Post Debridement Defects: How to Manage

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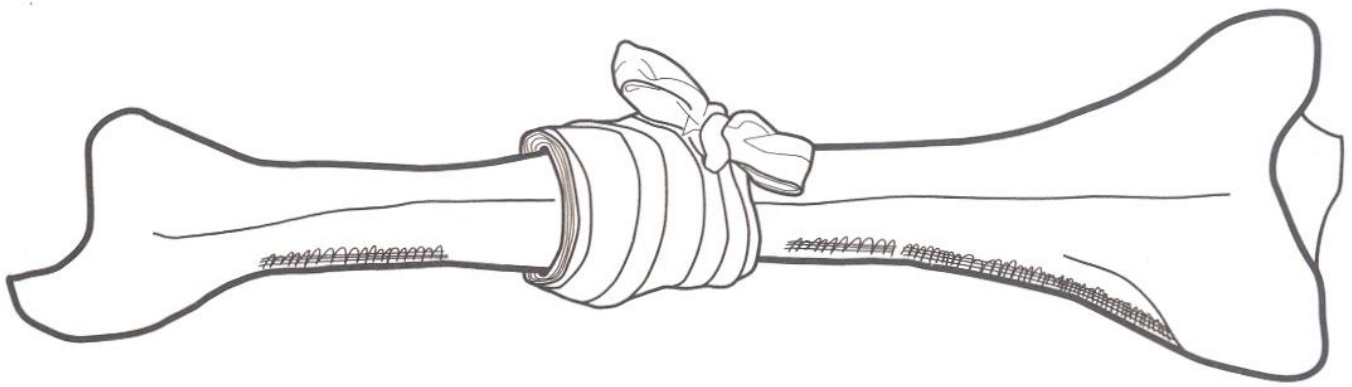
Mexican Institute Social Security

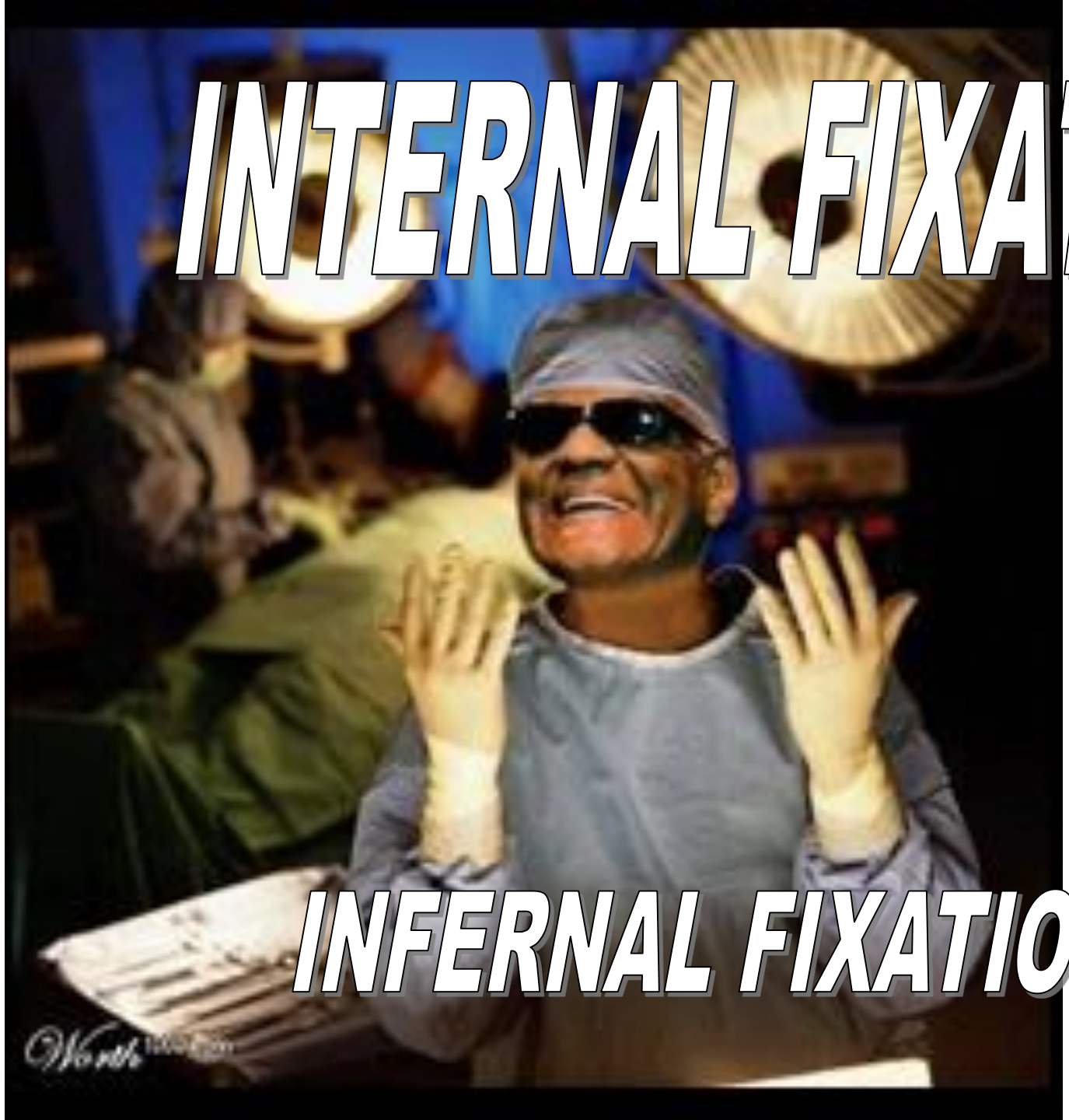
Disclosures

None

Learning objectives

- Overview of the clinical management of large bone defects
- Describe the strategies to manage these complex injuries
- Discuss the basic science for distraction osteogenesis




INTERNAL FIXATION
INFERNAL FIXATION

Infection

Internal Fixation

Devastating complication

Difficult to treat

AH Schmidt, M. F. Swiontkowski, MD: . J Am Acad Orthop Surg 2000;8:285-291

Normal bone
is highly resistant to infection

Very large inoculum,
Trauma,
Foreign body

The most common causes of adult Osteomyelitis

Trauma and surgical procedures

The bone and soft-tissue loss

May develop directly as a consequence of trauma or as a result of the initial or subsequent treatment

Surgical debridement

A wide resection in order to assure the eradication of infection.

Remove dead or infected bone and soft-tissue

Goals of treatment

Erradication of Infection

Reconstruction

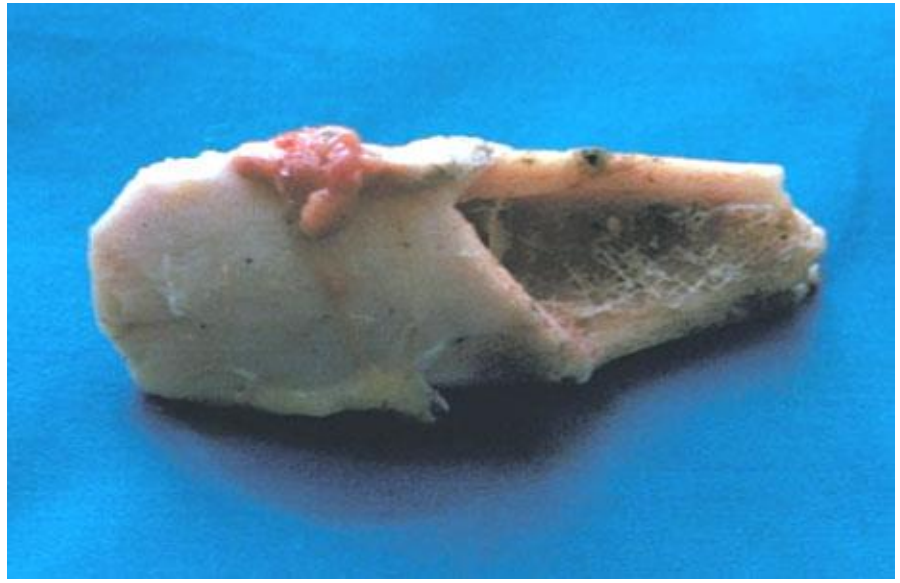
Treatment decisions to eradicated infections

Nonviable bone and Soft tissue may require debridement

The wound should be cleansed

Surgical Debridement

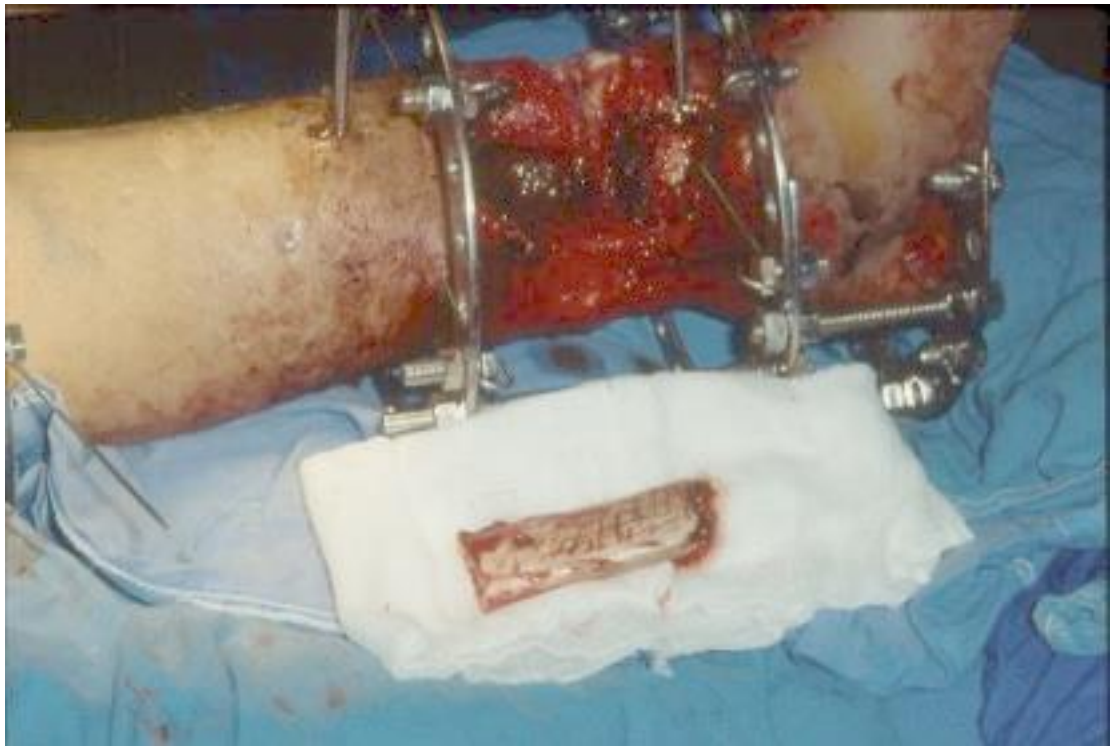
- Soft tissues, sinus tracts
- Loose, broken, or unstable hardware should be removed
- Aggressive removal of all devitalized bone



Recalcitrant Bone infection

The most critical factor

successful treatment



The quality of the surgical débridement

Watson J.T., Anders M.,Moed B. R:Management strategic for bone loss in tibial shaft fractures. *Clin. Orthop. Relat. Res.1995;315:138-152.*

Post Debridement management

resulting in bone defect

Post Debridement Defects: How to Manage

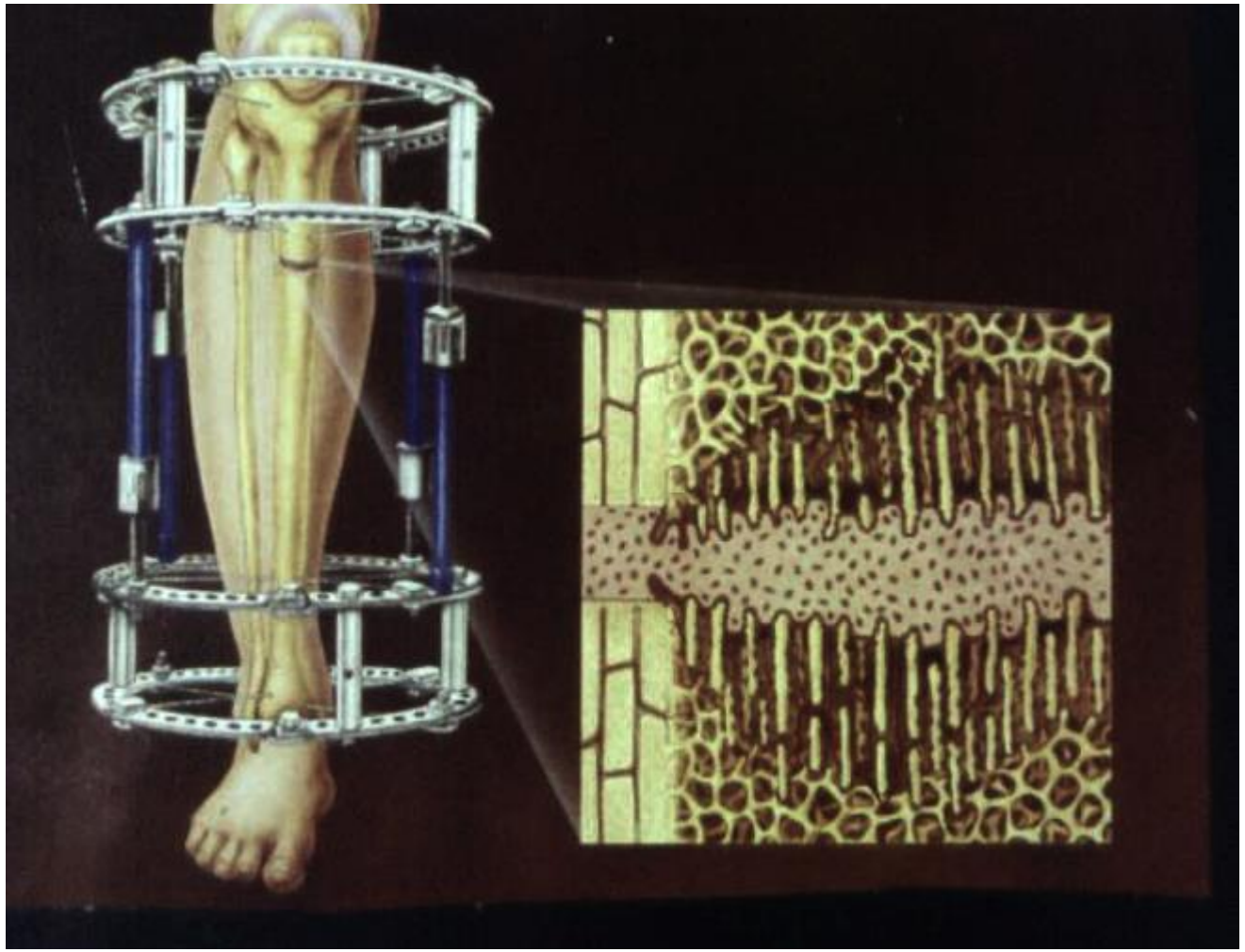
Different Strategies to fill Bone Defects

