

APOA Foot & Ankle Council Presents..

Case of the Month

June 2024



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Presented by:



Dr. Shui-wah, Man

Consultant and Director of Foot & Ankle Service,
Department of Orthopaedics & Traumatology
Queen Elizabeth Hospital, Hong Kong SAR, China

Learning Points:

- © Calcaneal fractures can be difficult to manage.
- © Both skeletal injury and soft tissue injury management in calcaneal fractures are challenging.
- © 3D printing technology helps a lot in the design of cutting guides for calcaneal osteotomy and internal fixation.
- © Patient specific instruments and implants may be one of the future directions of skeletal reconstruction, particularly for difficult cases.

Title:

A Case of Application of 3D Printing in Management of Calcaneal Fracture Malunion

*Upcoming Case of the Month
July 2024*

Presented by:

Dr. Yan Yu Chen M.D.
Chief Surgeon,
Foot and Ankle Center,
Show-Chwan Memorial
Hospital, Taiwan



Title:

Arthroscopic Tibio-Talo-Calcaneal Fusion for Severe Hindfoot Deformity

Want to present a case? Write to...



Prof. Chayanin Anthong
chatthara@yahoo.com



Dr Kwai Ming Siu
siukmhk@hotmail.com

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A Case of Application of 3D Printing in Management of Calcaneal Fracture Malunion

Dr. Shui-wah, Man

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Case Presentation

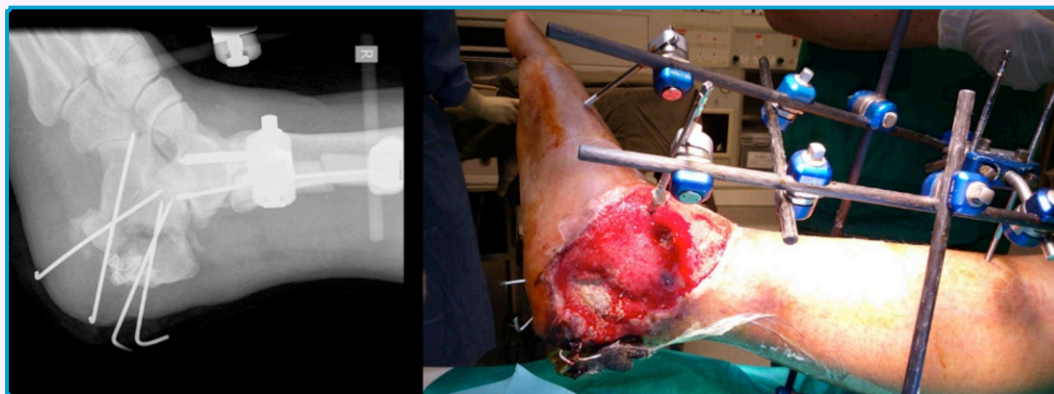
Mr. Ray was a 43-year-old local construction site worker. He enjoyed good past health. His right lower limb was crushed by heavy object in an industrial accident in 2015. He sustained right ankle fracture dislocation (**Fig. 1**), leading to right calcaneus open fracture with tissue & bone loss.

He was managed initially by our trauma surgeons with closed reduction, screws and K-wire fixation and external fixation (**Fig. 2**). He was sent to our foot and ankle team after initial damage control.



(Fig. 1)

X rays showing right ankle fracture dislocation



(Fig. 2)

X ray and clinical photo of the right ankle revealing closed reduction, screws and K-wire fixation and external fixation

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Foot & ankle reconstructions

The open calcaneal fracture was then managed with wound debridement and reverse sural faciocutaneous flap coverage (**Fig 3 & 4**).



(Fig. 3)

Clinical photo showing the skin markings for reverse sural faciocutaneous flap coverage



(Fig. 4)

Clinical photo showing the wound healed after reverse sural faciocutaneous flap

The wound finally healed (**Fig. 4**), but what's left behind was a malunited right calcaneum (**Fig. 5**) and the patient was not able to stand upright for deficit of the posterior process of the calcaneum.



(Fig. 5)

X rays demonstrating malunited right calcaneum

Mr. Ray suffered from chronic right foot & ankle pain with significant antalgic gait, for stiffness of right ankle and subtalar joints. His right heel not touching the ground while in ambulatory position and that's symptomatic even with orthosis support.

