid bones) (Fig 1, 2 & 3).

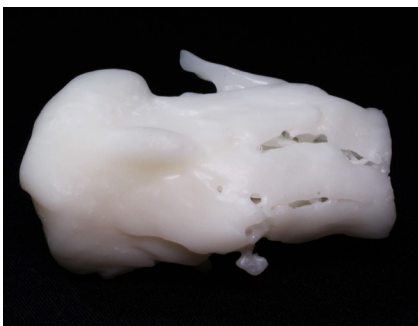


FIG 1
Lateral aspect of left calcaneus bone.

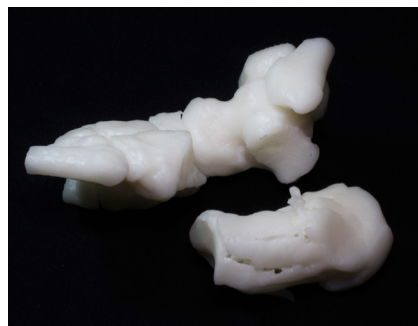


FIG 2
Lateral aspects of distal tibia and fibular, talus, navicular and cuboid bones with calcaneus removed.

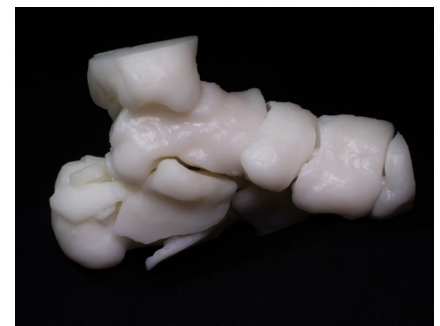


FIG 3
Full medial aspect of left foot.

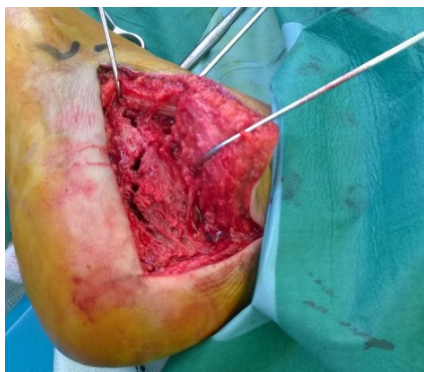


FIG 4 (Left)

Lateral aspect of calcaneus fracture during surgery.

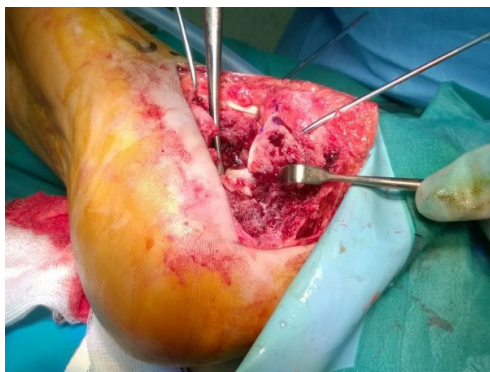


FIG 5 (Right)

Open reduction of calcaneus fracture.


Result

The model gave a much greater understanding of the complexity of the fractures and allowed accurate planning of open reduction and internal fixation (Fig 4 & 5). The model provided was also deemed to be extremely useful in educating medical staff on the extent of the patient's injuries prior to surgery.

Conclusion

Using the 3D printed models, trial operations can be carried out and used intraoperatively as guides to improve planning and reduce surgical time associated with difficult cases. Articular sites and fractures are particularly clear on the models, compared to standard imaging. 3D models also enable clearer communication with patients and post-op staff.

Benefits



Patient

Elevating Patient Care

- ◆ Faster treatment
- ◆ Reduced time in theatre
- ◆ Rapid recovery
- ◆ Improved communication
- ◆ Reduced complications



Clinicians

Advancing Surgical Standards

- ◆ Greater insight into the complexity of the fracture
- ◆ More accurate preoperative planning
- ◆ Useful for educating the medical team



Healthcare Provider

Improving Standards and Efficiencies

- ◆ Increased standards of care
- ◆ Reduced risk of complications and infections
- ◆ Saved time and money in surgery and post-operative care

Model Specifications

Patient Data:	201 CCT images			
Color:	White <input checked="" type="checkbox"/>	Grey <input type="checkbox"/>	Clear <input type="checkbox"/>	Clear with Contrast <input type="checkbox"/>
Layout:	In-situ <input type="checkbox"/>	Separate <input checked="" type="checkbox"/>		
Construction:	Solid <input checked="" type="checkbox"/>	Hollow <input type="checkbox"/>	Split <input type="checkbox"/>	
Process and Delivery:	48 hours			

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