Distraction Osteogenesis

Restoration of large bone Defects

Without the need for
Bone grafts
or
complicated flaps

Avoiding morbidity of donor sites



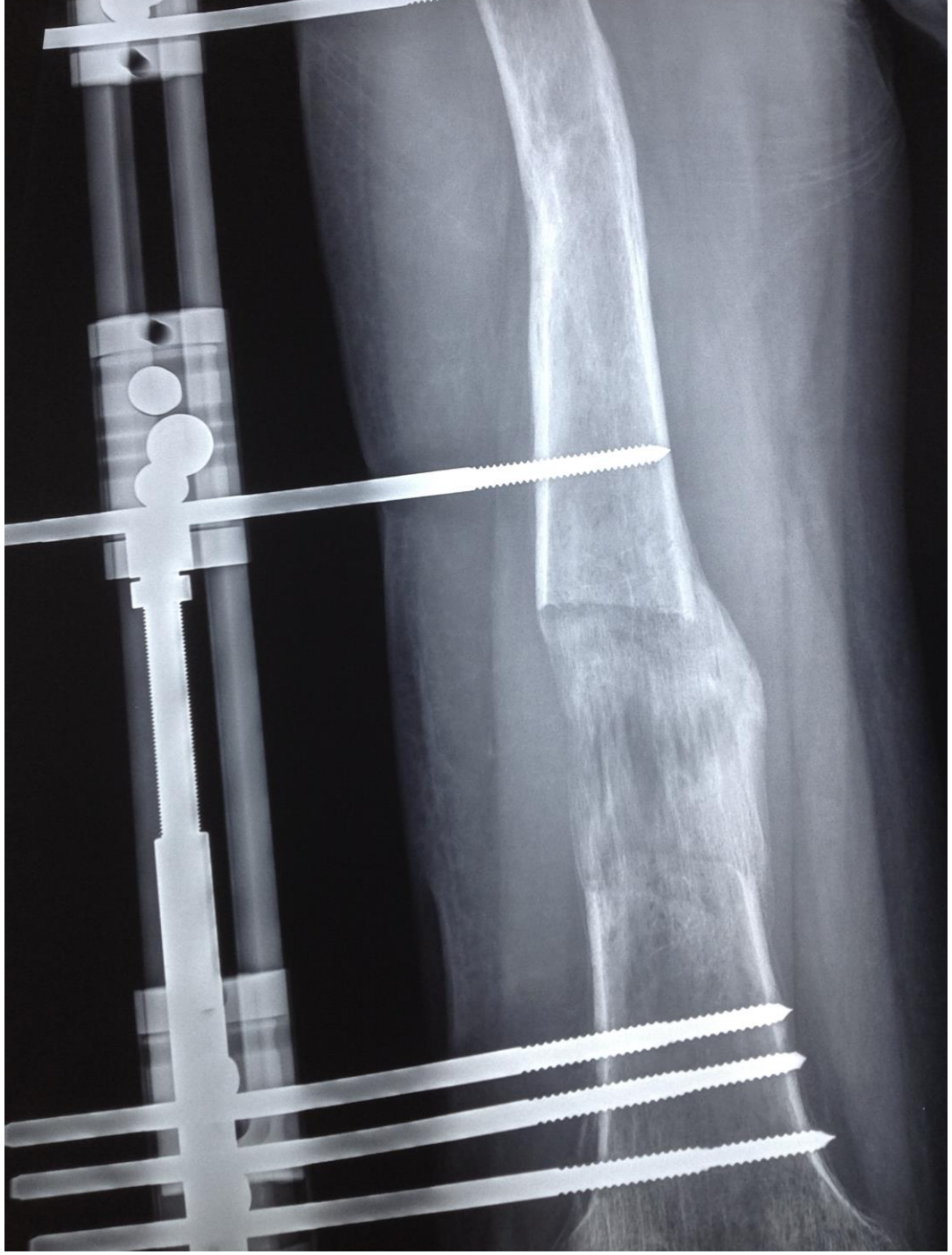
Ilizarov GA (1989a) The tension-stress effect on the genesis and growth of tissues. Part I. The influence of stability of fixation and soft-tissue preservation. Clin Orthop Relat Res 238:249–281

The ability to stimulate neo-osteogenesis

Encourage

Healing of bone fragments,

Restore length and thickness of osseous tissue



Surgical strategies

Resection Infected bone

Extensive operative debridement

Elimination of purulent cavities

Aronson J. Limb-lengthening, skeletal reconstruction, and bone transport with the Ilizarov method. J Bone Joint Surg Am. 1997;79:1243–1258.

Surgical strategies

Bone transport
    Monofocal
Transversal bone growth
Acute shortening
Gradual shortening

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Infected Bone
and soft-tissue
Resection

Bone Transport
Monofocal

Bone transport

An osteotomy is created

The intervening segment of bone
is transported distally

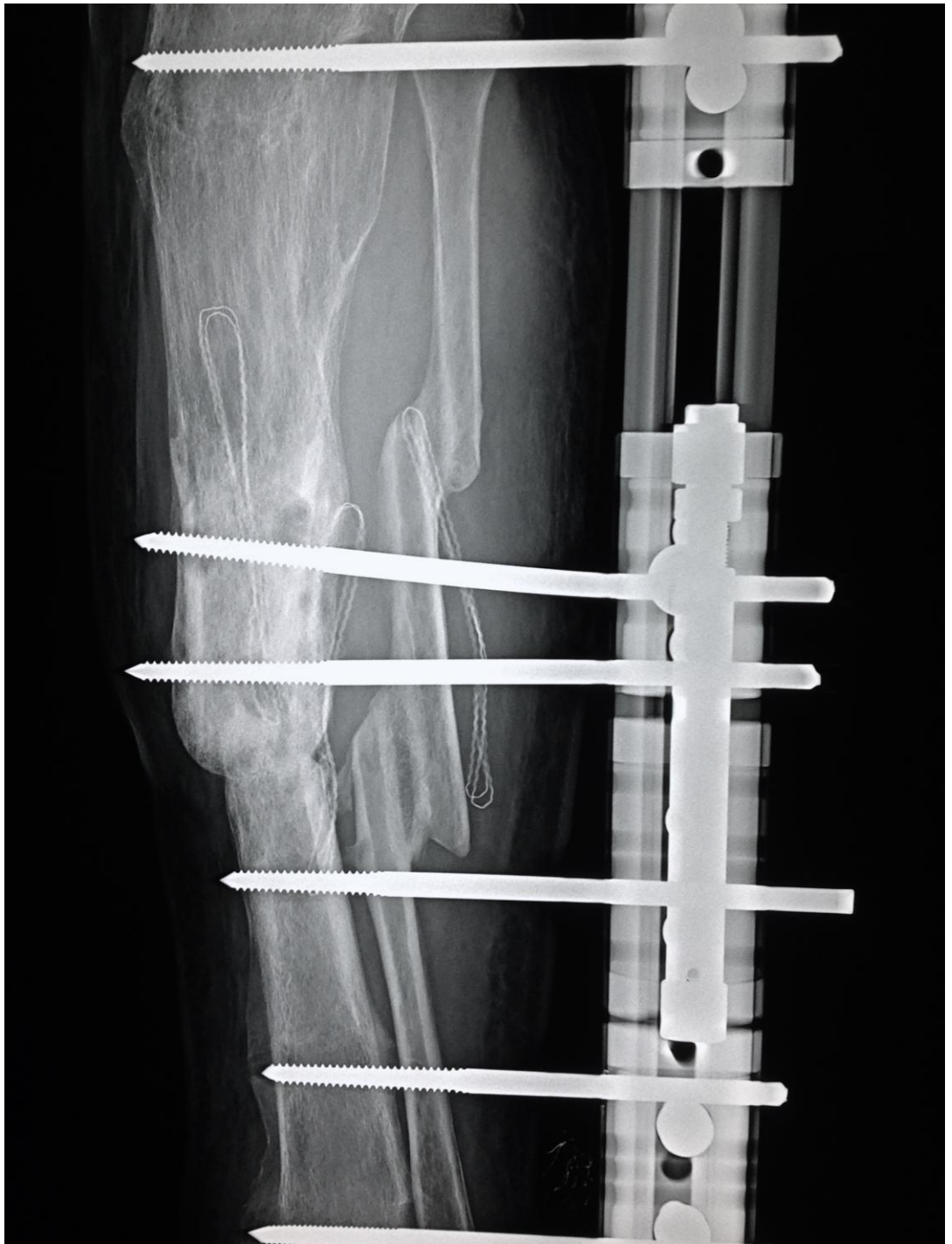
The local blood flow
can be increased
By distraction and compression

Bone defects can be treated with various techniques

Distraction osteogenesis can be an effective treatment for bone reconstruction

Bone transport

It can promote new bone growth in areas when infection has damaged

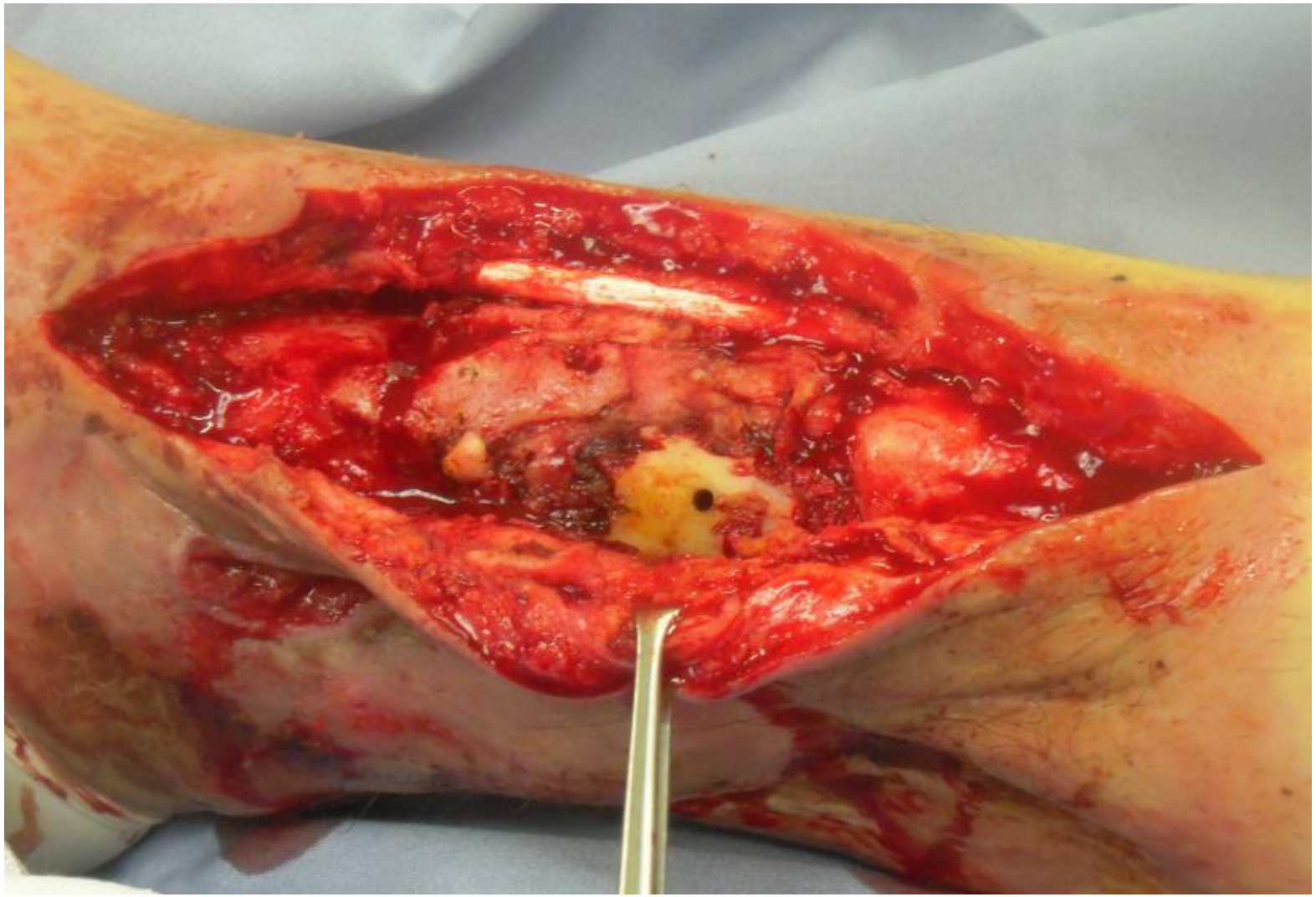


Recalcitrant Osteomyelitis

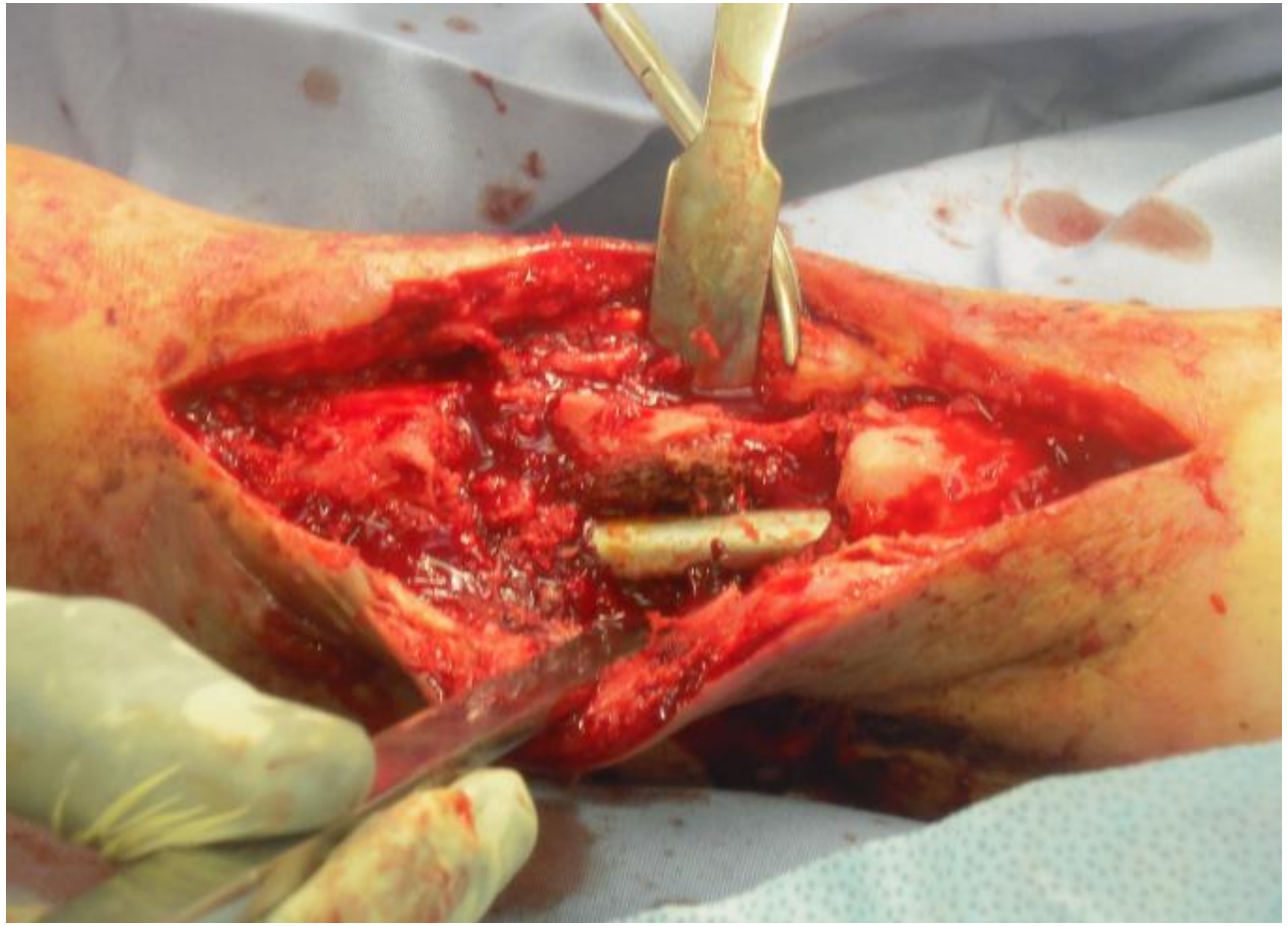
male patient
26 years-old
treated with IM nail
bone infection

2 Years, Osteomyelitis

Débridement must include the complete removal of all necrotic bone,



Débridement must include the complete removal of all necrotic bone, foreign material, and tissue with compromised viability.