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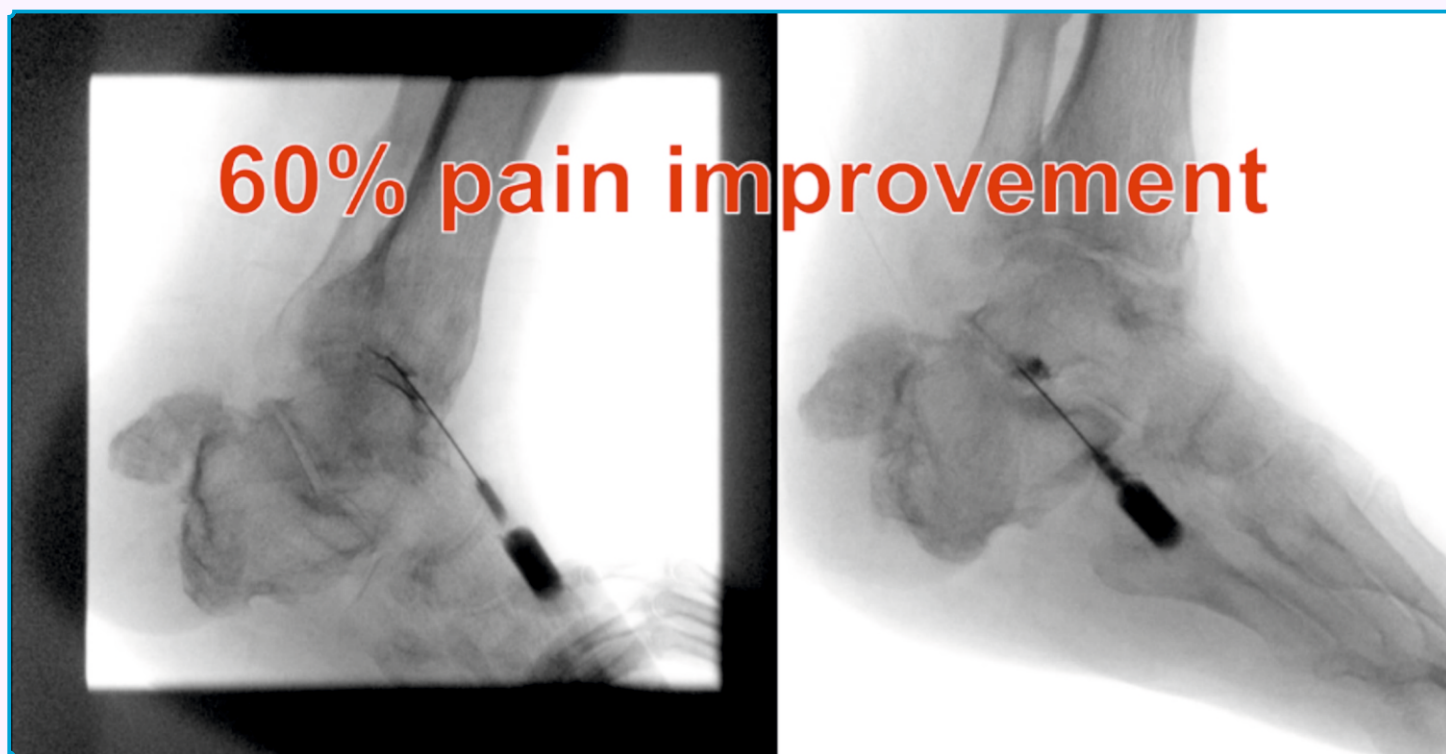
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Pain management & rehabilitation

Mr. Ray attended outpatient Physiotherapy for rehabilitation. Orthosis was prescribed for accommodations of the deformed right heel with referral to the Prosthetic and Orthotic (P&O) Department. He also attended our psychiatrist for post-traumatic disorder management. Referral was made to our Anesthetic Pain Team. Pain control was tried with multiple medications. However, the result was still not optimal. He experienced VAS pain score of 8/10 with no pain killers, and VAS 5/10 with drugs.

We performed a contrast arthrogram for his ankle and subtalar joint (**Fig. 6**), which yielded 60% of pain relief.



(Fig. 6)

X rays showing contrast arthrogram for his ankle and subtalar joint

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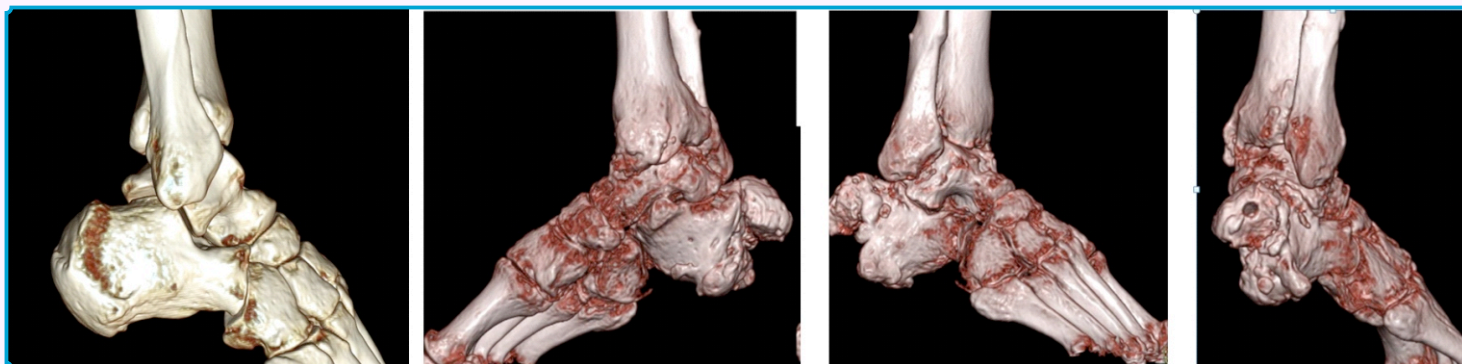
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Goal setting,

