Limb Reconstruction/Foot & Ankle Subspecialty Day: Session I – Basics of Lower Limb Reconstruction and Foot and Ankle

Tracks | Meeting Room 408

Wednesday, September 28, 2022

8:00 – 8:40

Meeting Room 408

Speaker

Nazri Mohd Yusof
International Islamic University Of Malaysia

Distraction osteogenesis: basic science, principles and development

Arvind Puri

Biomechanics of lower limb: an overview

Hemant Sharma
Professor In Trauma & Orthopaedics
Hull University Teaching Hospitals

Principles of deformity correction in lower limb reconstruction

Luckshmana Jeyaseelan
The Royal London Hospital, Barts Health Nhs Trust

Pillon fracture reconstruction: how to do it

Distraction osteogenesis: Basic science, principles and development

PROF DR NAZRI MOHD YUSOF
ADVANCED TRAUMA AND LIMB RECONSTRUCTIVE SURGERY
DEPT. OF ORTHOPAEDIC, TRAUMATOLOGY AND REHABILITATION
KULLIYYAH OF MEDICINE

Outline

- Definition
- Biology
- Technique
- Application

Definition

- Production of **new bone** between **vascular** bone surfaces created by an **osteotomy** and separated by **gradual distraction.**

Tissue regeneration

The story

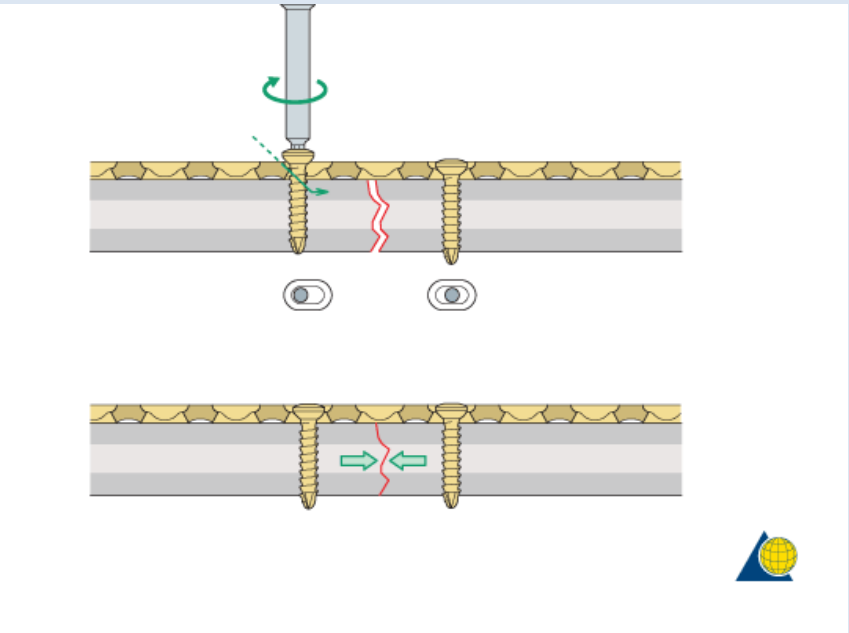
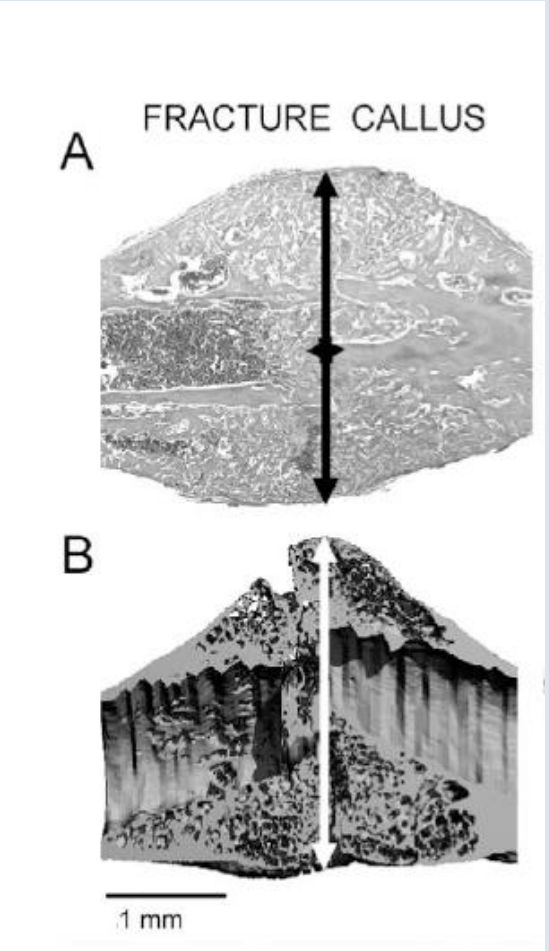


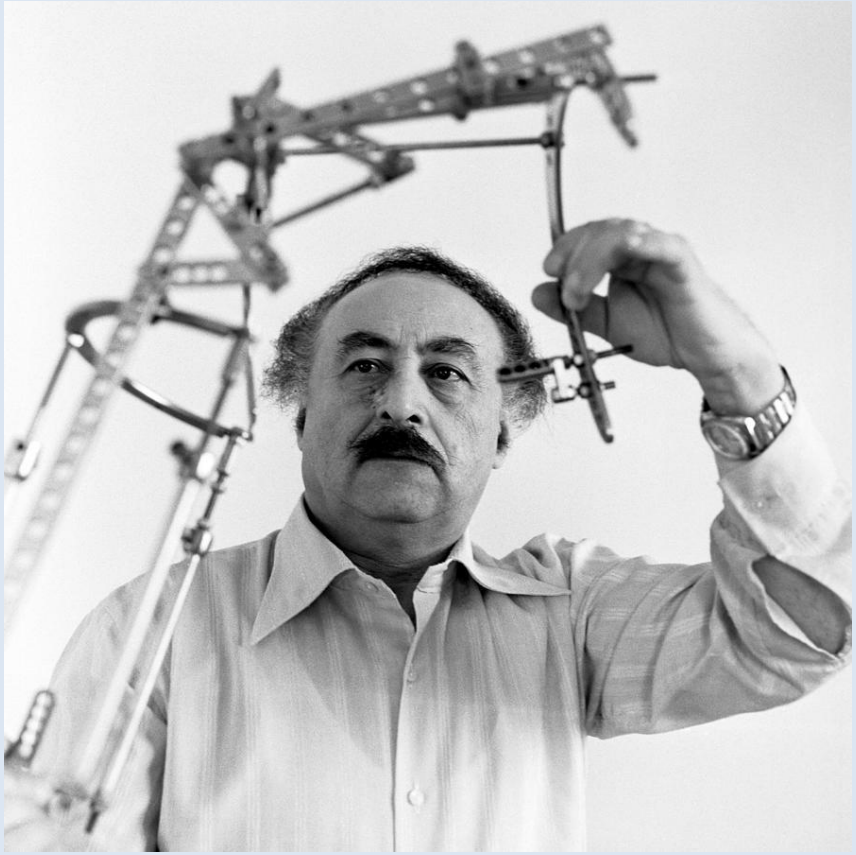
FIG. 3-6 Contact healing. An osteon crossing the osteotomy connects the two fragments of bone deposited in a longitudinal direction. This process of repair by primary restoration of the original structure is called primary bone healing. (Rahn BA, Gallinaro P, Baltensperger A et al: Primary bone healing. An experimental study in the rabbit. J Bone Joint Surg 53A, No. 4: 783–786, 1971)