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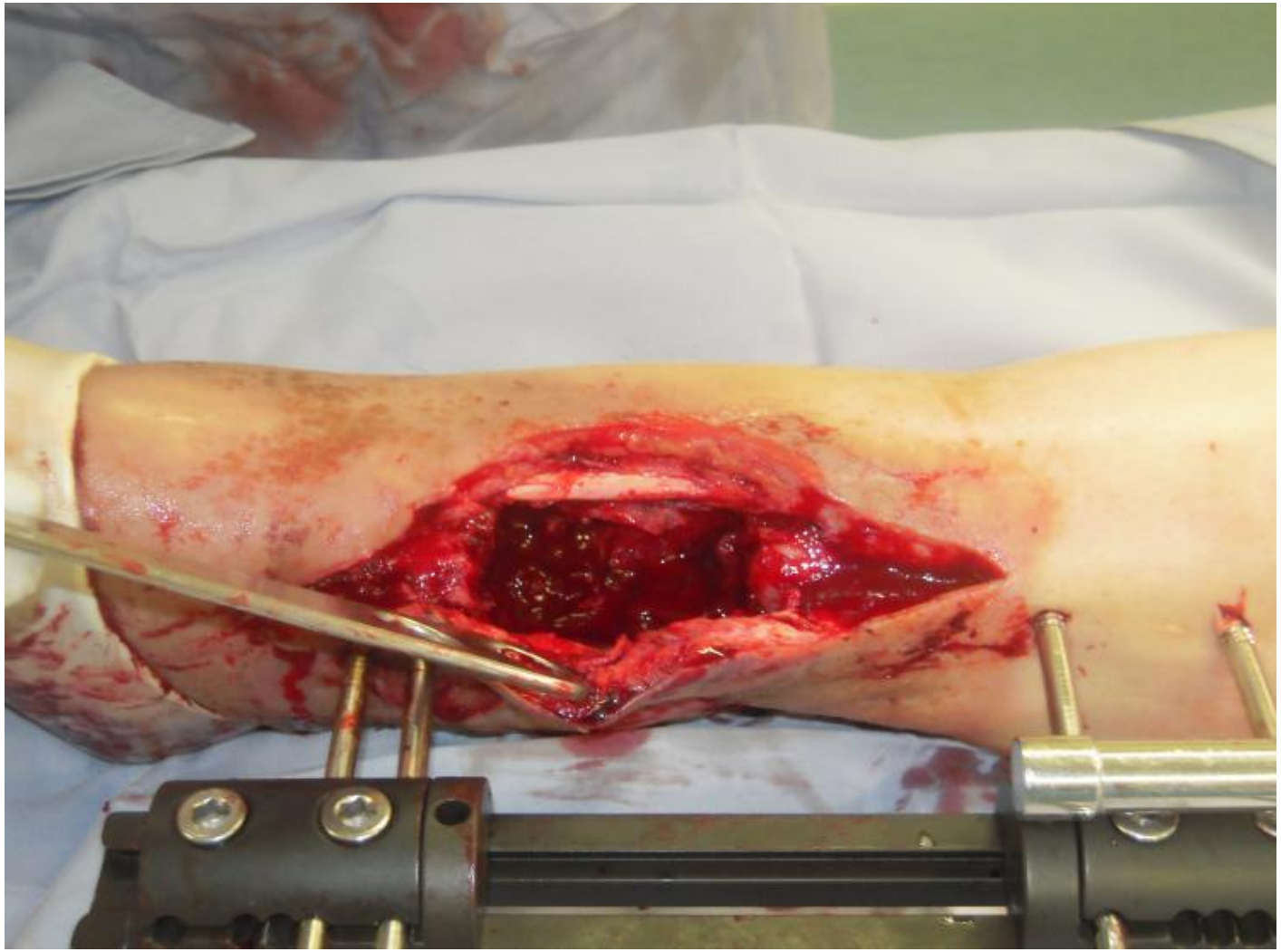
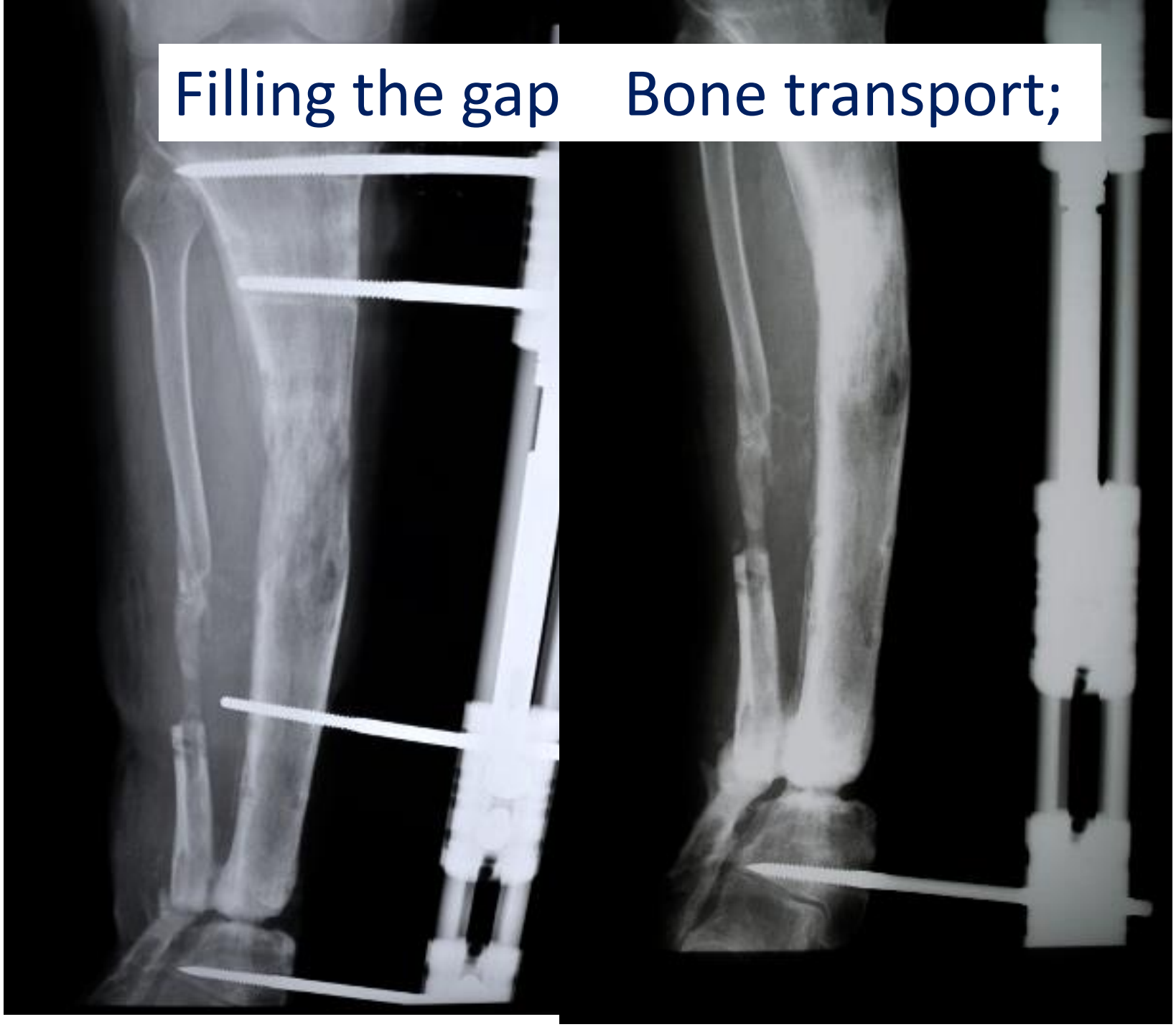


External fixation for gradual, controlled mechanical distraction has been effective for both skeletal and soft-tissue reconstruction.

Filling the gap Bone transport;



Pre-op

Post-op

Reconstruction with bone transport

32 yrs, old
male pat.
Tibial exposed fracture
infected non-union


Stabilization

Wide debridement Soft-tissue and bone

The purulent cavities were substituted by normal bone tissue

the purulent cavities were substituted by normal bone tissue

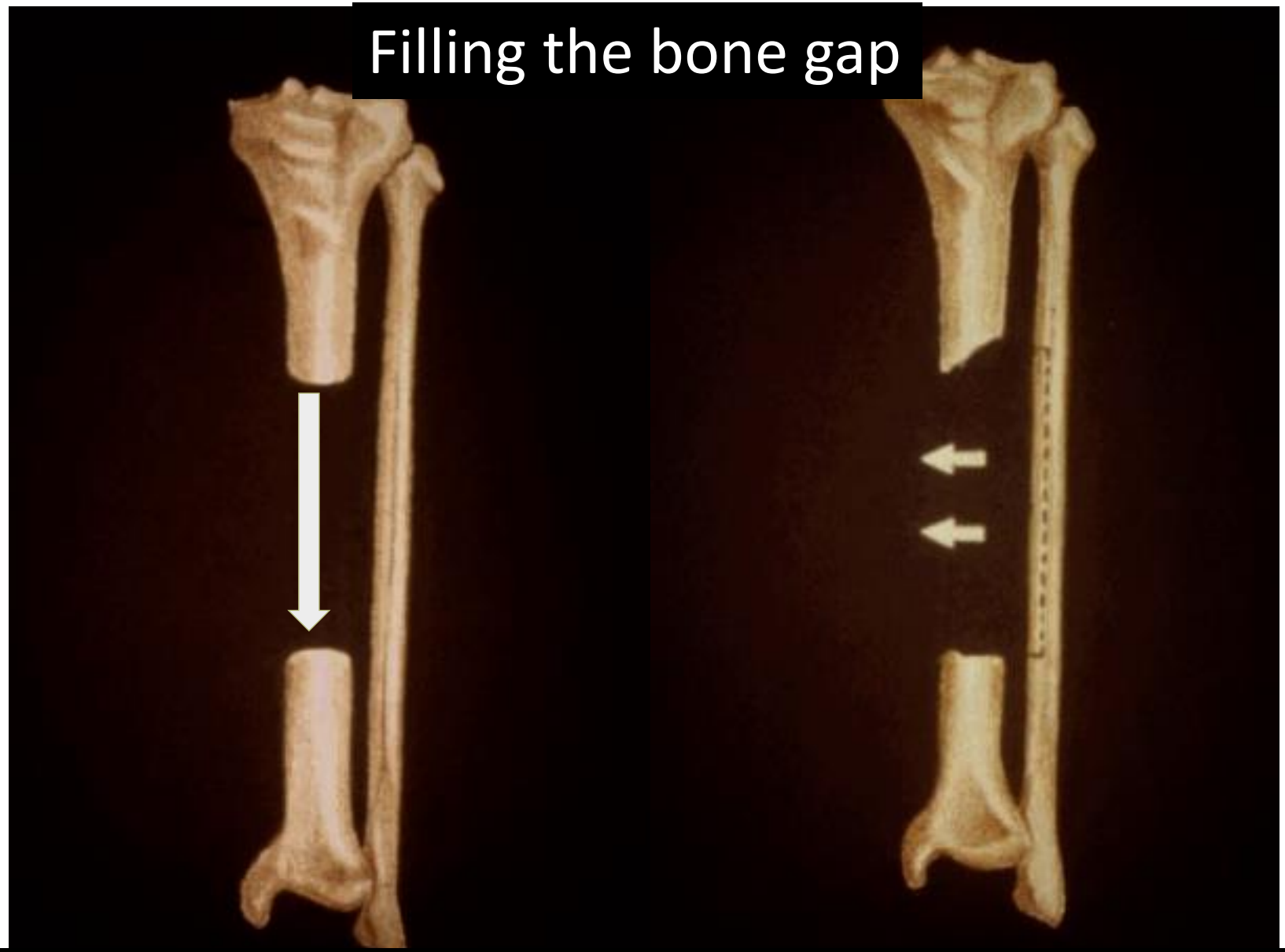
Surgical Strategy

Transversal
Bone transport

Filling the bone gap

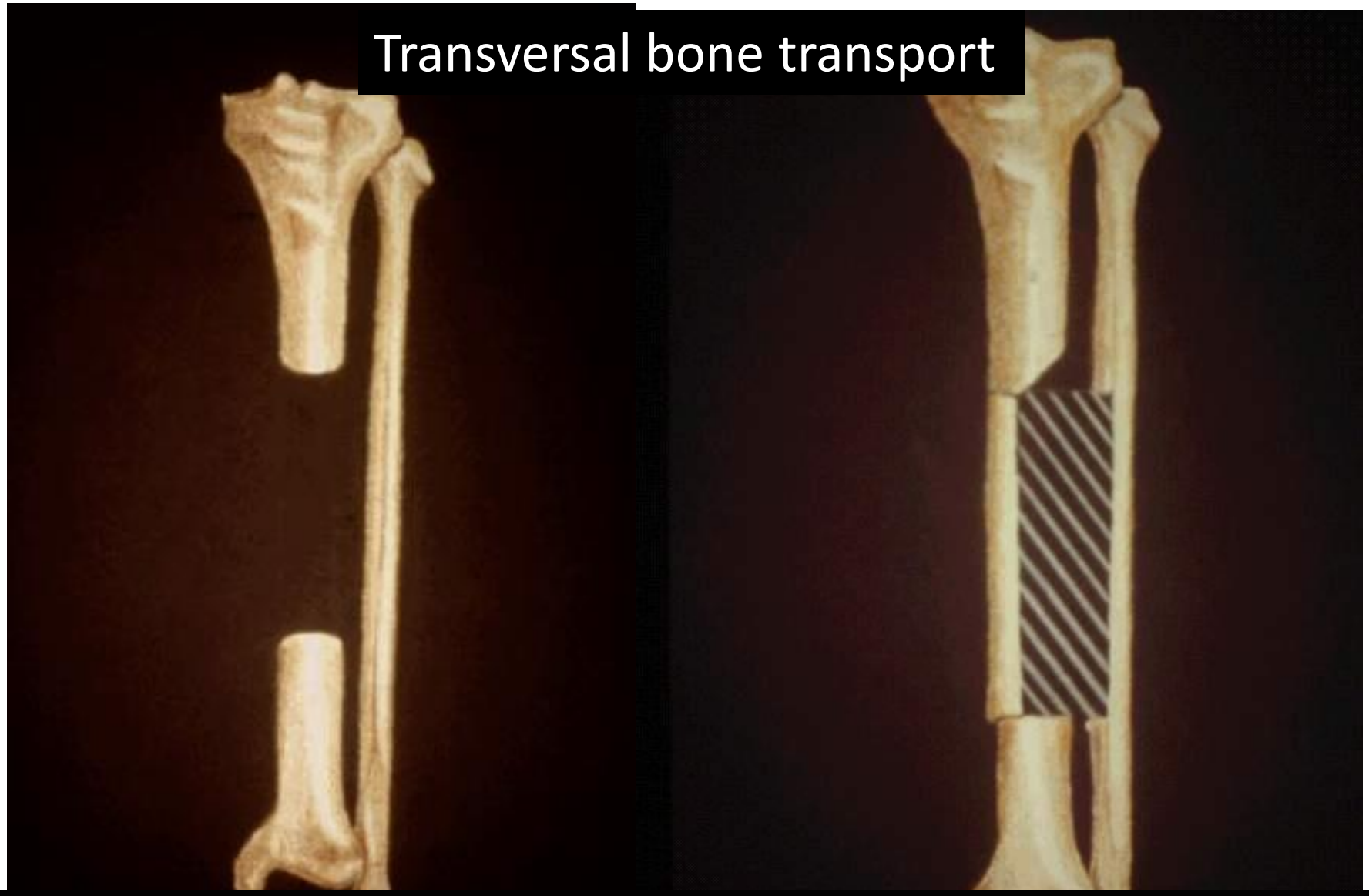
32 year-old-man
Motorcycle accident
Recalcitrant bone infection
Bone segment removal
10 cms bone gap

