

Principles Of External Fixators



By
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Indications

- External fixation has a vital role in both provisional and definitive fracture fixation.
- In provisional stabilization, the surgeon must consider the impact of the fixator on the patient's care (wound and hygiene) and definitive management.

1- Fractures With Soft-tissue Damage

- Closed ,open fractures and after fasciotomy



Closed fracture with severe soft-tissue injury, joint-bridgiri external fixator

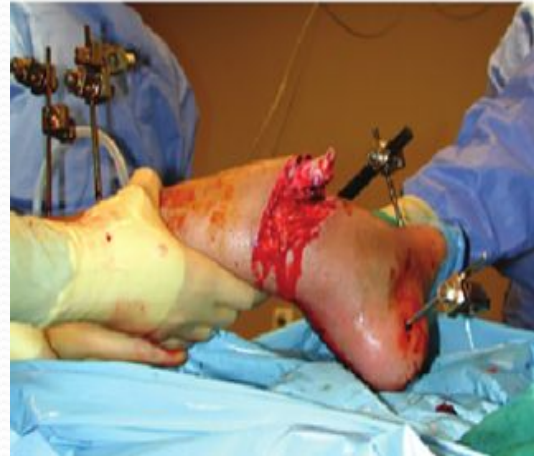


Open fracture



Skin wrinkling after 7 days

AC



Open fracture, redislocation at second look operation

AO

2- Polytrauma—Damage Control Surgery

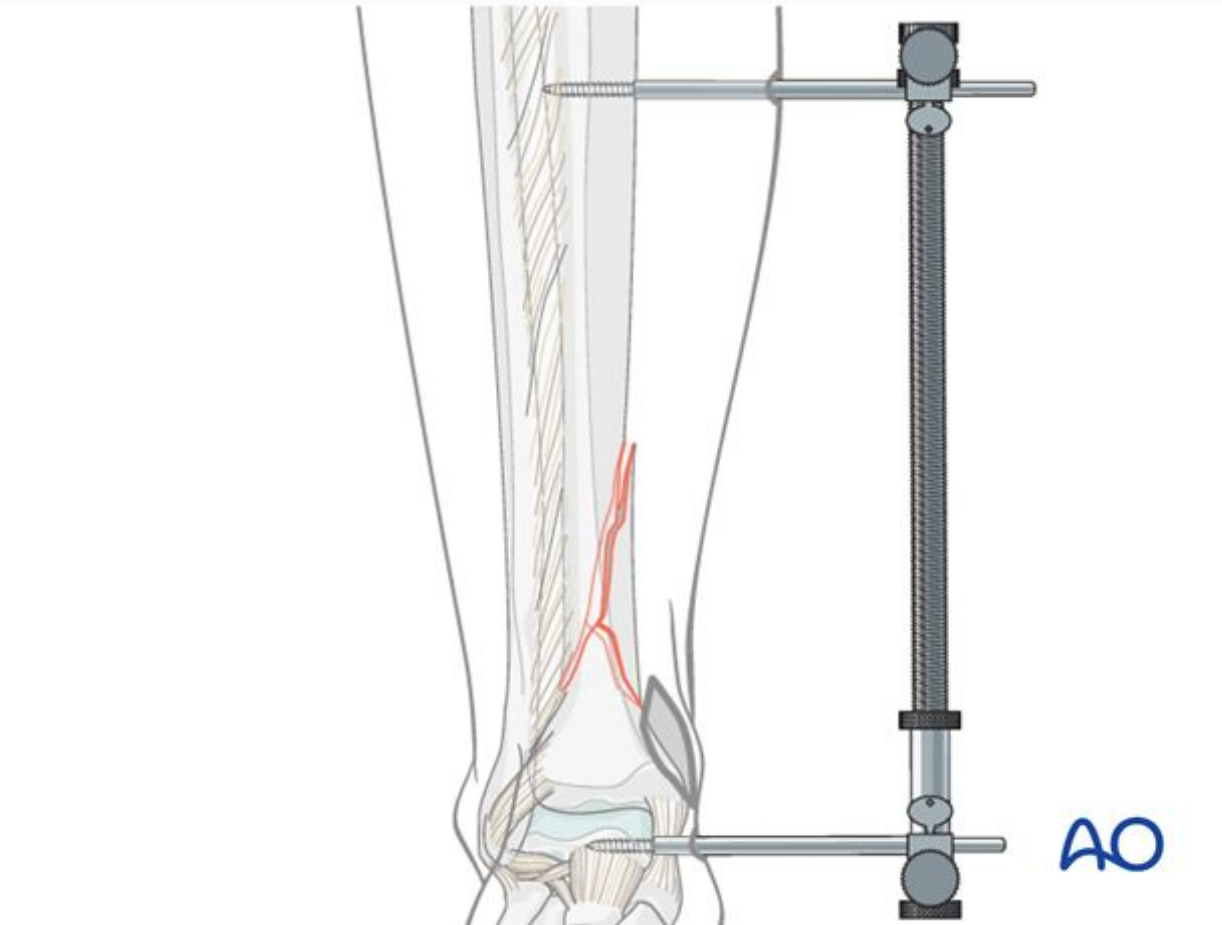
- Provisional application of external fixator as fast as possible to stabilise the patient and save life and limb.