During the subsequent outpatient clinic follow-up session, Mr. Ray requested if any surgical intervention could help to improve his right foot and ankle symptoms.

We had a detailed discussion about possible options of surgery with him. His major wish was to optimize pain control and resume a job. He was well informed that he would not be able to work in construction site again. Anyway, we would try and see if he could walk with his heel again with a more normal gait, and, at the same time, we would try to see if any ankle or hindfoot range of motion could be preserved.



(Fig. 7)

CT scan of his right foot and ankle, with 3D reconstruction were shown

We performed CT scan of his right foot and ankle, with 3D reconstruction (**Fig. 7**). CT scan of the left foot and ankle was also performed at the same time to be as template to guide the right foot reconstruction afterwards (**Fig. 8**).

(Fig. 8)

CT scan of the left foot and ankle to be as template to guide the right foot reconstruction afterwards



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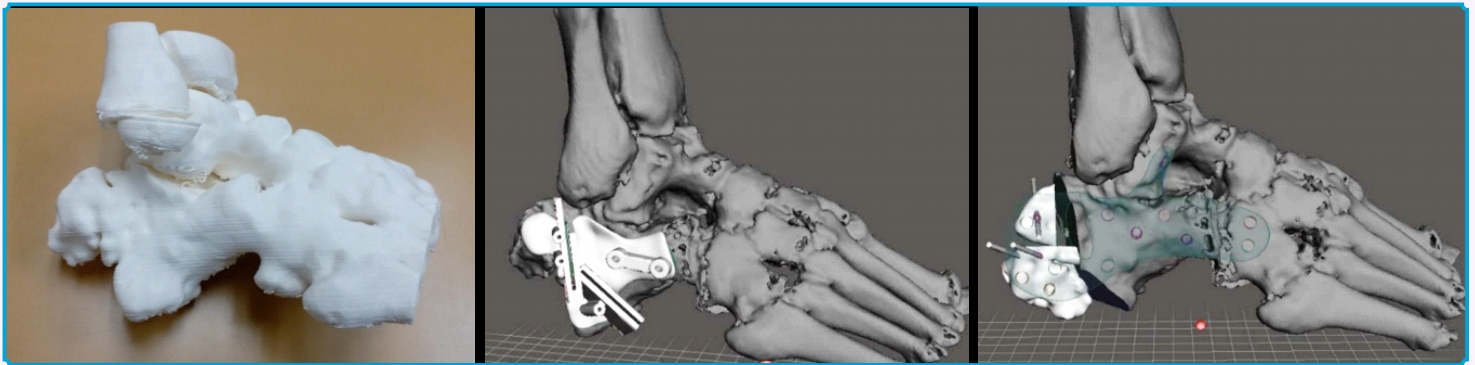


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Application of 3D printing technology,

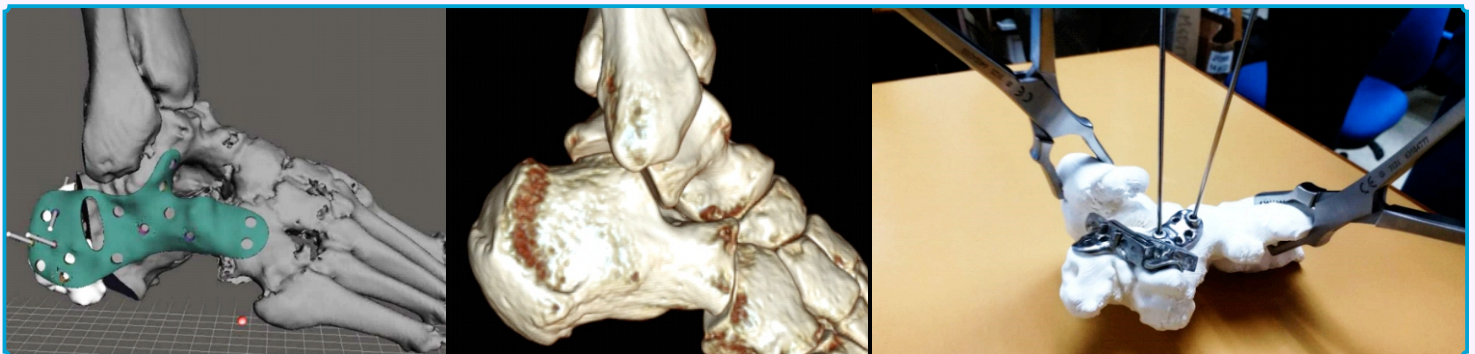
We worked with our P&O Department for design of the location of bone cut for corrective osteotomy of the right calcaneum. A 3D printed cutting guide and temporary internal plate fixation after osteotomy were designed at the same time (**Fig. 9**).