Filling the bone gap



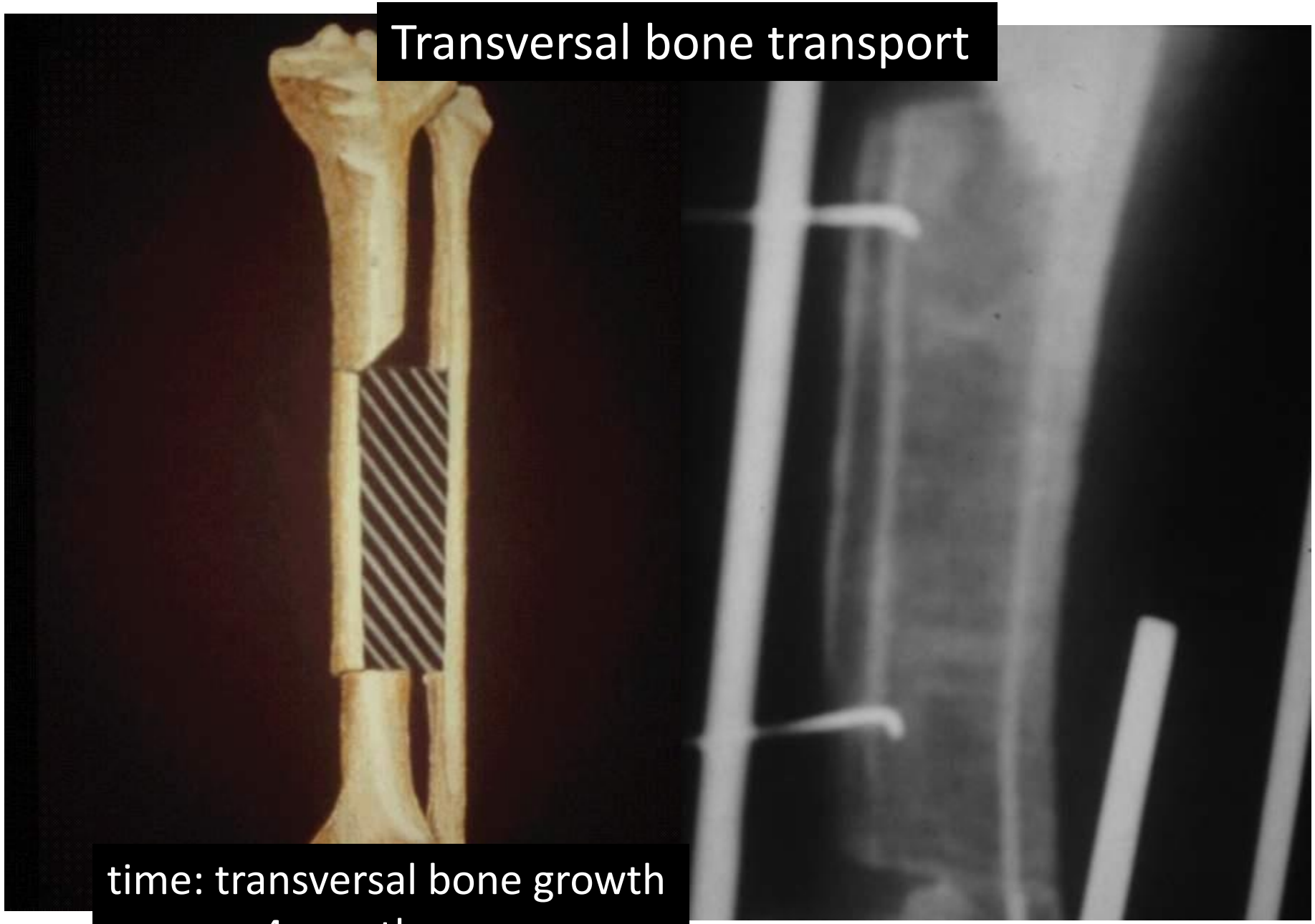
Fibula axial corticotomy and transversal bone transport

Transversal bone transport



The defect filling period is shortened by transversal bone fragment

Transversal bone transport

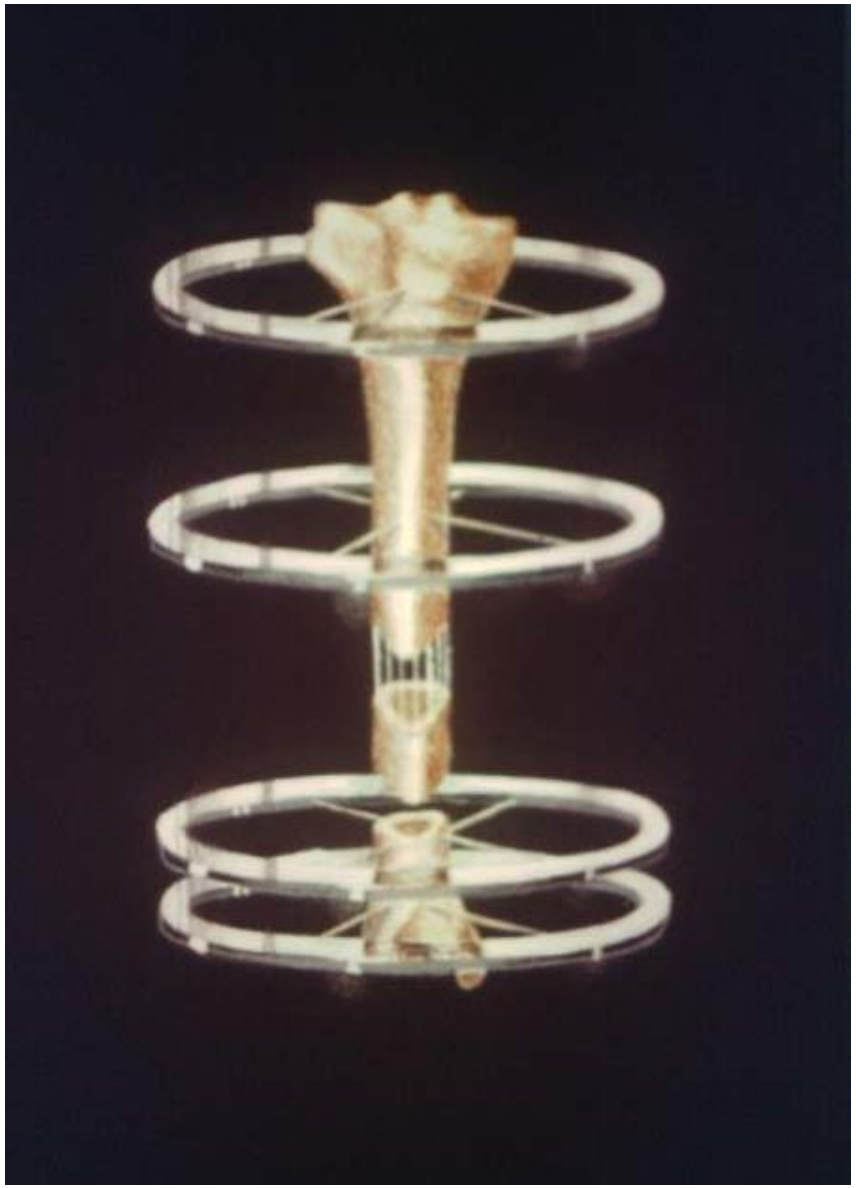


time: transversal bone growth
4 months

Strategies to succeed

Acute
Shortening of the limb

Ilizarov, G.A.: The Tension-Stress effect on the genesis and growth of tissues : Part I The influence of stability of fixation and soft-tissue Preservation . Clin. Orthop. 238:249, 1989