3- Skeletal Infection

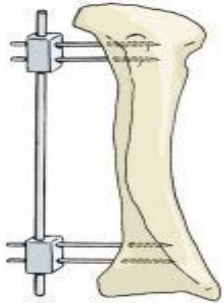
4- Corrective Surgery And Bone Transport

5- Arthrodiastasis and Joint Fusion

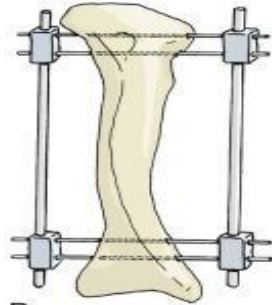
6- Indirect Reduction By Ex fix or Distractor



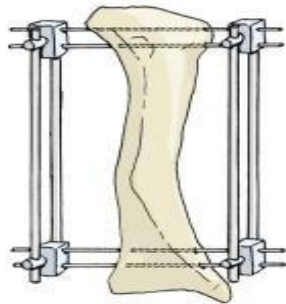
Frame Configuration



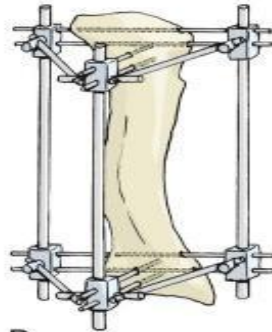
A



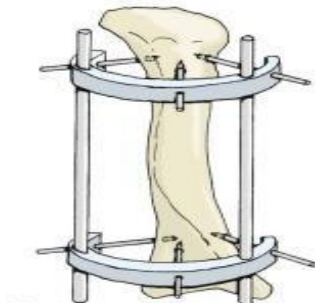
B



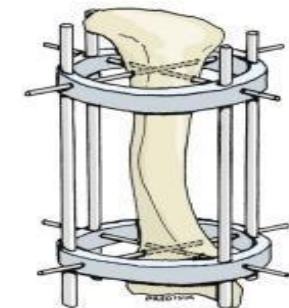
C



D



E



F

A- Unilateral.

B- Bilateral.