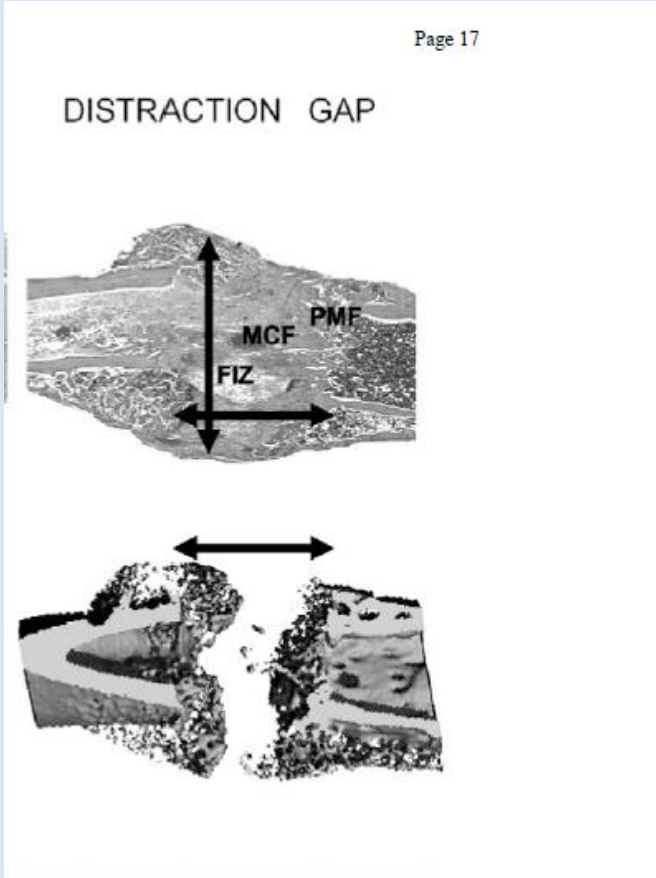
COMPRESSION

SPLINTING

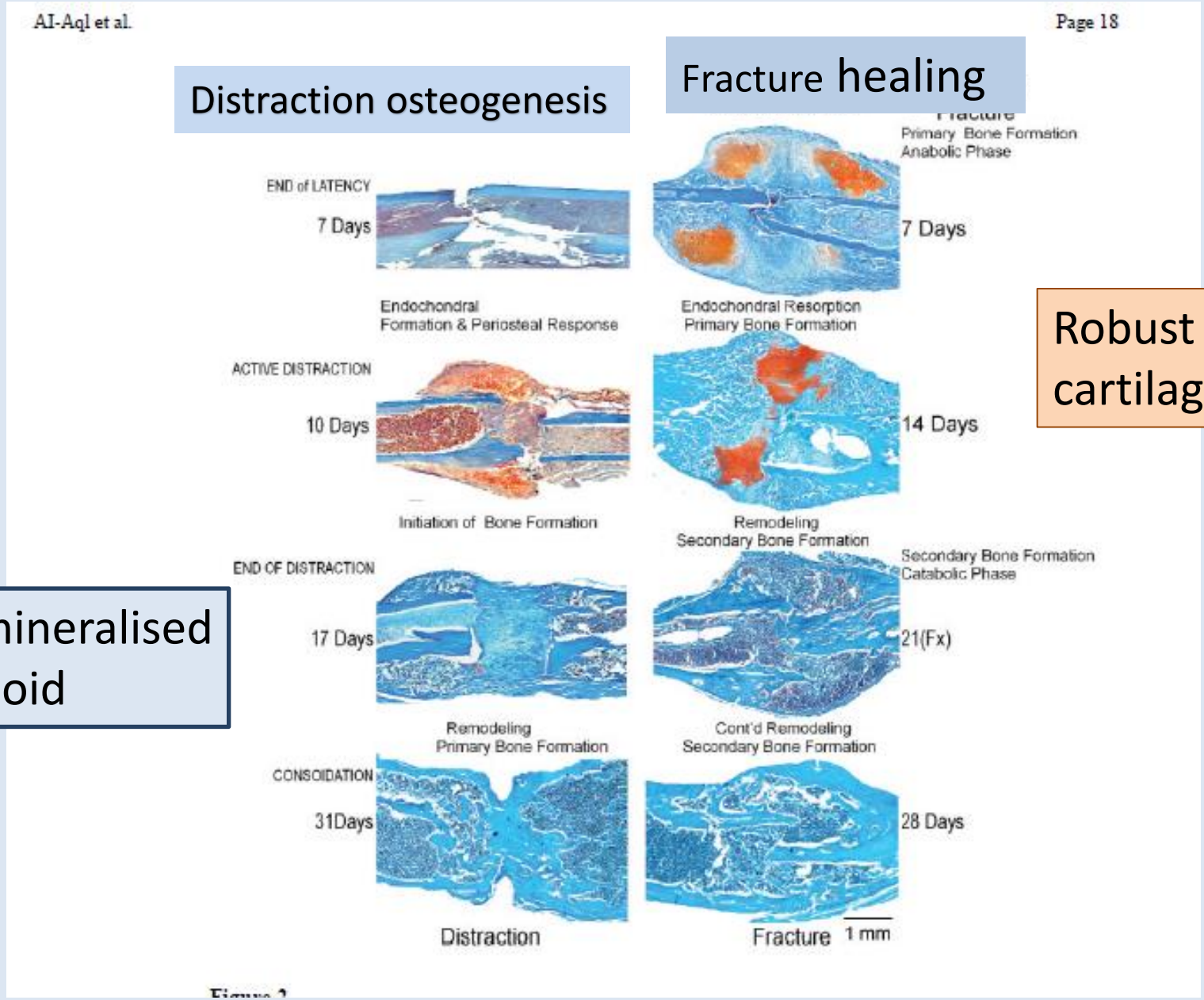


DISTRACTION





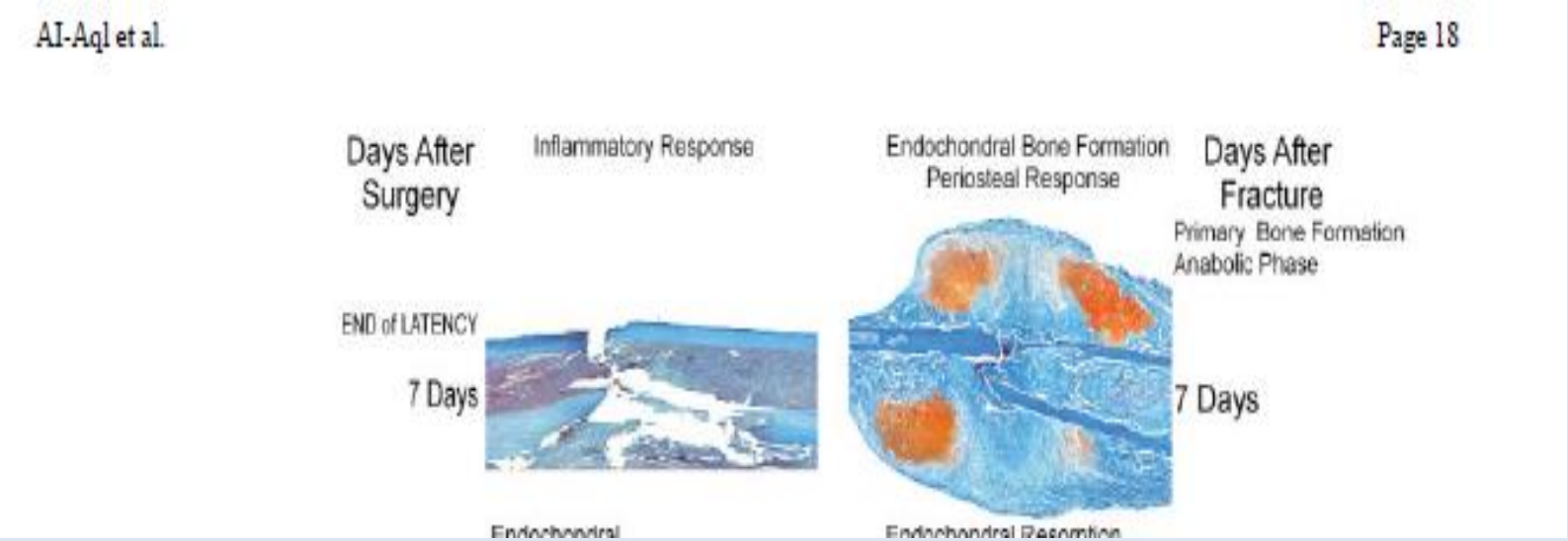
Al-Aql ZS et al.. J Dental Res. 2008;87:107-118



Al-Aql ZS et al.. J Dental Res. 2008;87:107-118

Latency phase

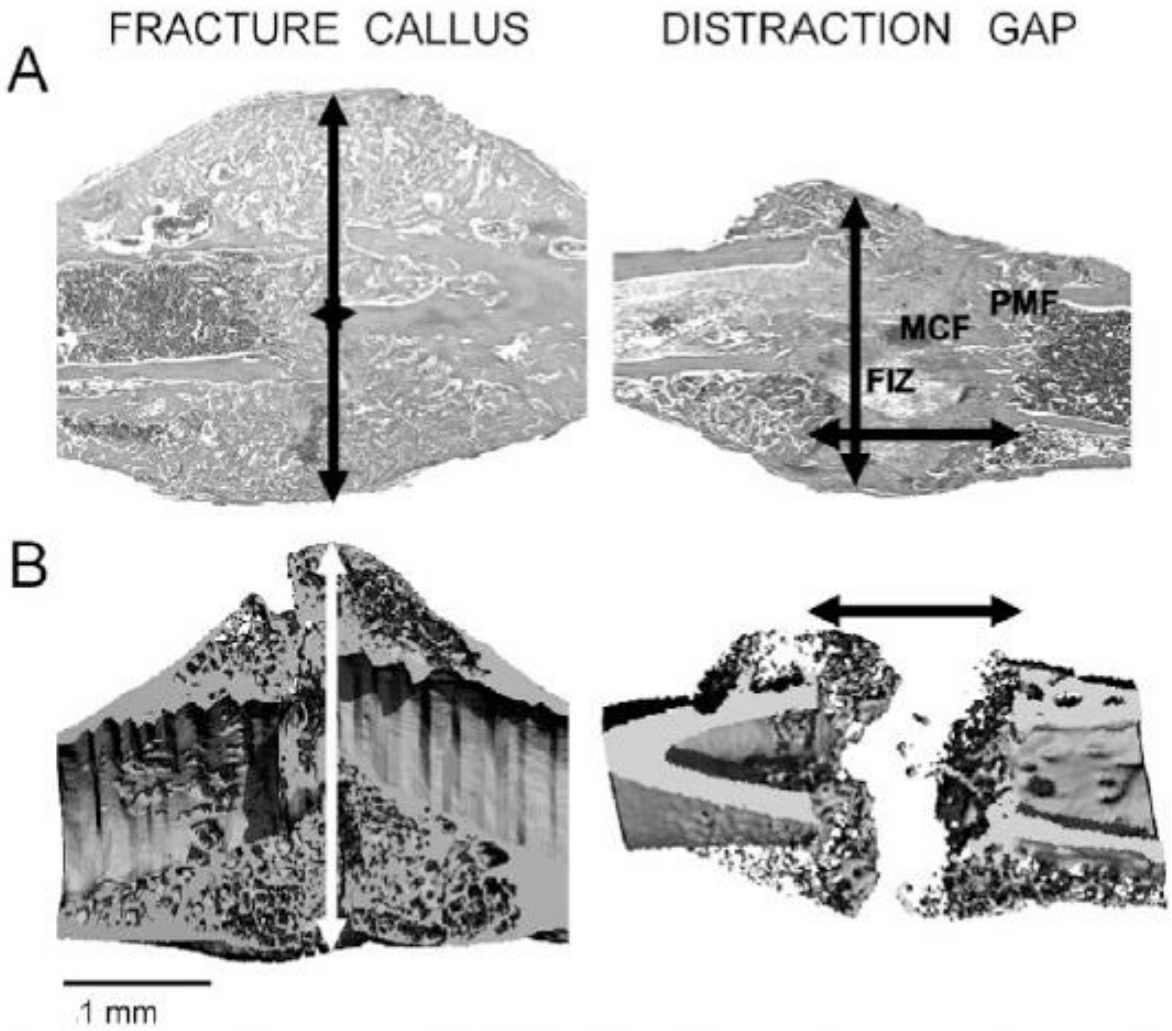
- 3-10 days
- Inflammatory phase
- Same with fracture healing



Al-Aql ZS et al.. J Dental Res. 2008;87:107-118

Distraction phase

- 0.5-2 mm/day
- Callus stretch
  - Fibrous interzone **(FIZ)-**chondrocyte like fibroblast
  - Microcolumn formation **(MCF)-** osteoid along collogen-mineralized parallel
  - Primary mineralization front **(PMF)-** highly proliferating cell