Filling bone defects

Acute shortening

Gradual distraction

Operative plan

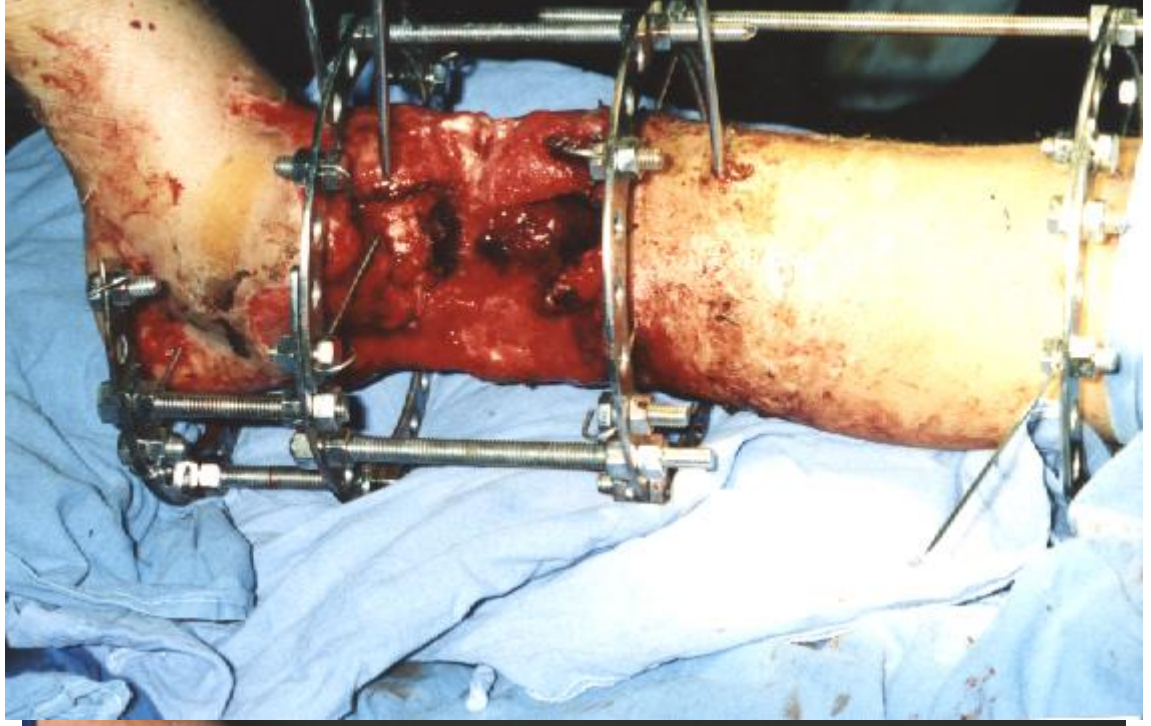
External fixation

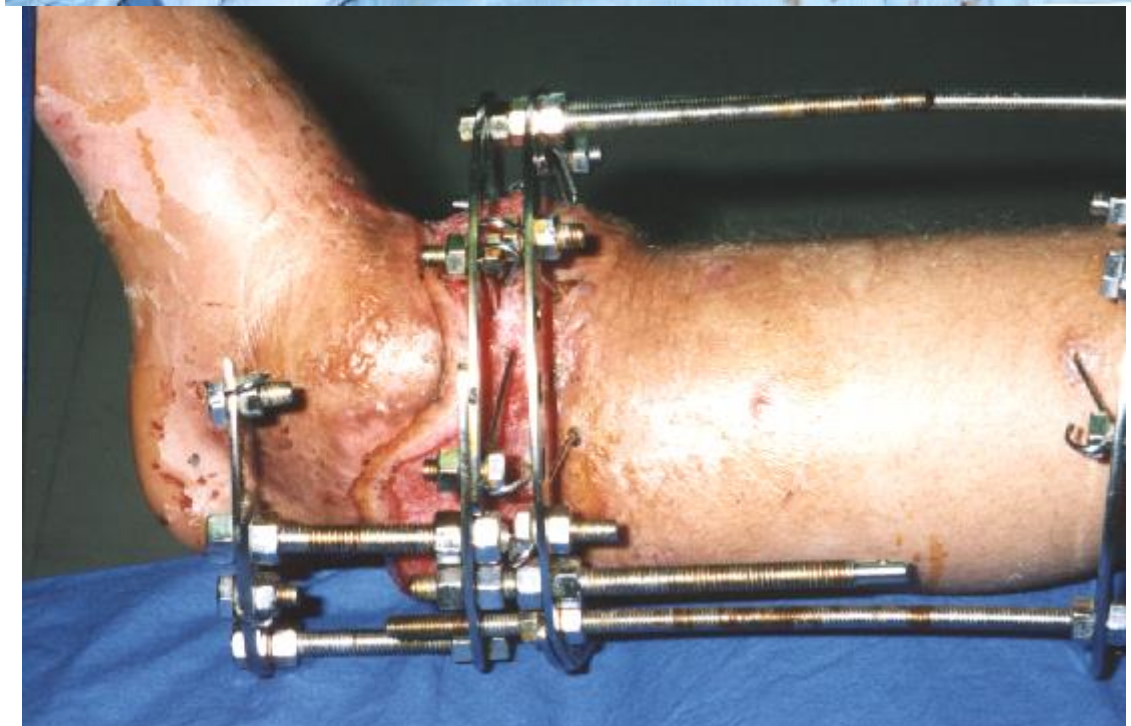
Wide Debridement

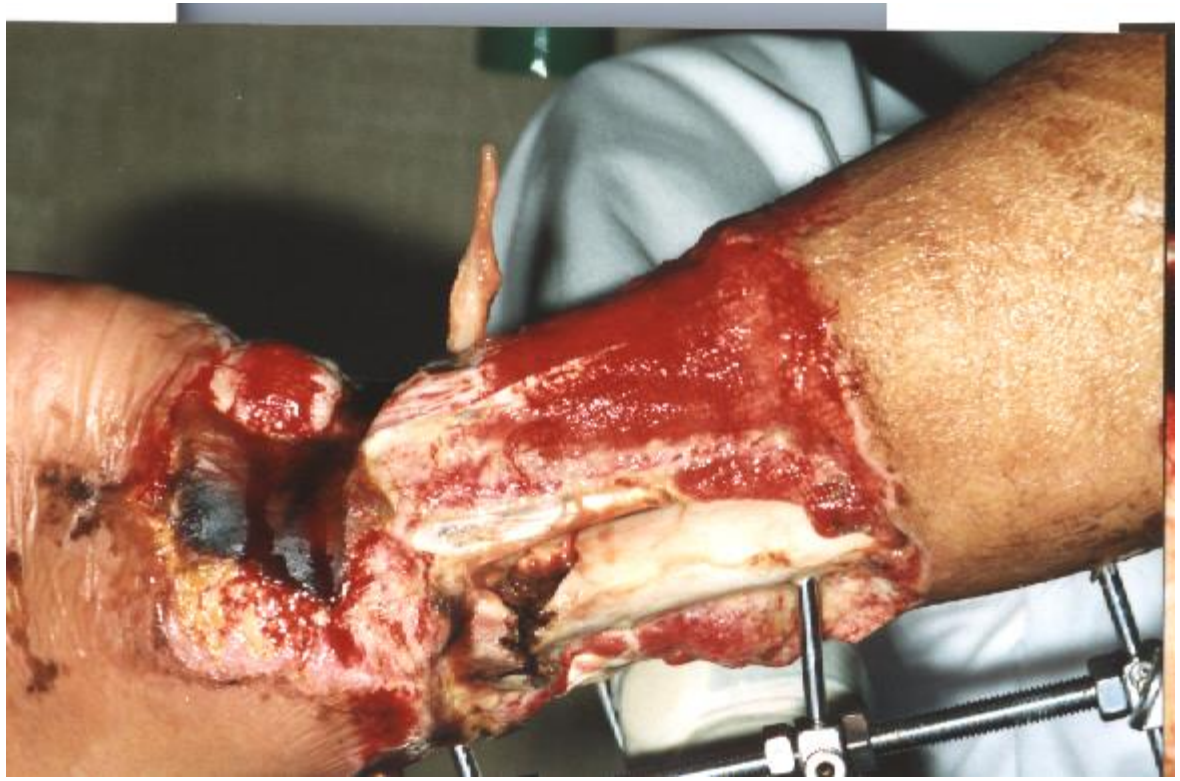
Close the wound

Soft-tissue
Bone fragments

Contact end to end







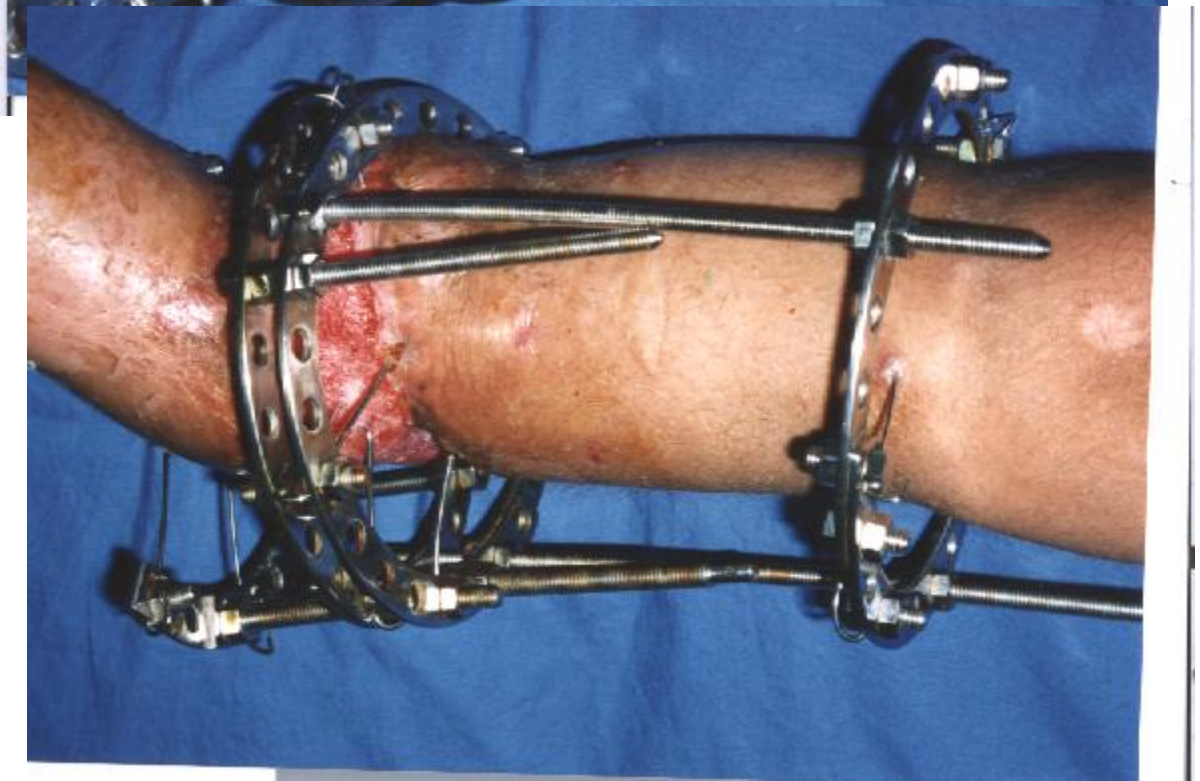
Pre-op

Post-op

Soft-tissue healing

Compression 3 weeks

distraction



Strategies to succeed

Acute

Shortening of the limb

Corticotomy

Ilizarov, G.A.: The Tension-Stress effect on the genesis and growth of tissues : Part I The influence of stability of fixation and soft-tissue Preservation . Clin. Orthop. 238:249, 1989

Male Pt
27 yrs old
Exposed fracture
Loss of bone
Loss of soft-tissue

Wide resection

bone
Soft-tissue

Wound:

Necrotic Bone
soft-tissue removal

Acute shortening

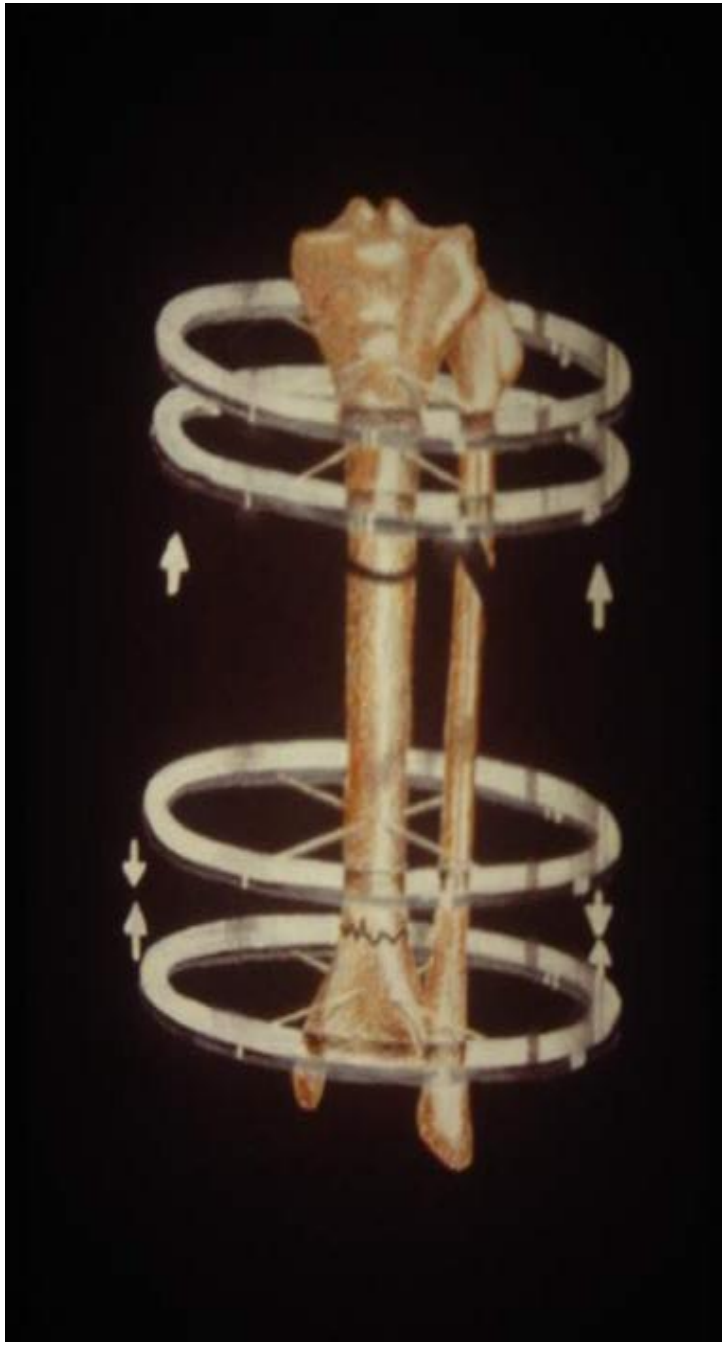
close the wound

end-to-end

Simultaneous

Compression and

Distraction



Disparity of leg length

Wound healing

Equalize leg length

Leg length discrepancy eradicated


Time of bone transport
BEAST ON THE ROPE
Bone transport : 45 days/1cm

Strategies to succeed

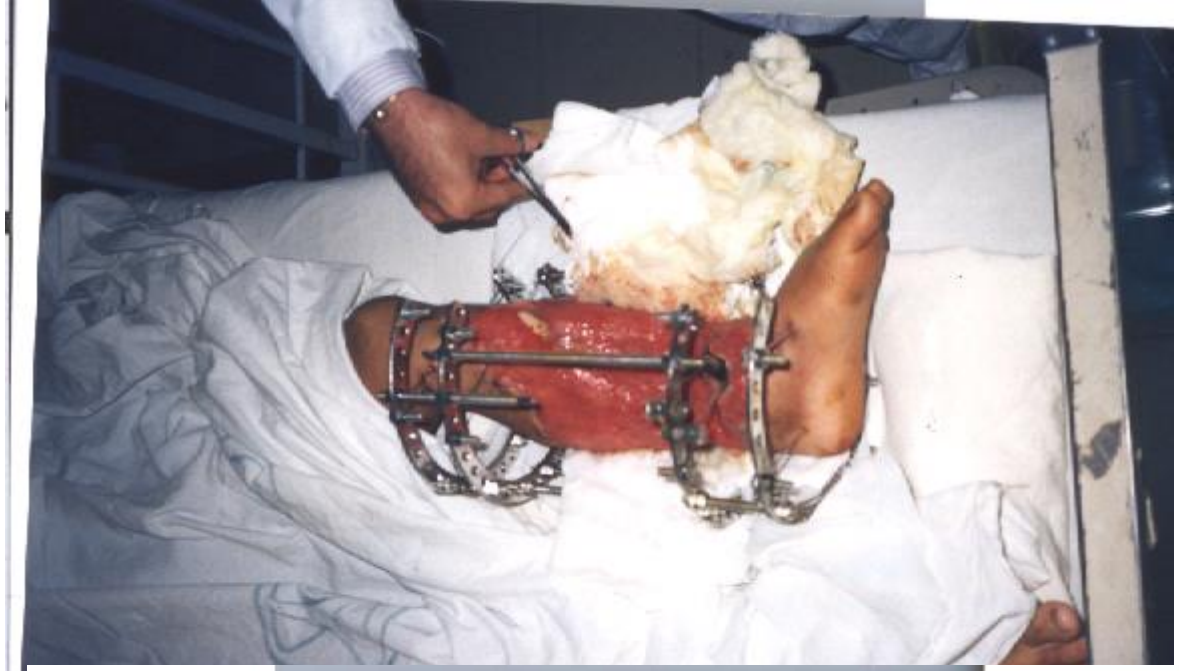
Gradual

Shortening of the limb

Critical bone defects

Ilizarov, G.A.: The Tension-Stress effect on the genesis and growth of tissues : Part I The influence of stability of fixation and soft-tissue Preservation . Clin. Orthop. 238:249, 1989