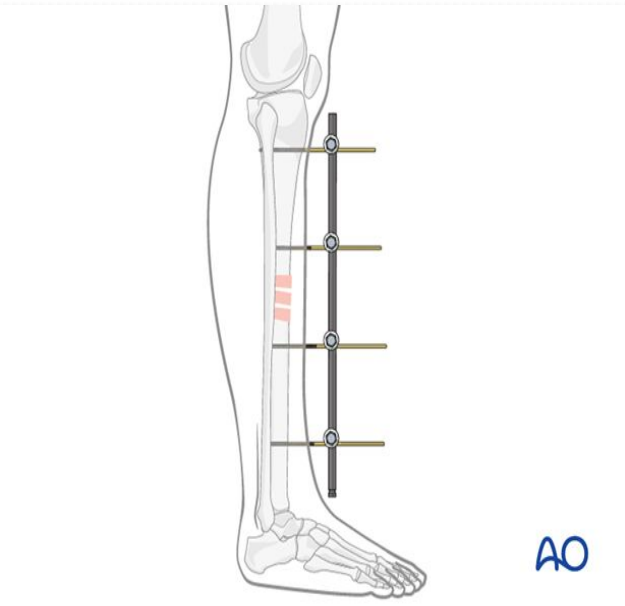
C- Multiplanar (quadrilateral)

D- Multiplanar (delta configuration).