Al-Aql ZS et al.. J Dental Res. 2008;87:107-118

Osteoblast on collagen

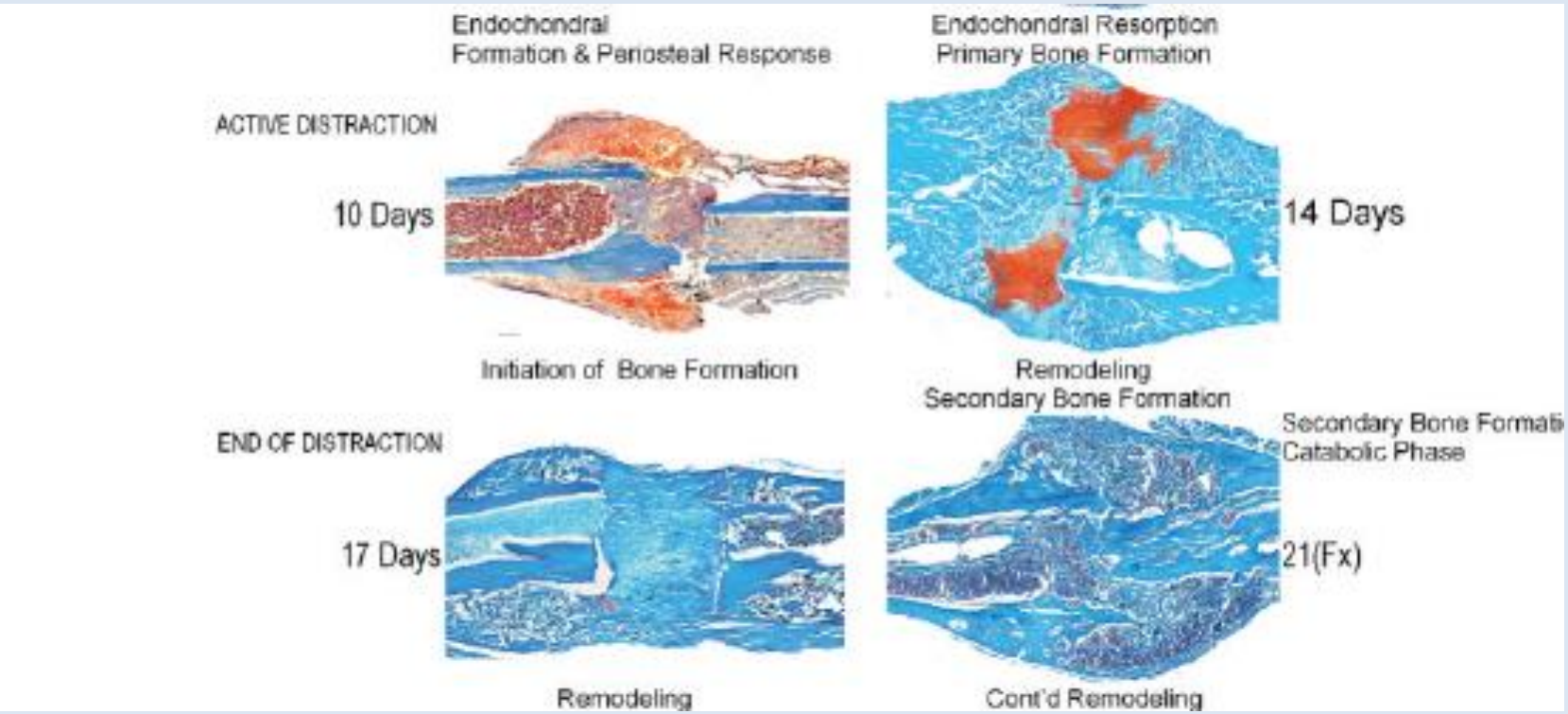
FIG. 1

FIG. 3

Aronson J.. J Bone J Surg. 1997;79A: 1243-58

Intramembranous ossification

Differentiating osteoblast depositing osteoid along the collagen bundles



Al-Aql ZS et al.. J Dental Res. 2008;87:107-118

Consolidation phase

- Osteoid mineralisation and remodelling
- 2-3 times of distraction phase
- Healing index
  - 1 month/cm in children
  - 2-3 months/cm in adult

Osteotomy

- Atraumatic / percutaneous
- Metaphyseal
- Healthy soft tissue
- Complete

Multiple drill hole osteotomy

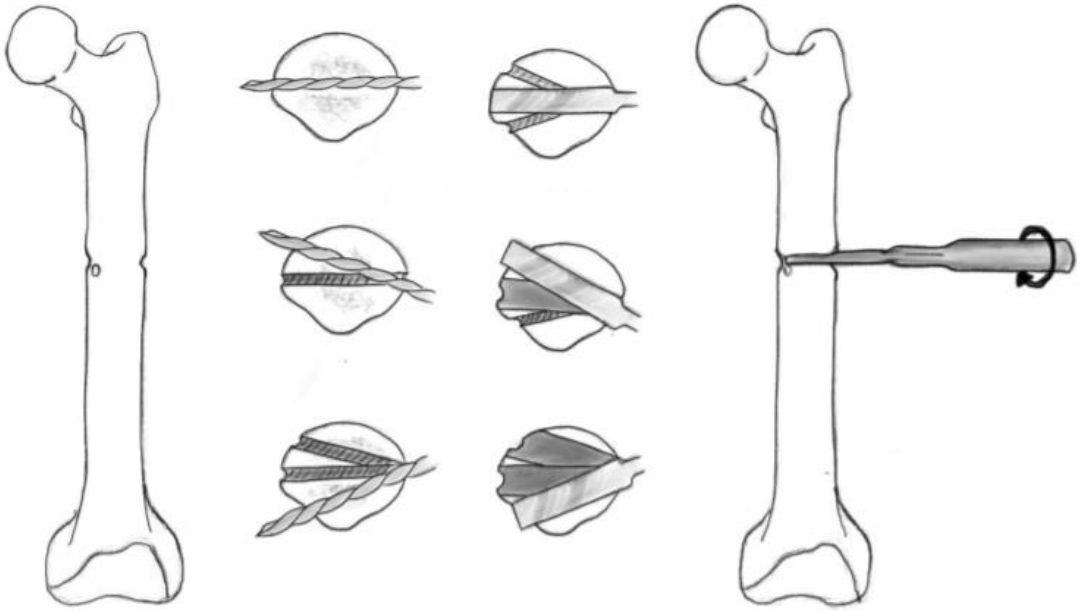


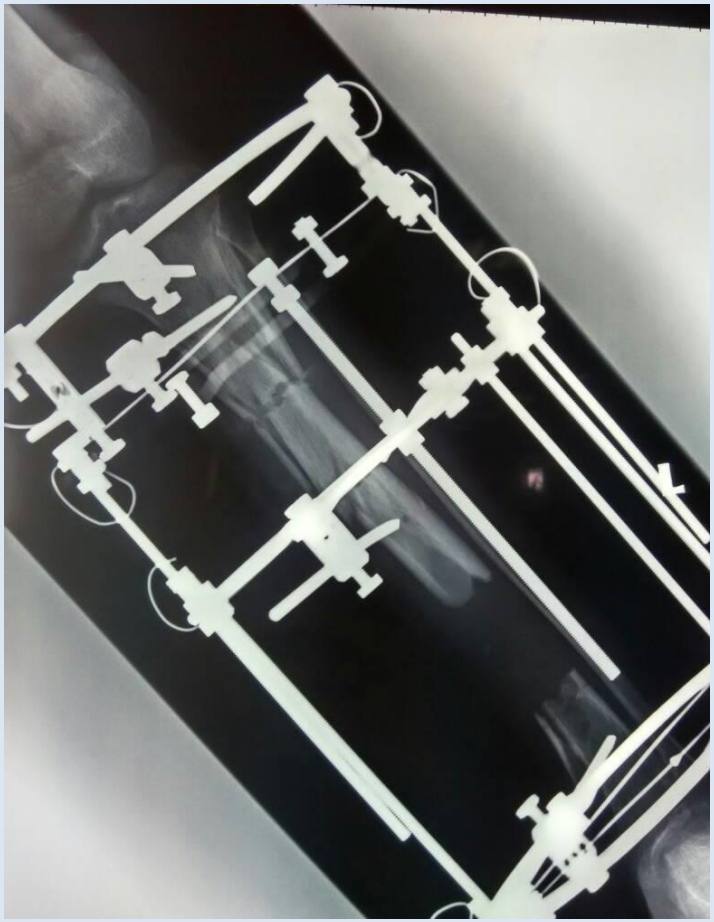
Fig. 5 Diagrammatic (coronal and axial) sequential representation of the direction of the multiple drill hole osteotomy technique. Redrawn from original illustration in Principles of Deformity Correction, Paley [3], Springer