Male pat.
27 yrs
Motorcicle Accident
Loss of soft tissue
Loss of bone



Wide debridement

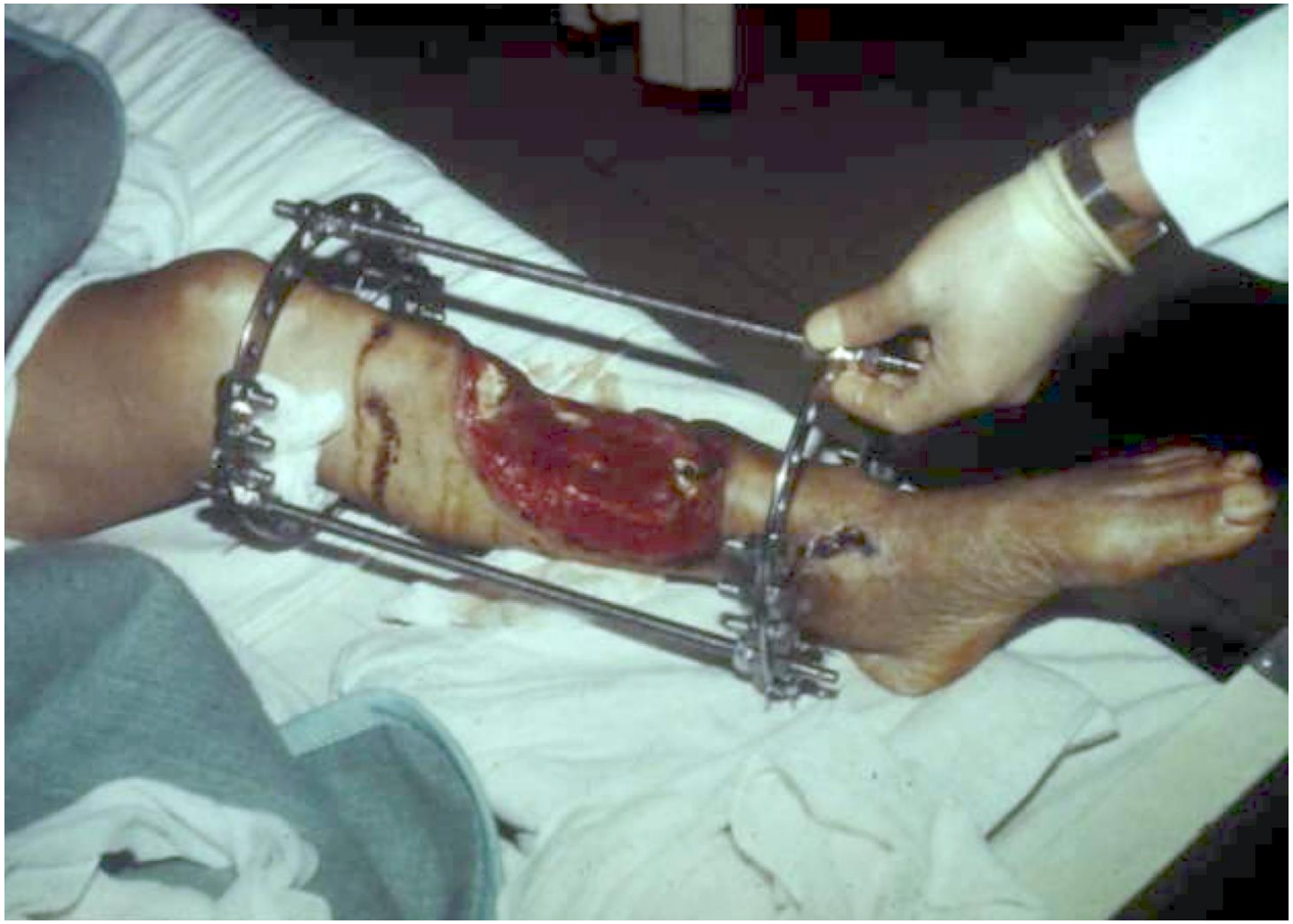
External fixation was applied

High-energy complex limb injuries

Extensive tissue damage or loss

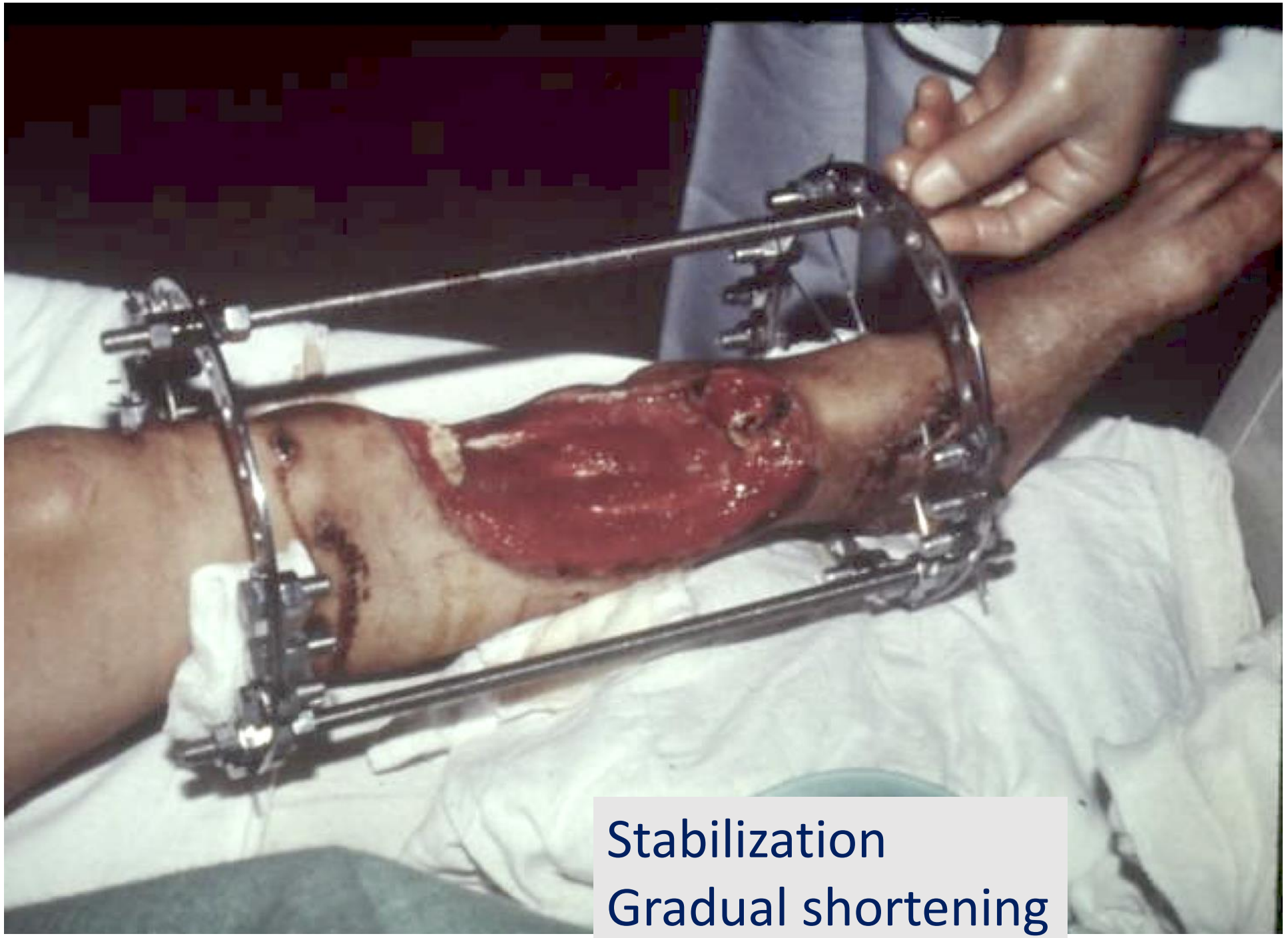
Poses a challenge

Orthopaedic
Plastic
Vascular surgeons

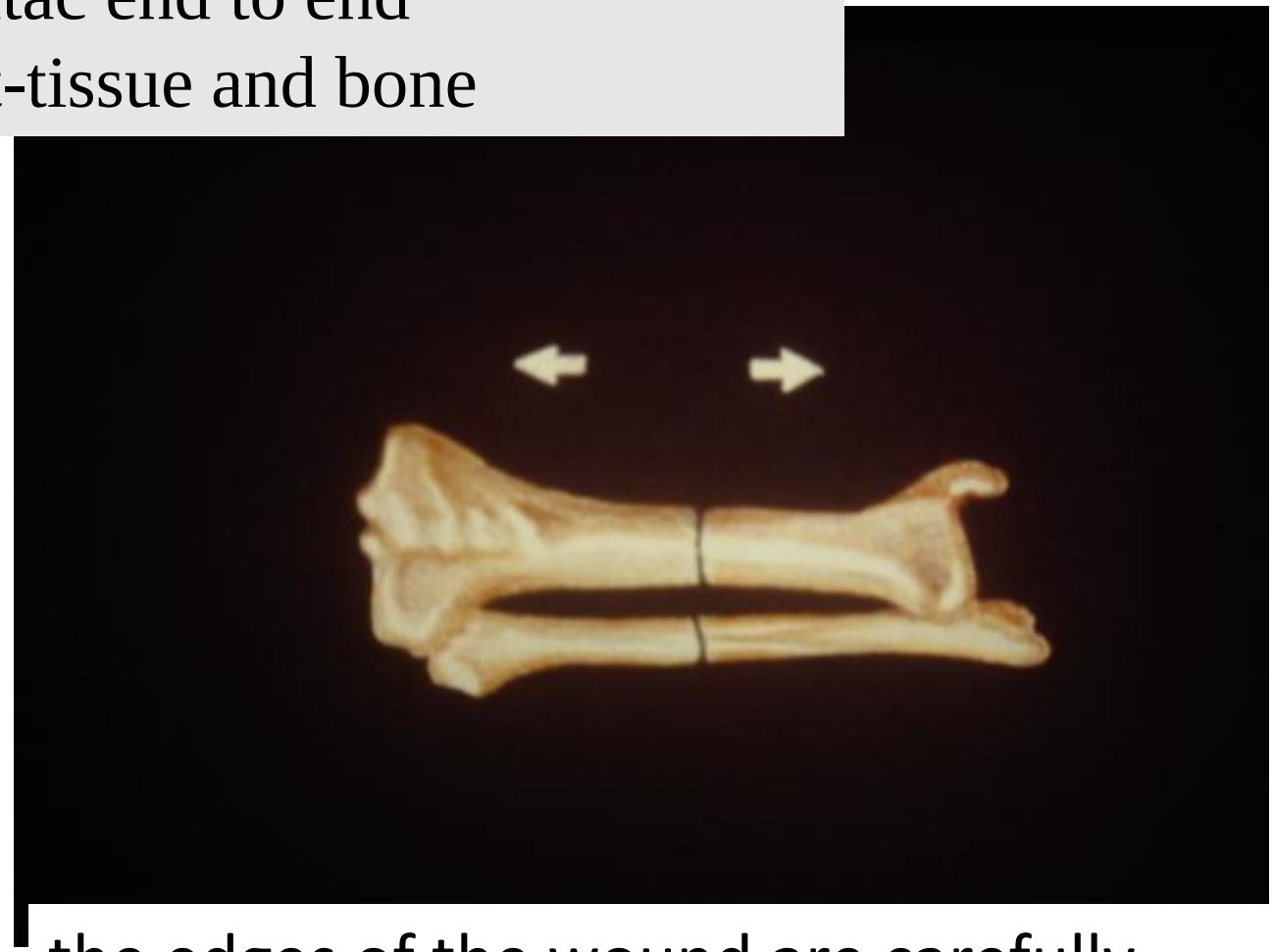


Extensive debridement
Soft-tissue
Bone

Surgical tactic: Step by step

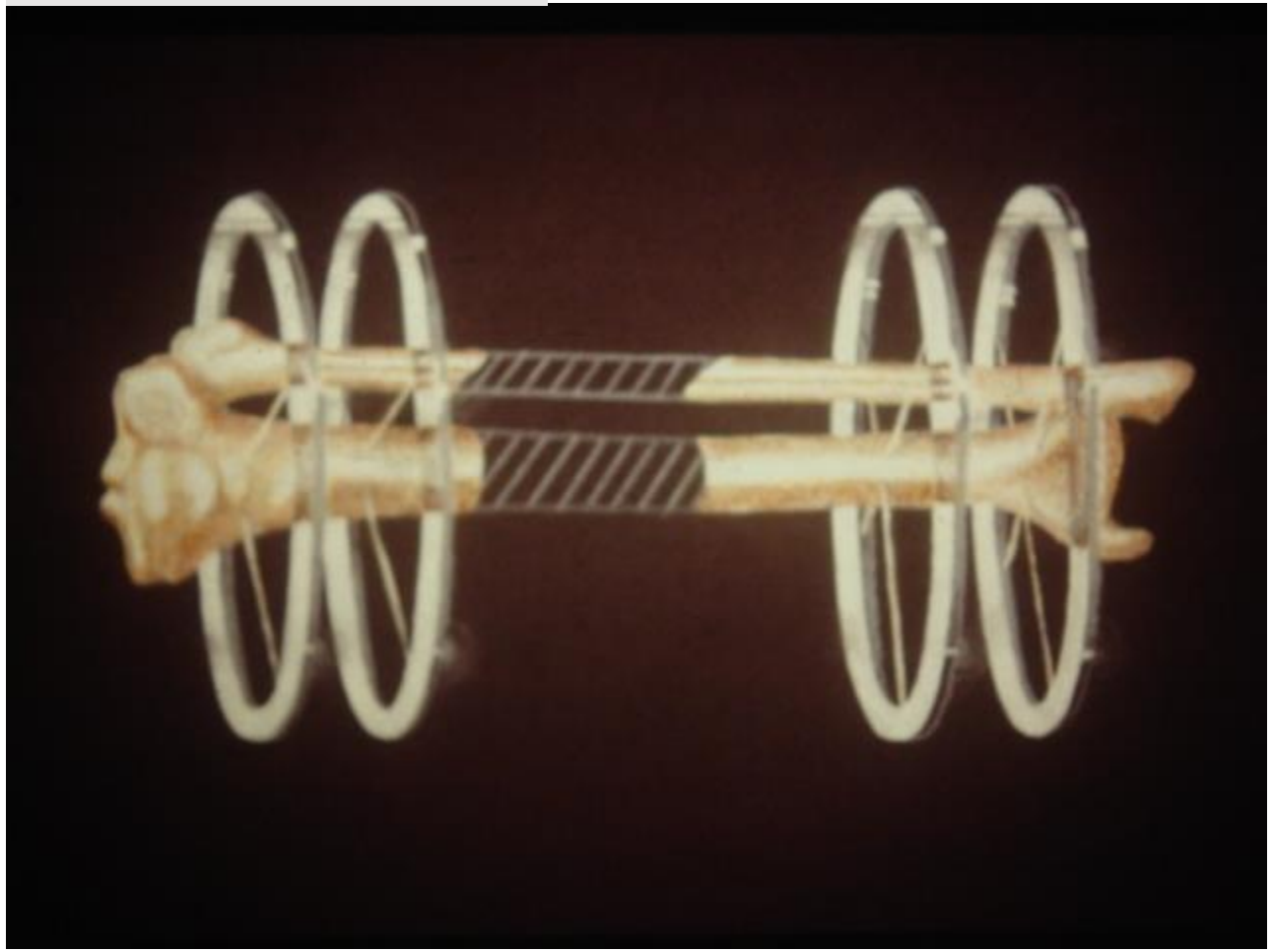

Stabilization
Gradual shortening

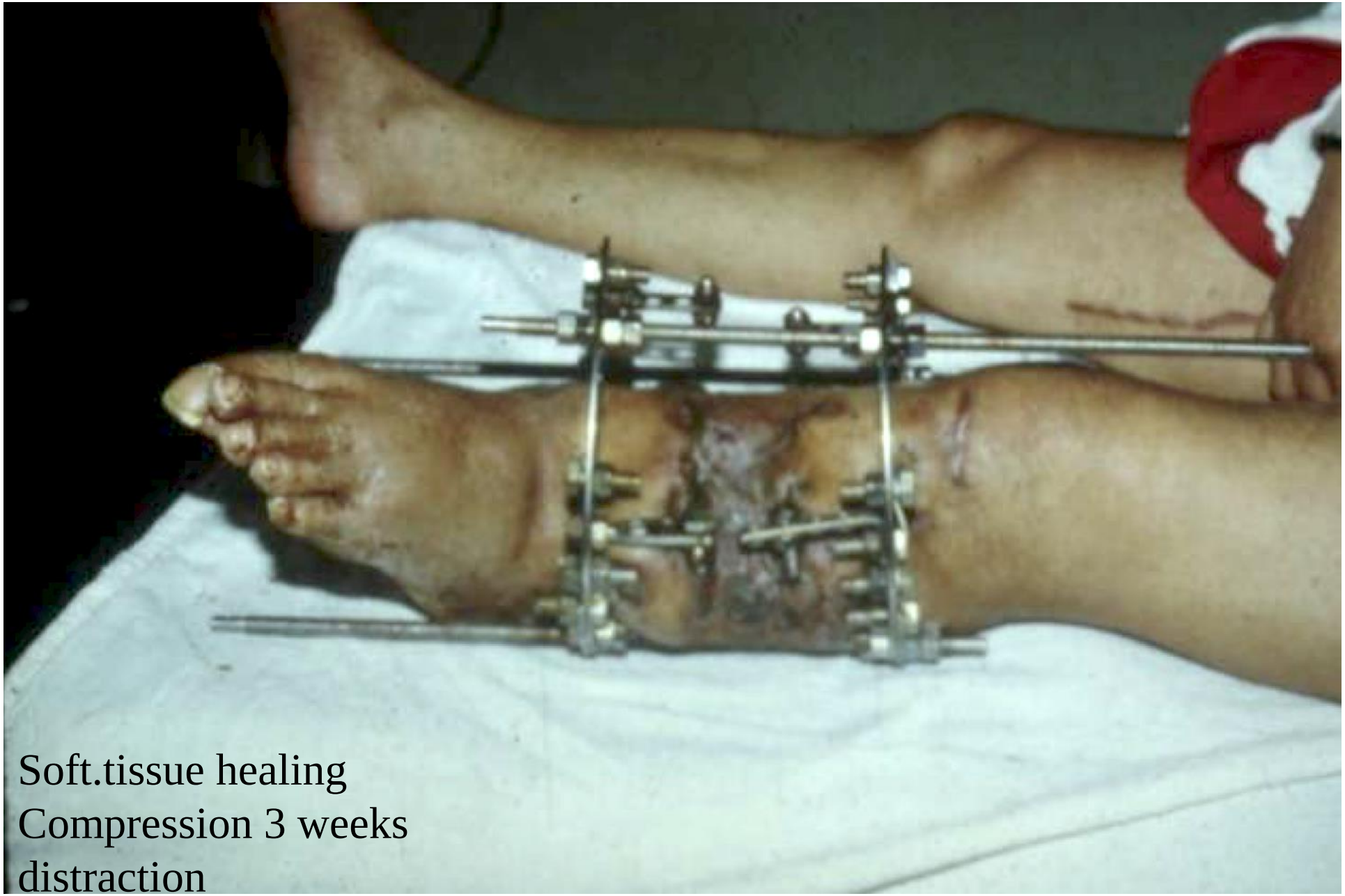
Gradual shortening; 3 cms / day
Contac end to end
Soft-tissue and bone