(Fig. 9)

A 3D printed cutting guide and temporary internal plate fixation after osteotomy were designed at the same time

We performed a trial cut in the saw bone model (**Fig. 10**).



(Fig. 10)

Pictures showing a trial cut in the saw bone model

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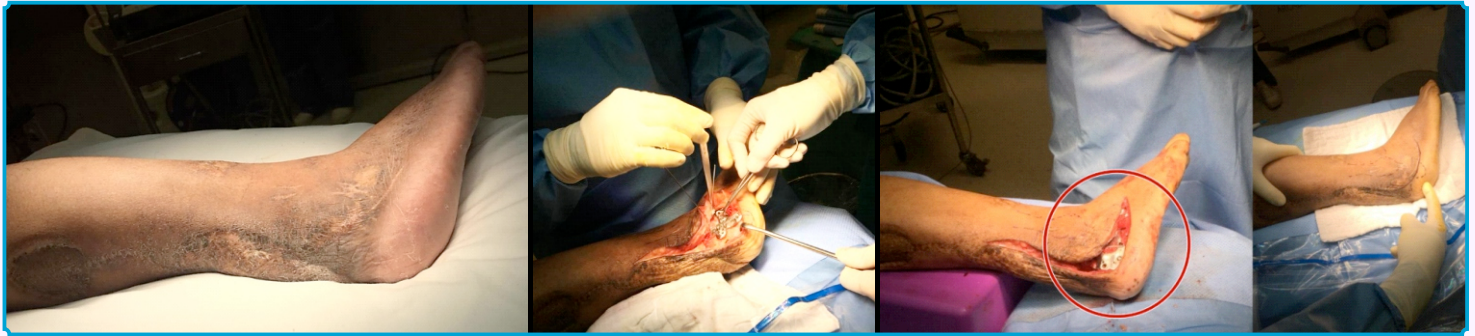
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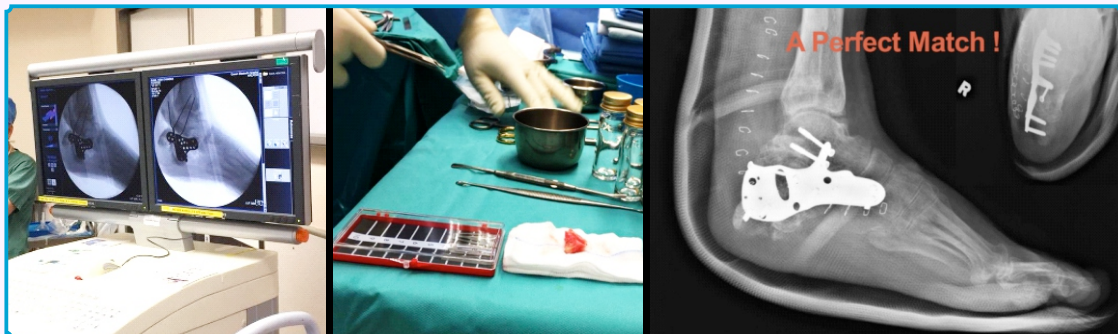
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Finally, 3D printing cutting guided osteotomy for our patient was performed (**Fig. 11**). Early post-op X-rays showed a very good reconstruction (**Fig. 12**).



(Fig. 11)

Intra-op photos demonstrating the 3D printing cutting guided osteotomy for our patient



(Fig. 12)

Early post-op X-rays showed a very good reconstruction

Osteotomy had a solid union at about 8 months after surgery. The right ankle and hindfoot alignment were very much corrected with the osteotomy (**Fig. 13**).



(Fig. 13)

X rays showing solid union of the osteotomy at about 8 months after surgery. This was a comparison of contours of the right heel pre-operation and post-operation

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Mr. Ray enjoyed an uneventful recovery. He did have residual symptoms of mild pain and stiffness of right ankle. He walked with one elbow crutches now. He was still in outpatient physiotherapy for rehabilitation. Serial blood tests of serum cobalt and chromium were normal, which indicated no evidence of systemic effect of metallosis in relation to the metal implants. We planned to remove the implants subsequently and perform a total ankle replacement to take care of the symptoms of end stage post-traumatic arthropathy of the right ankle.

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