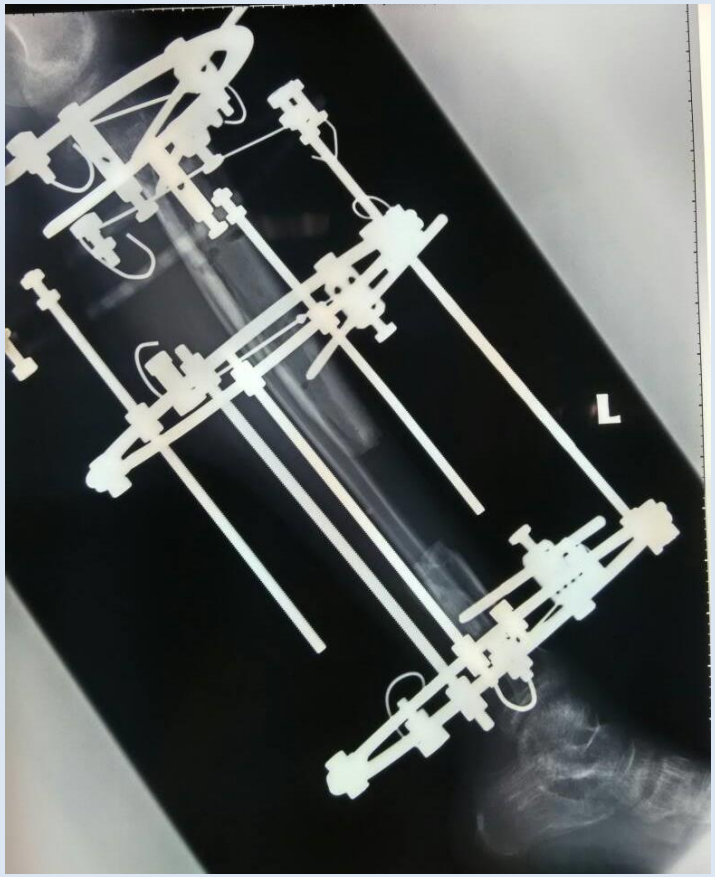
Dabis J et al. Strat Traum Limb Recon. 2017

Stability

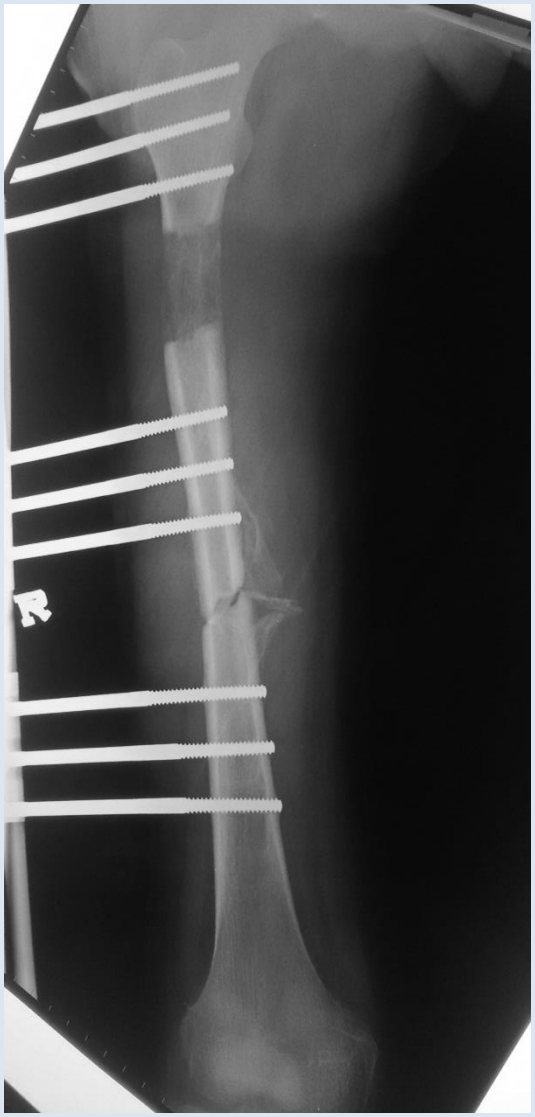
- Circular external fixation
- Monolateral external fixation
- Intramedullary device