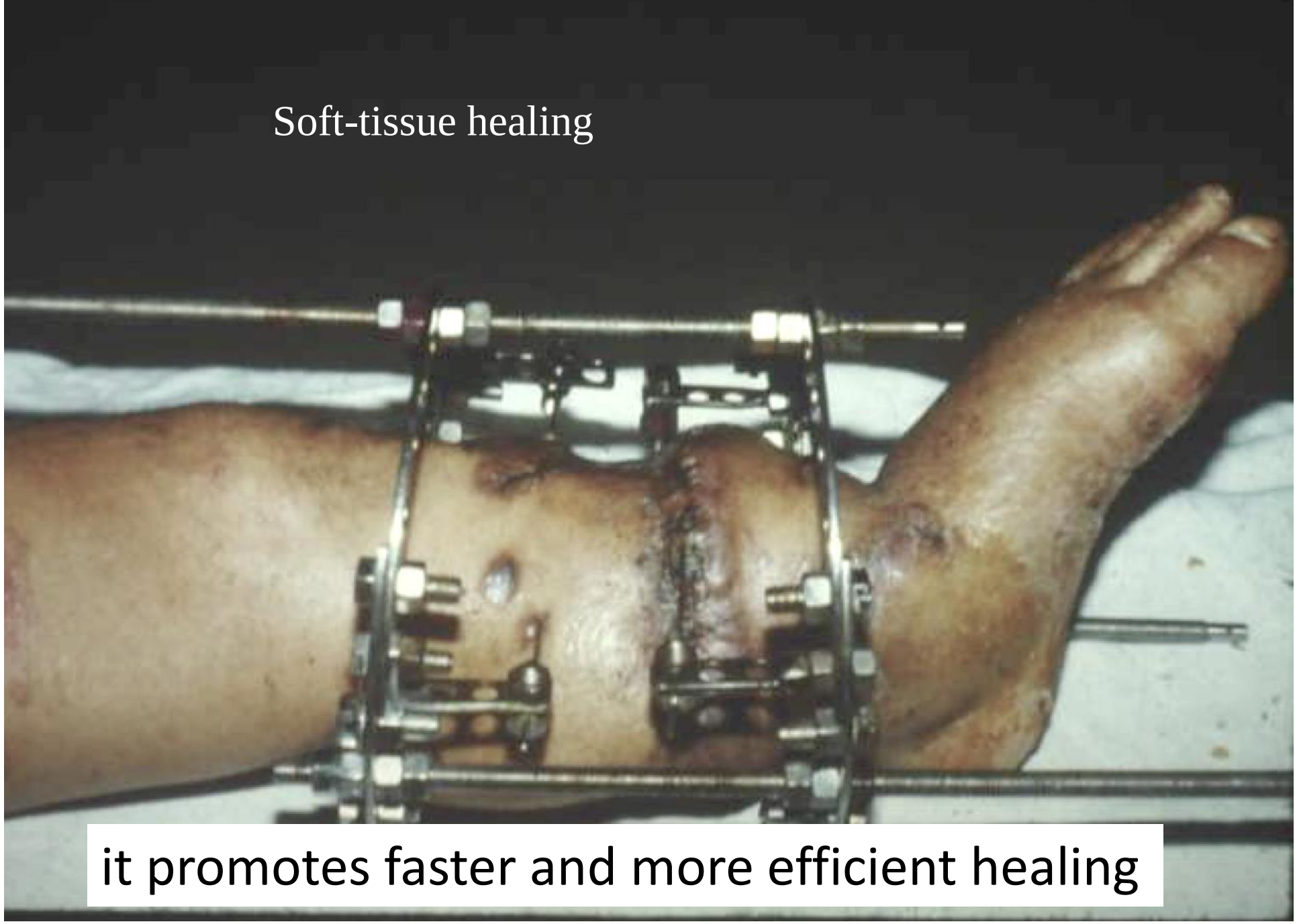
the edges of the wound are carefully aligned that allows the skin and tissues to heal properly