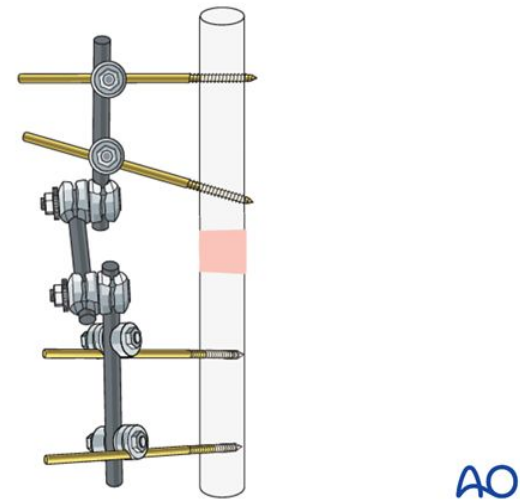
E,F- Ring fixator

Types

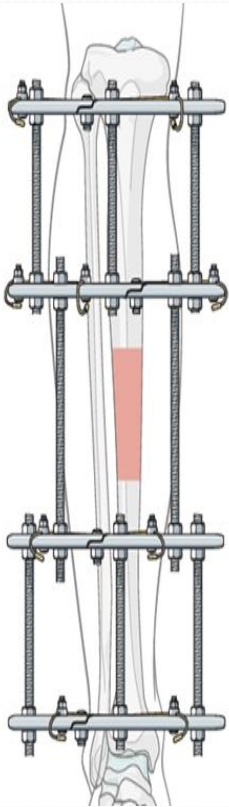
1- Single Tube



2- Modular

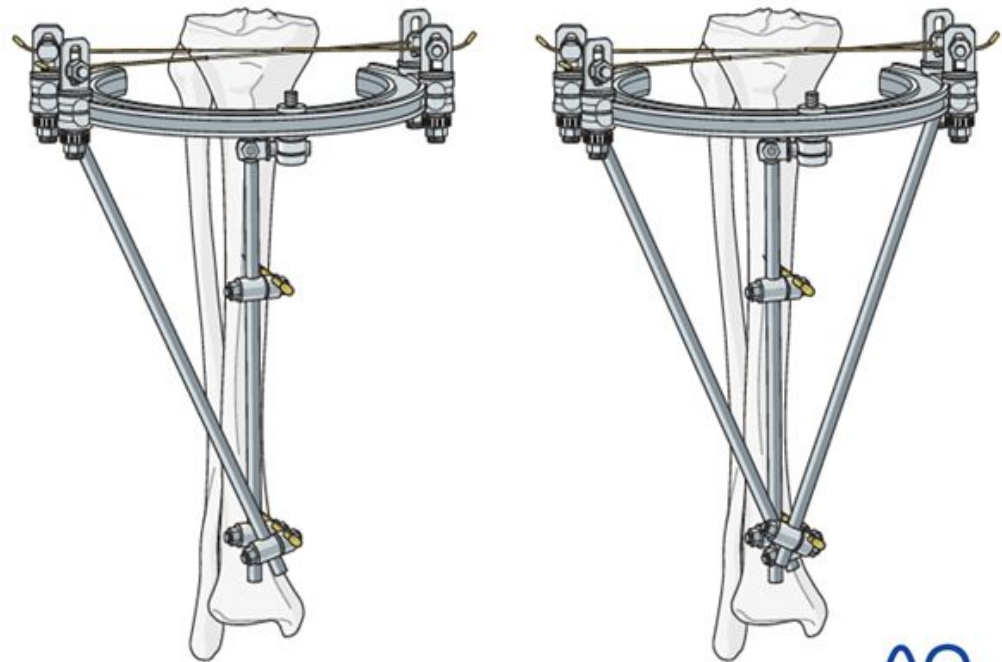


3- Ring



AO

4- Hybrid



AO

5- Monolateral Dynamic

Lrs and ball joint spanning orthofix



Basic Implants

1- Schanz Screws

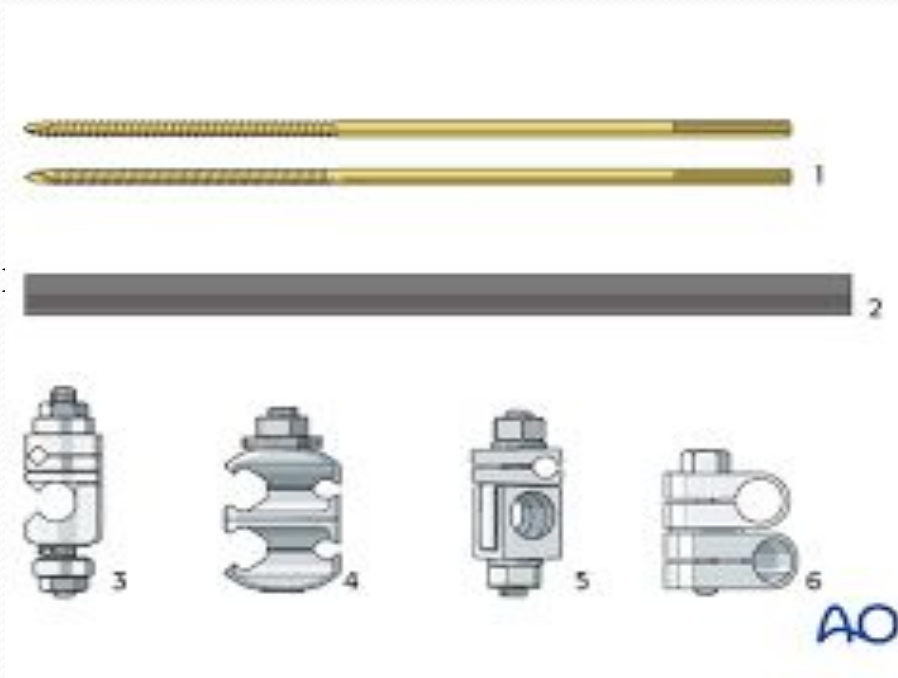
- Size never use more than one third of bone diameter
- Pin bending strength is increased to the fourth power of the increase in the pin's radius
- 5-6 mm for femur and tibia
- 4-5 mm for humerus
- 4 mm for forearm
- 2-3 in hand and foot
- Avoid thermal necrosis

Preloading ,irrigation and t handle insert:

- Avoid skin damage
- Use asleeve
- Know the safe zones well.