Circular



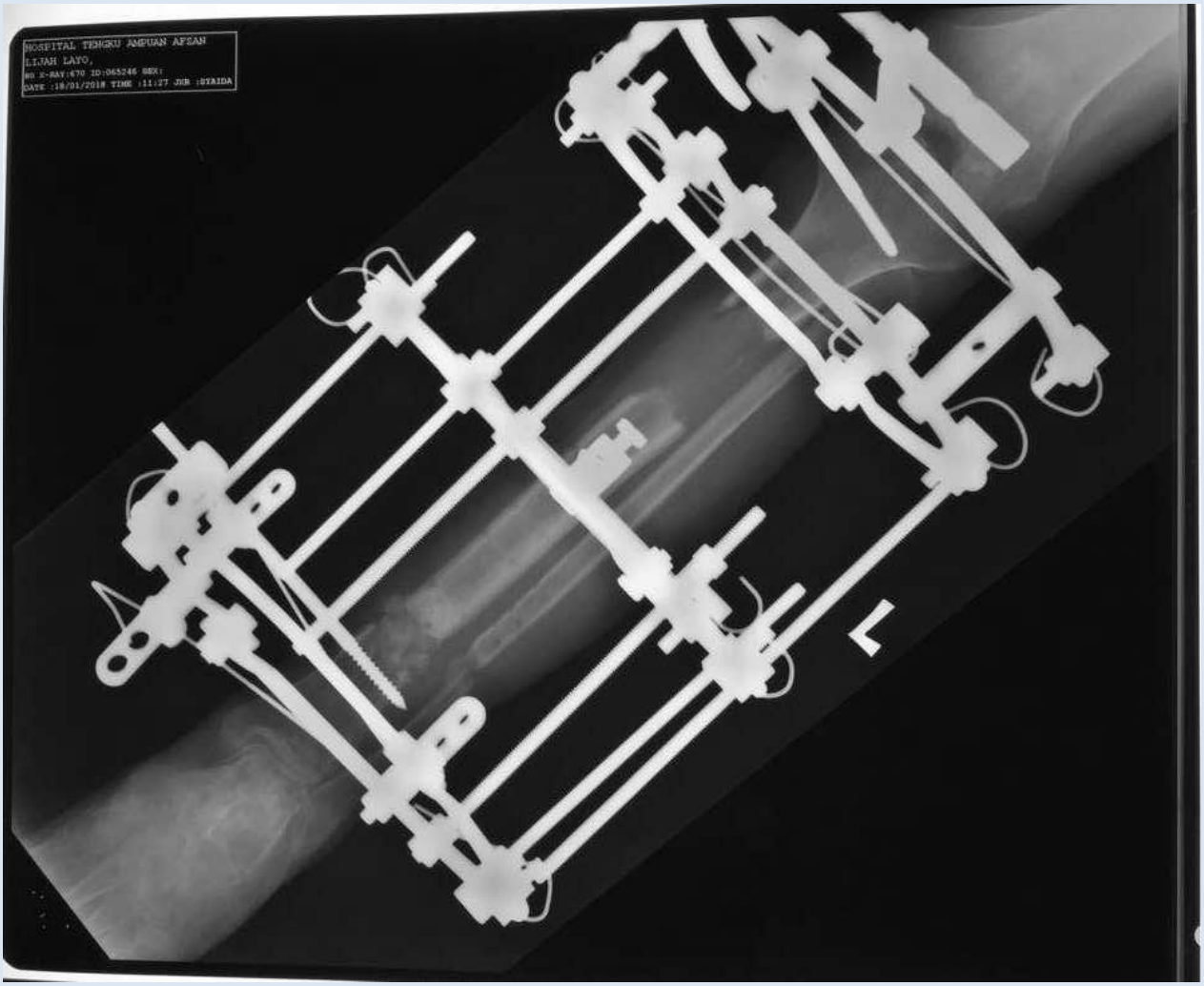


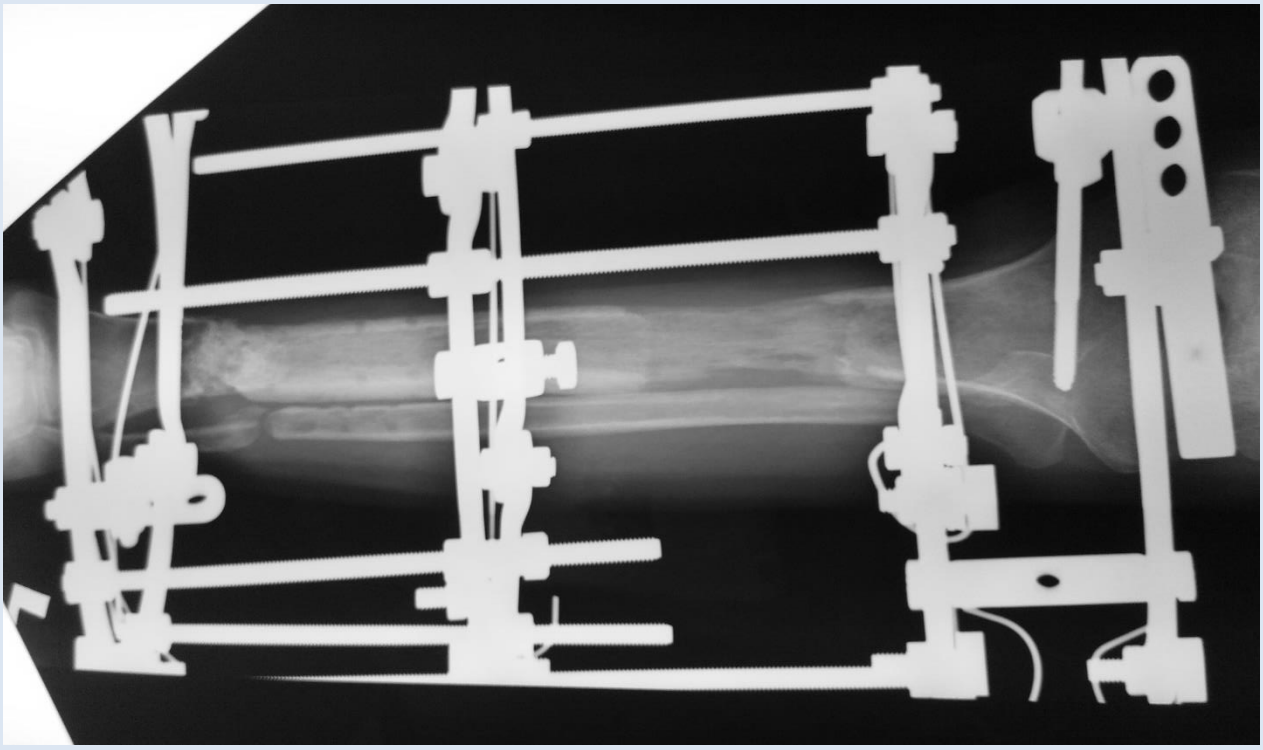
Monolateral



Rate and rhythm

- 1 mm/day (0.5-2 mm/day)
  - Depends on quality of regenerate
  - Follow up every 2 weeks
- Quarter turn 4 times/ day


HOSPITAL TENGKU AMPUAN AFZAN
LIJAH LATO,
NO X-RAY:670 ID:065246 SEX:
DATE :18/01/2018 TIME :11:27 JOB :STAIDA

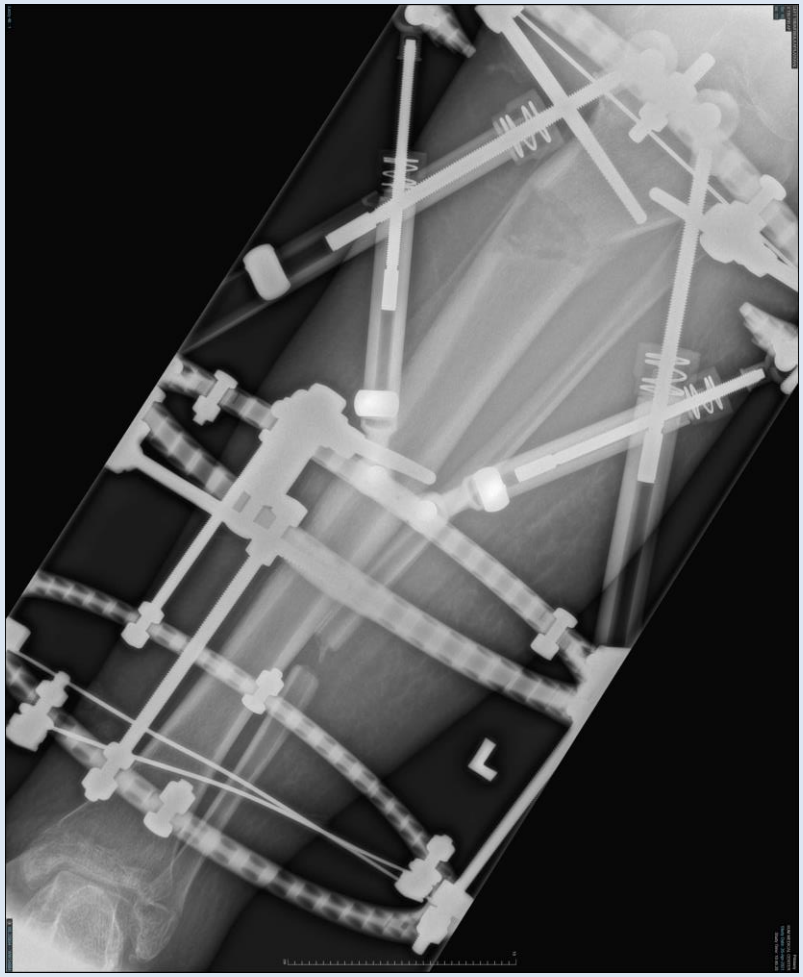


- Do’s
  - Pin site care
  - Move joint
  - Strengthen muscle
  - Pain control
- Don’t
  - Smoking
  - NSAID