2- Clamps

3- Rods



Safe Zones

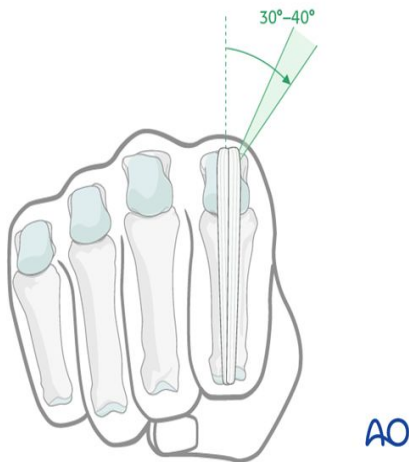
Humerus

- Pins (5 mm) are placed anterolaterally in the proximal humerus, taking care to avoid damage to the axillary and radial nerves, and posterolaterally (4 to 5 mm) in the distal humerus, avoiding the olecranon fossa .

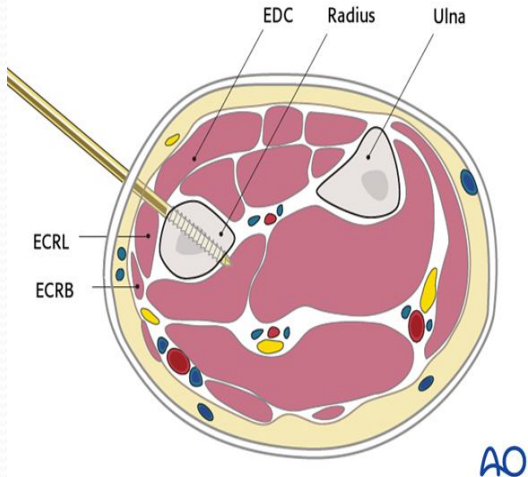
Femur

- Femoral shaft fractures are stabilized using pins (5 mm) placed anterolaterally or directly lateral .

Wrist

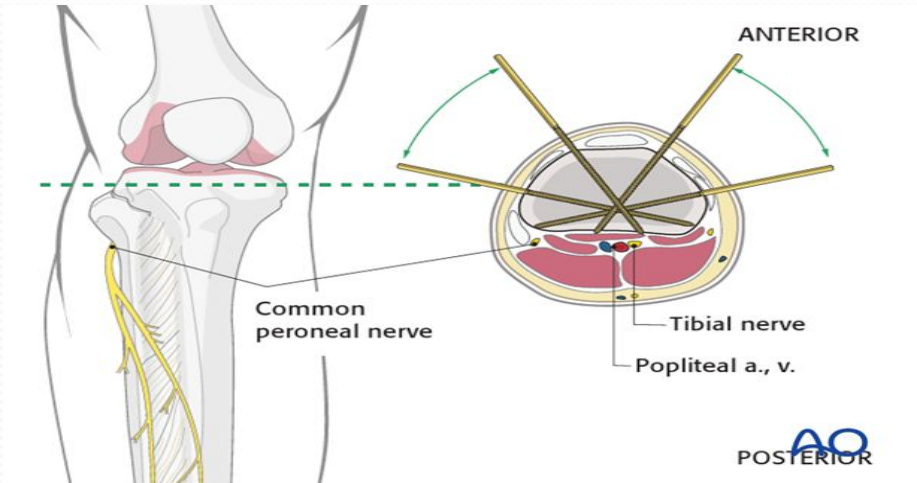


- 30°-40° in relation to the sagittal plane to avoid transfixing the extensor tendon/hood

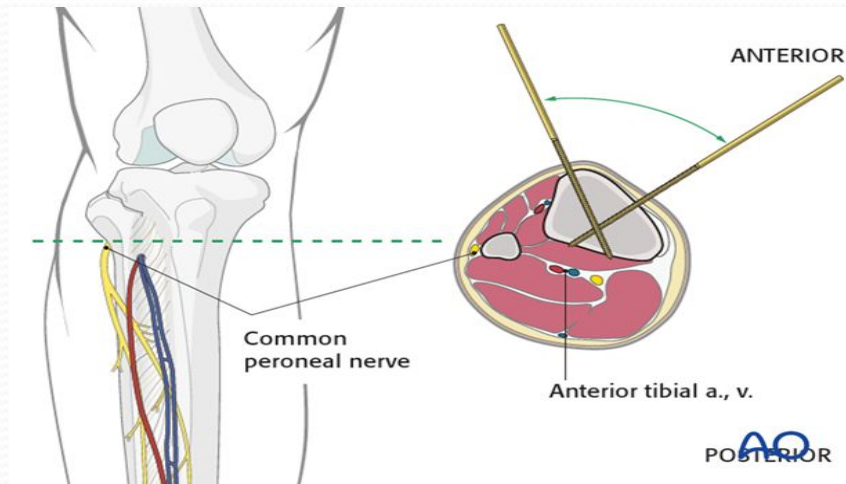


- The proximal two pins should be inserted proximal to the muscle bellies of abductor pollicis longus (APL) and extensor pollicis brevis (EPB), and should not penetrate them.

Tibia



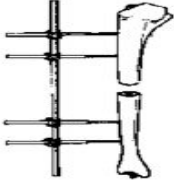

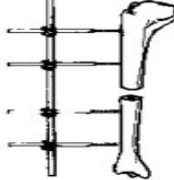
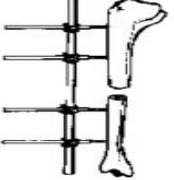
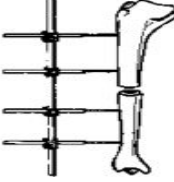
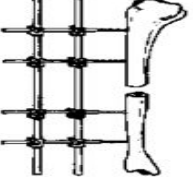
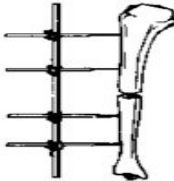
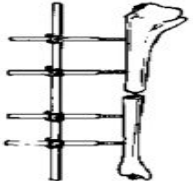
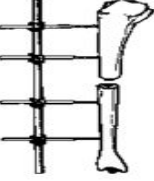
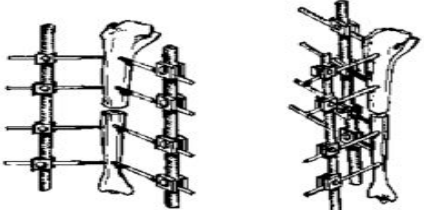
Proximal tibial head
2CM distal to tibial plateau
and avoid patellar tendon
. transfixion



***Distal of the tibial
tuberosity***
Tibial crest and the medial
face of the tibia

Factors Adding To Stability Of External Fixation

- 1- The stiffness of the frame increases with the thickness of a screw.
- 2- The thread design will define the holding strength in the bone.
- 3- It is better to insert a pin as close as possible to the fracture site.
- 4- Through larger distances between the pins in a fragment, the holding strength increases.
- 5- Also, a second rod will additionally increase the stiffness.

Method of Increasing Stability	Less Stable Construct	More Stable Construct
<p>Controlling both near and far ends of each bone segment</p>		
<p>Decreasing the distance between the rod and the bone</p>		
<p>Increasing the number of connecting rods</p>		
<p>Increasing the diameter of the pins</p>		
<p>Using multiplanar fixation</p>		

Postoperative care

The goal of post-operative care is to remove any debris, such as crusts or exudates

Pin-site infections

- virulent *Staphylococcus aureus* and *E.coli*

Table 2

Pin-tract Infection Classification and Treatment⁴⁰

Grade	Appearance	Treatment
1	Slight erythema, little discharge	Improved pin care
2	Erythema, discharge, and pain in soft tissue	Topical and/or oral antibiotics
3	Grade 2 but no improvement with antibiotics	Remove pin and change antibiotic regimen
4	Soft-tissue infection involving several pins	Remove any loose pins
5	Grade 4 and radiographic evidence of bone involvement	Remove entire fixator construct and curettage pin tract
6	Infection after fixator removal (clinical and radiographic)	Débridement, irrigation, and systemic antibiotics