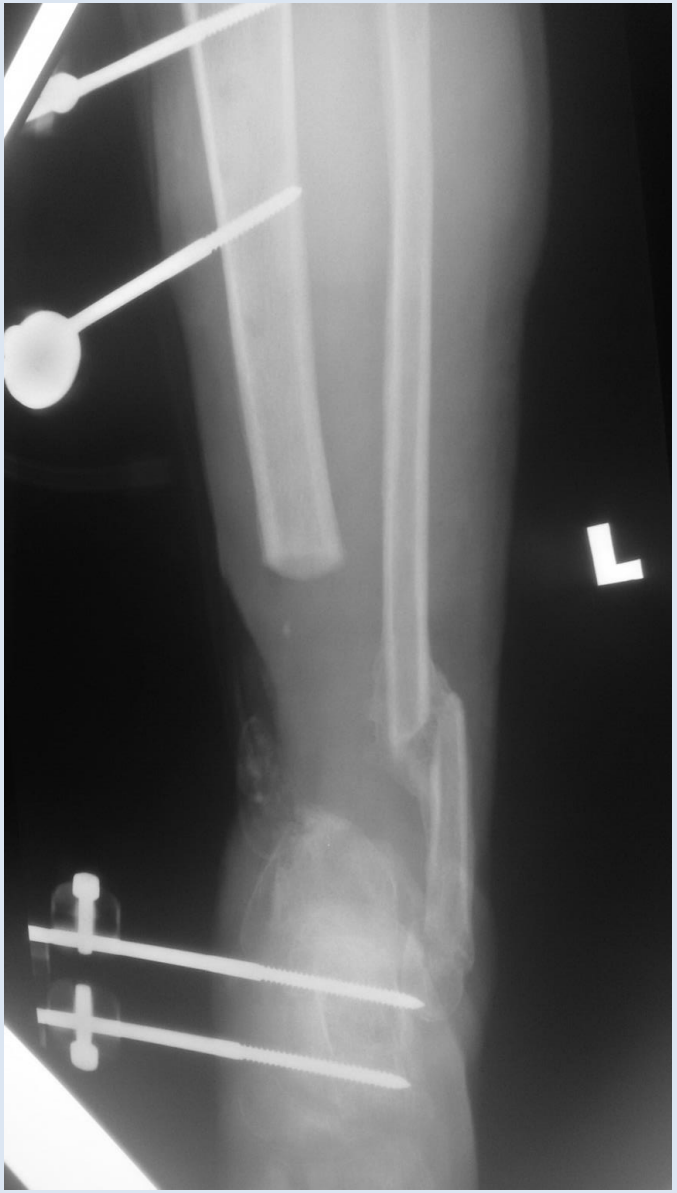
Lengthening

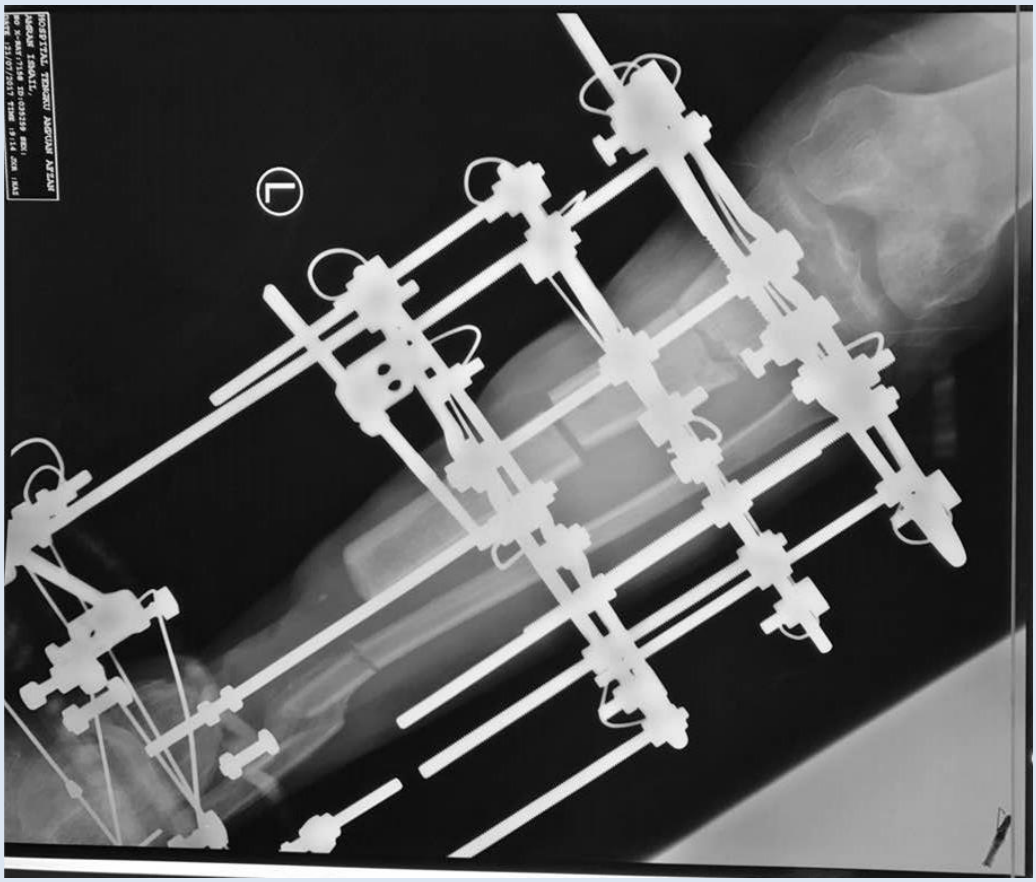
Deformity correction

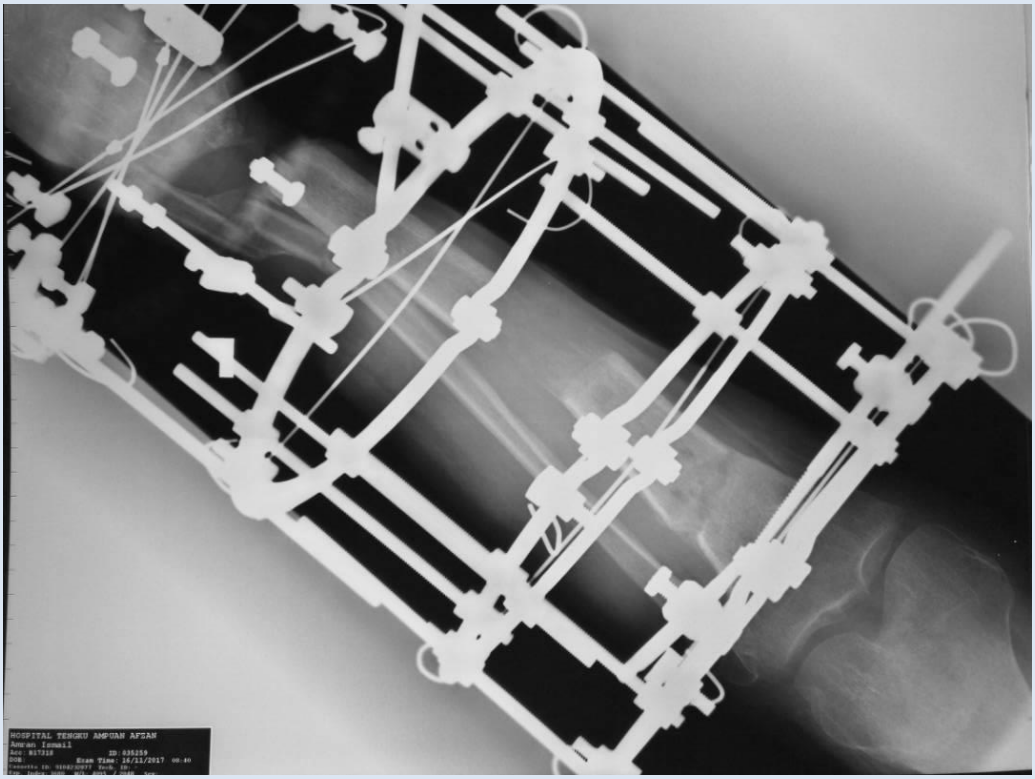
Development



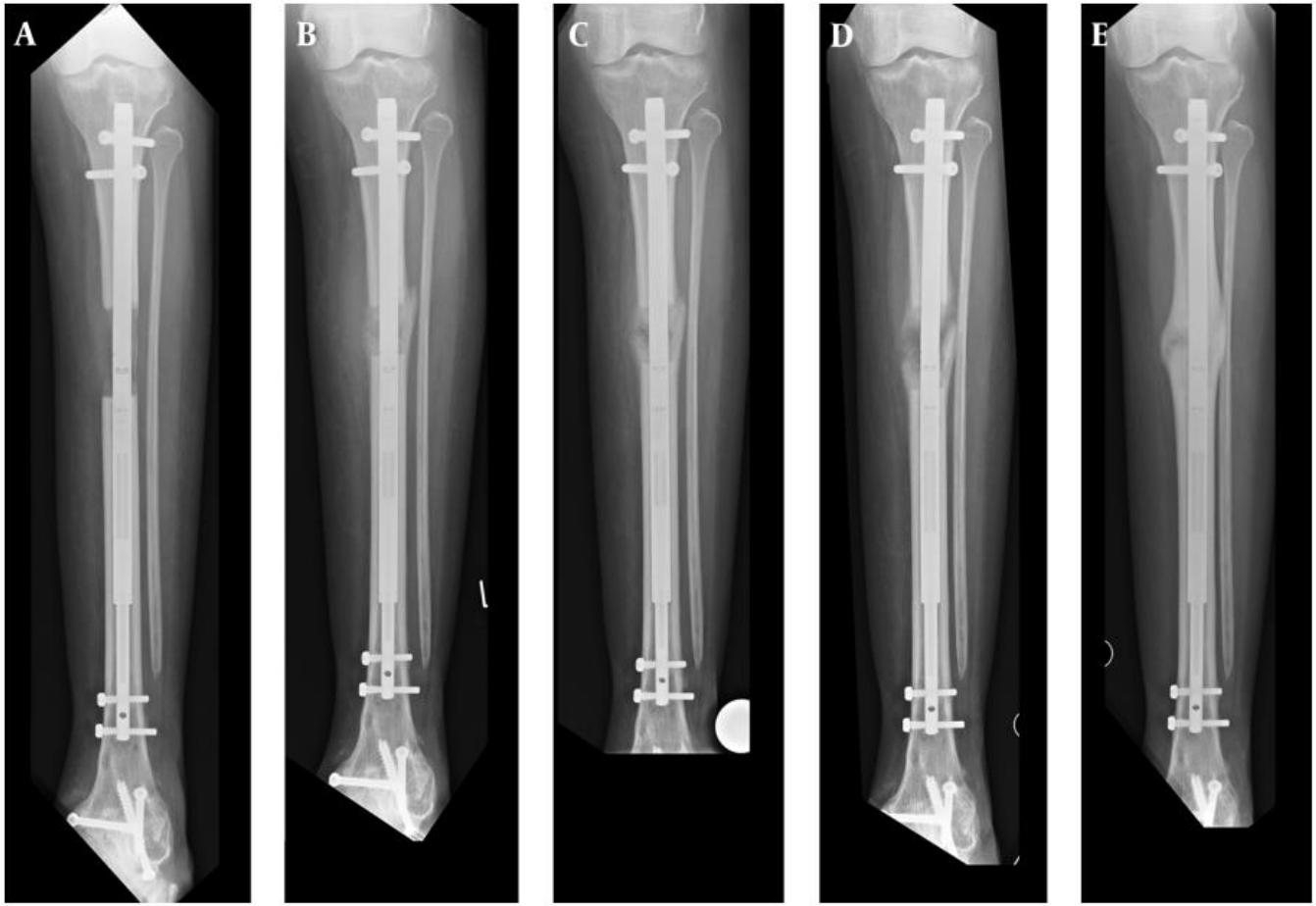
Bone transport


L


HOSPITAL TENGKU AMPUAN AFZAN
AMPUAN ISMAIL,
MR R-MRT/1588 ID:035259 MSC
DATE 25/07/2017 TIME 10:14 .608 .1842


HOSPITAL TENGKU AMPUAN AFZAN
Ampuan Ismail
Acc: 817318
ID: 035259
DOB:
Exam Time: 16/11/2017 08:40


L



Arch Trauma Res. inpress(inpress):e36273. doi: 10.5812/atr.36273.

Published online 2016 August 23. **Research Article**

Limb Lengthening Using the PRECICE™ Nail System: Complications and Results

Ulrich Wiebking,[1,*] Emmanouil Liodakis,[1] Mohamed Kenawey,[2] and Christian Krettek[1]

Take home message

- **S**table fixation
- **O**steotomy minimise damage
- **R**ate and rhythm
- **Re**hab – load, move, strength

SORRe

Reference

- Aronson J. Current concept review. Limb lengthening, skeletal reconstruction and bone transport with the Ilizarov method. J Bone J Surg. 1997;79A: 1243-58
- Al-Aql ZS et al. Molecular mechanism controlling bone formation during fracture healing and distraction odteogenesis. J Dental Res. 2008;87:107-118
- Dabis J et al. The history, evolution and basic science of osteotomy techniques. Strat Traum Limb Recon. 2017