Compression
3 weeks
Then distraction





Soft.tissue healing
Compression 3 weeks
distraction


Soft-tissue healing
it promotes faster and more efficient healing

with less scarring than other methods of wound closure

Limb lengthening

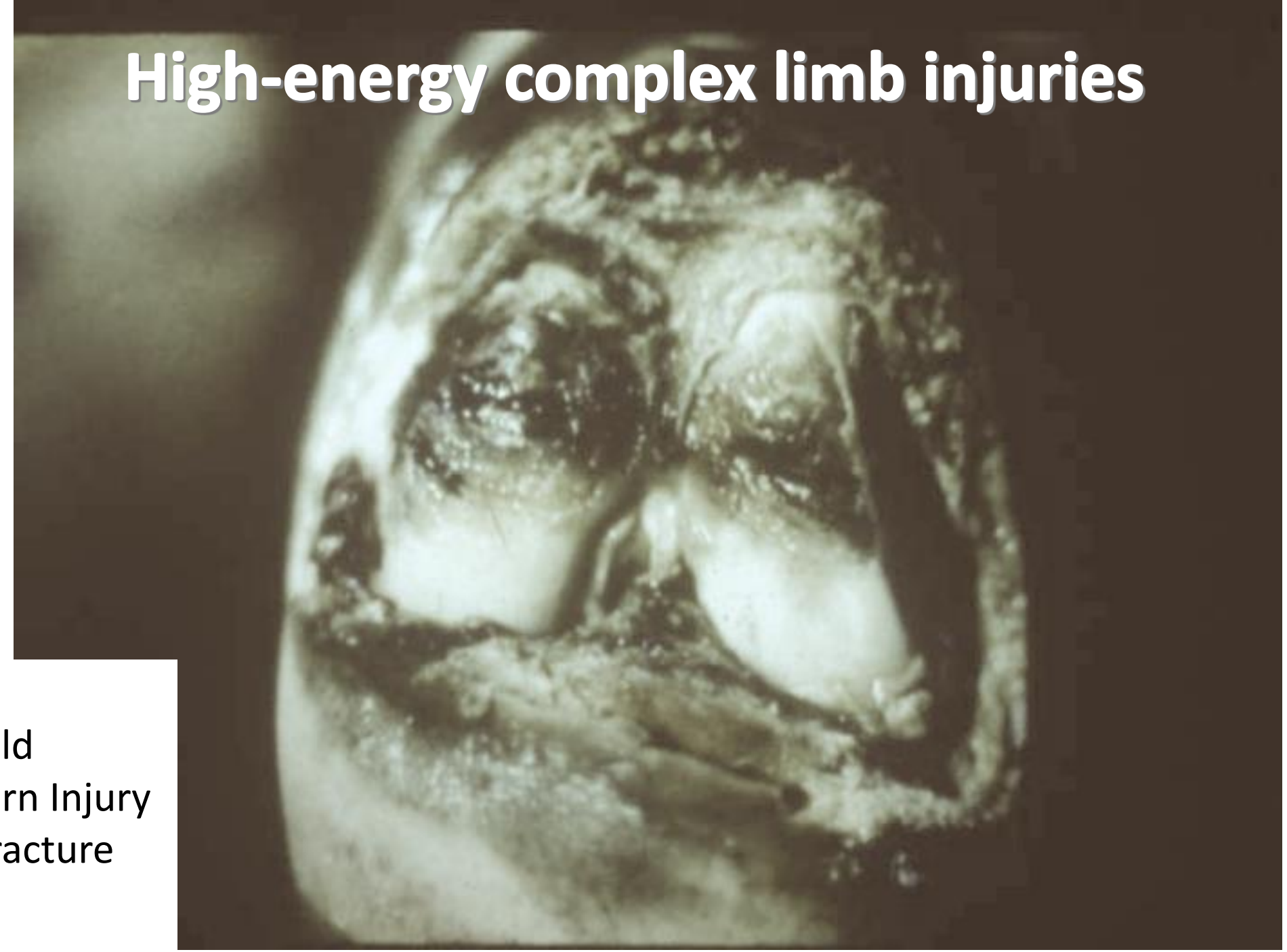

Bone quality

Plantigrade support

Electrical burn Injuries

High voltage

High-energy complex limb injuries

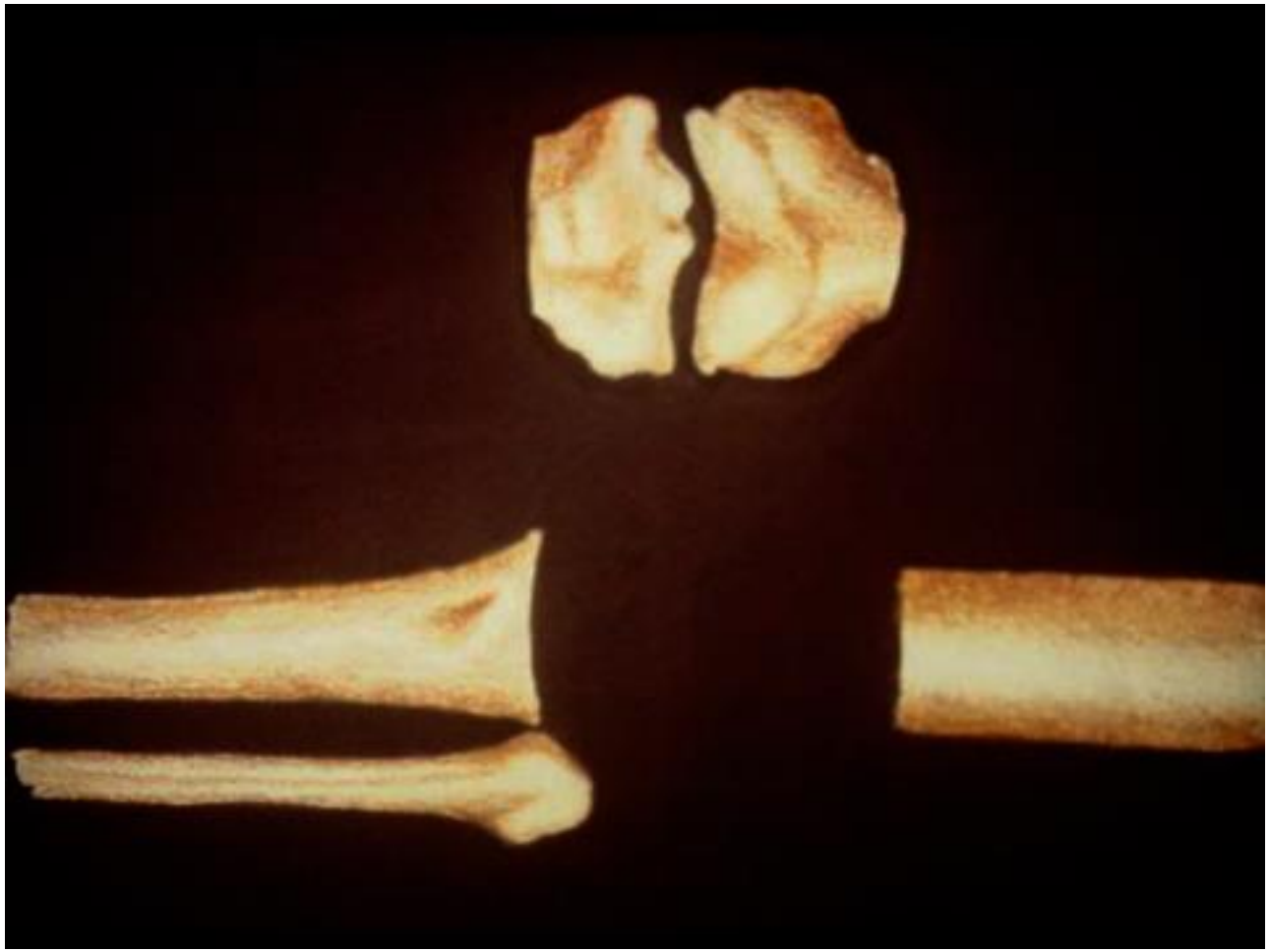


Male Pat.
34 Years Old
Electric burn Injury
Exposed fracture
Knee joint

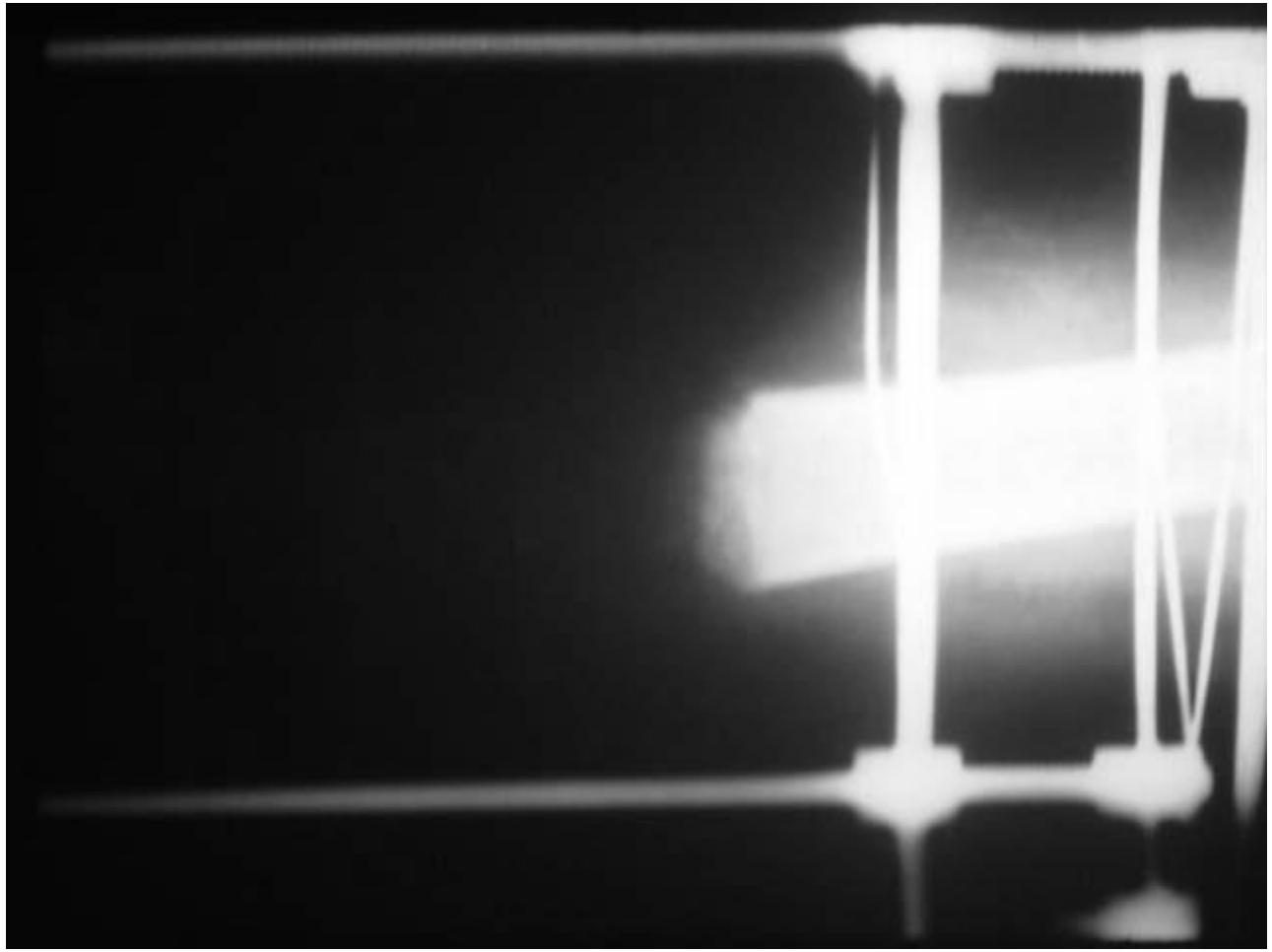
Left Shoulder

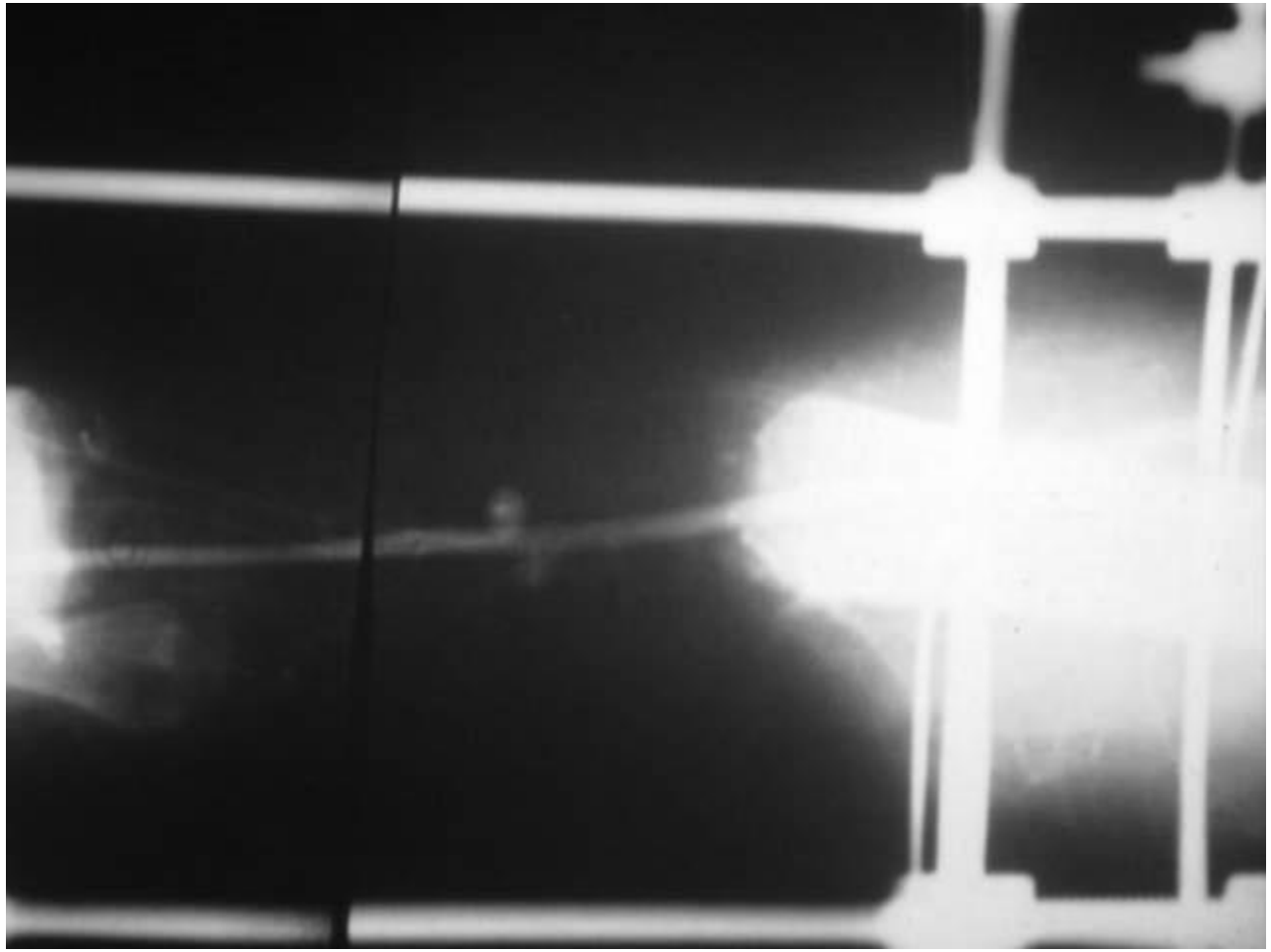
unpredictable nature of electrical injuries

The extent or volume of tissue damage involved with an electrical injury is difficult to assess



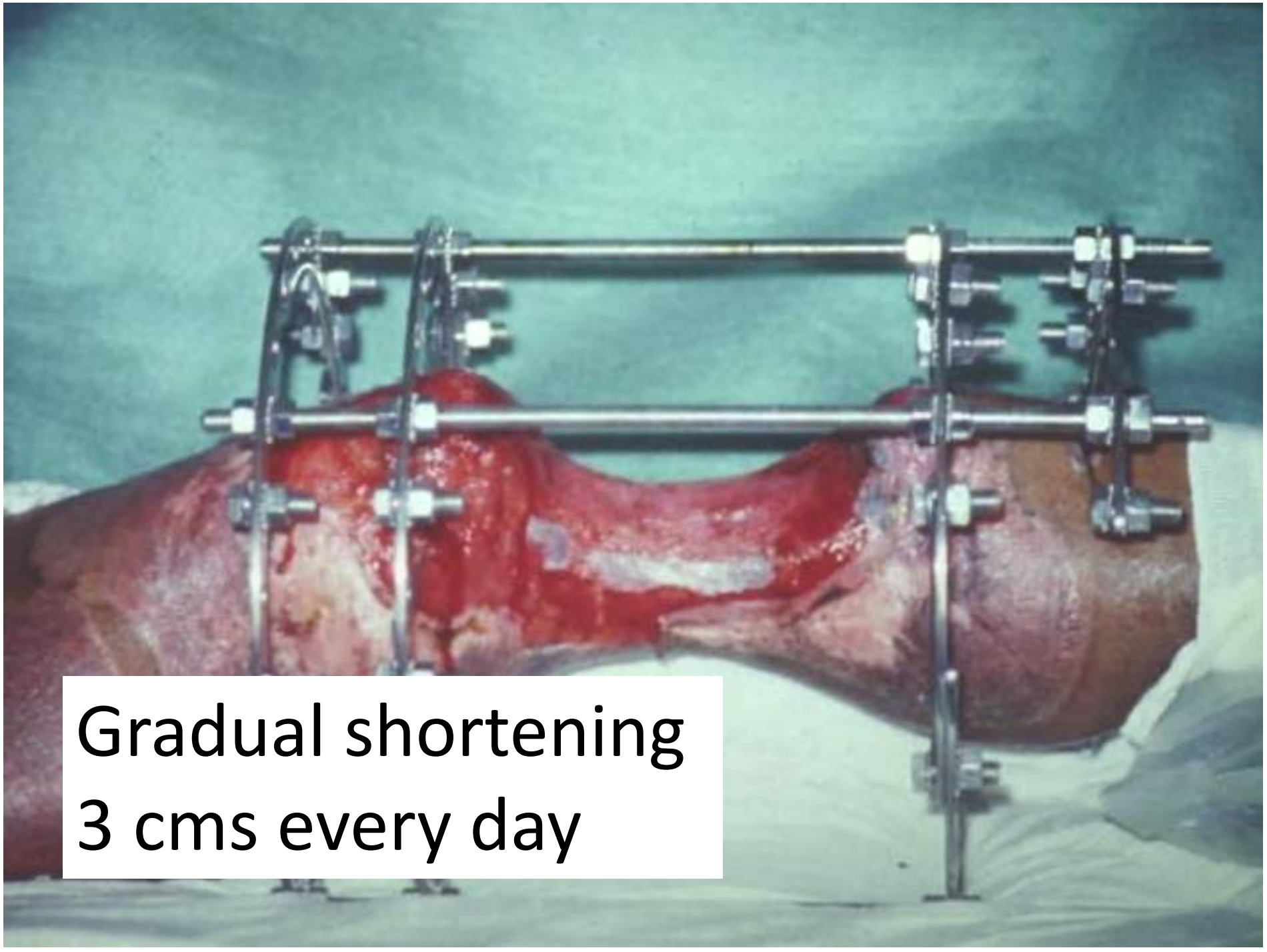
Loss of bone of knee joint

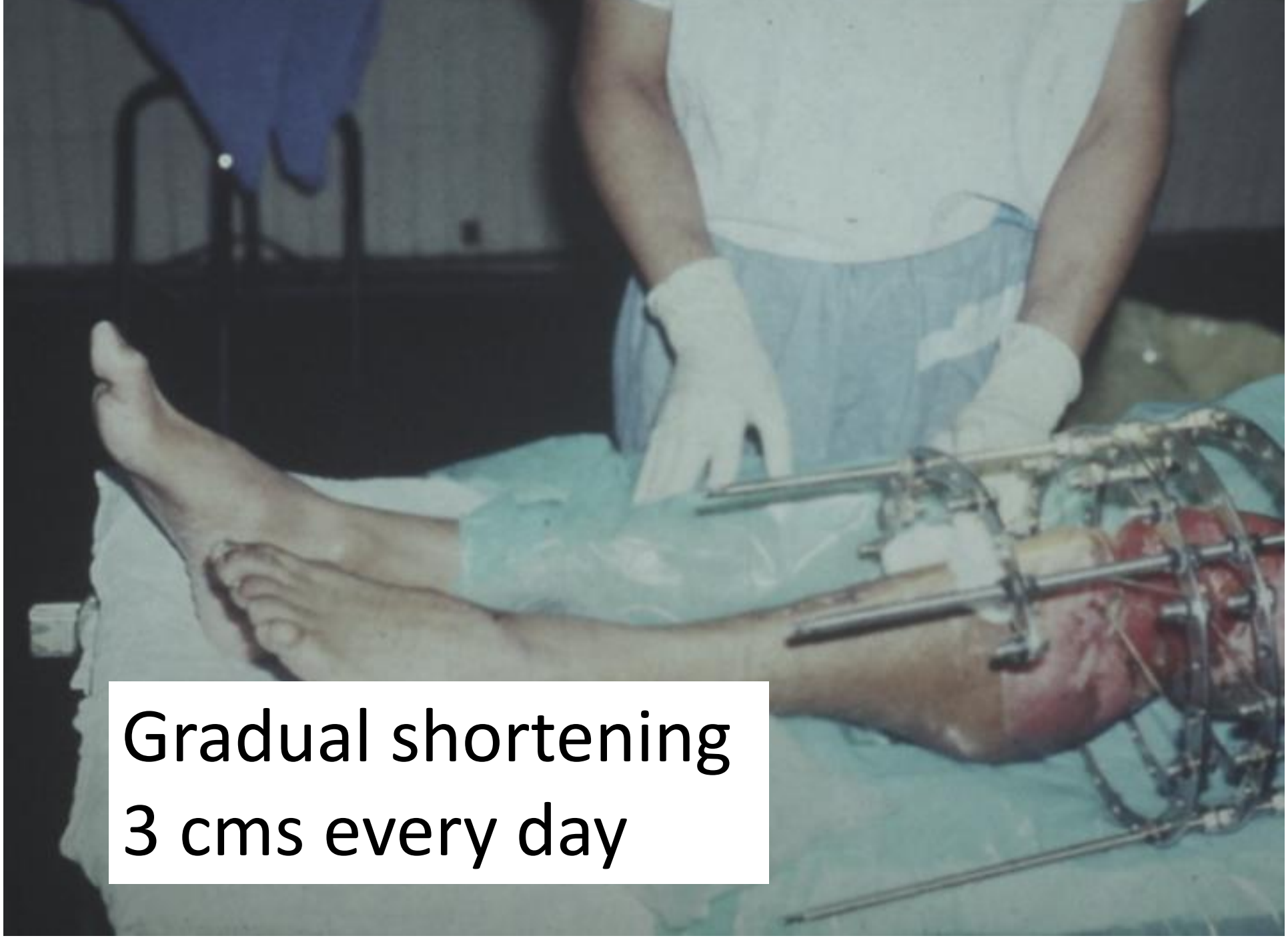


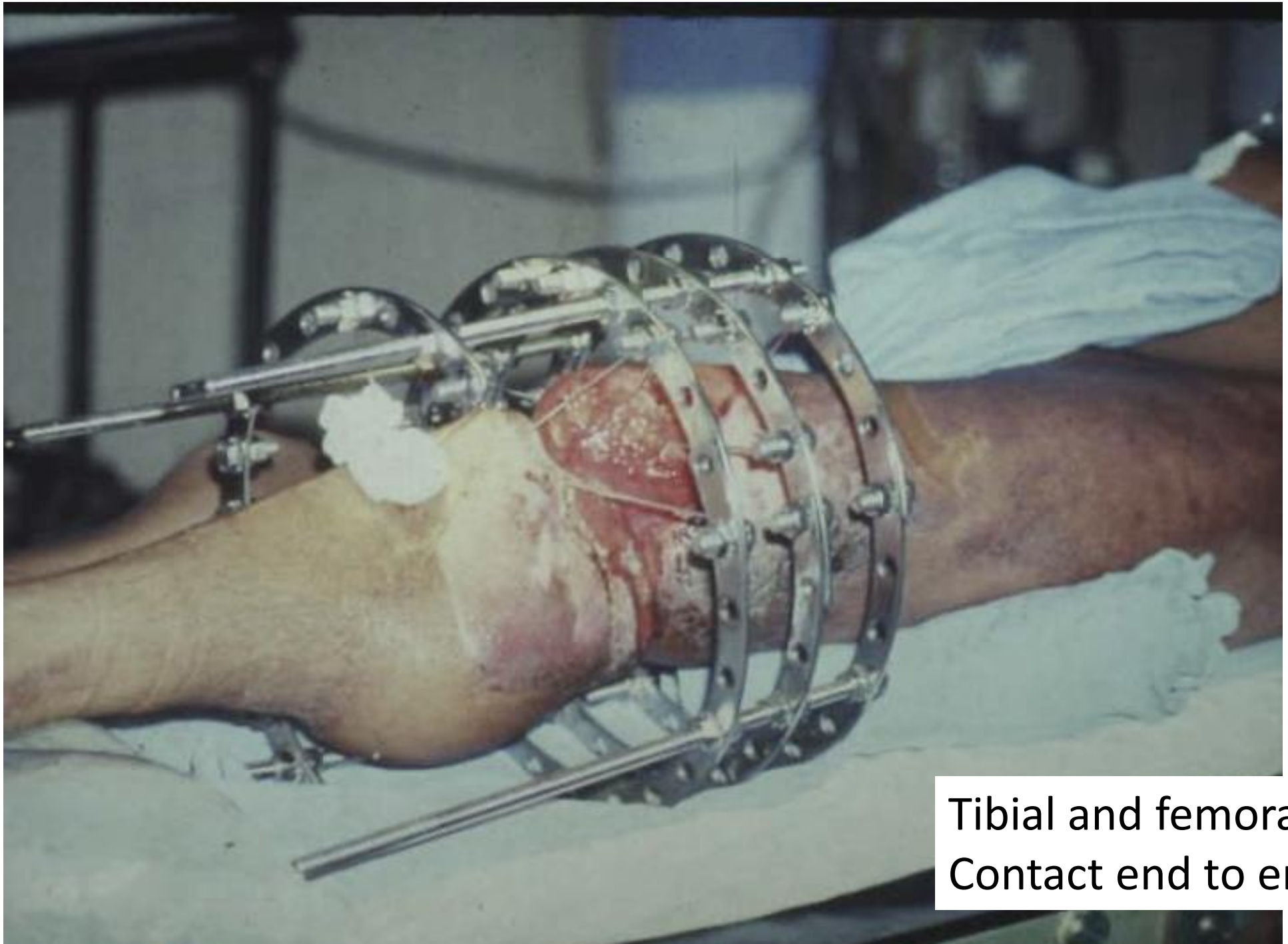


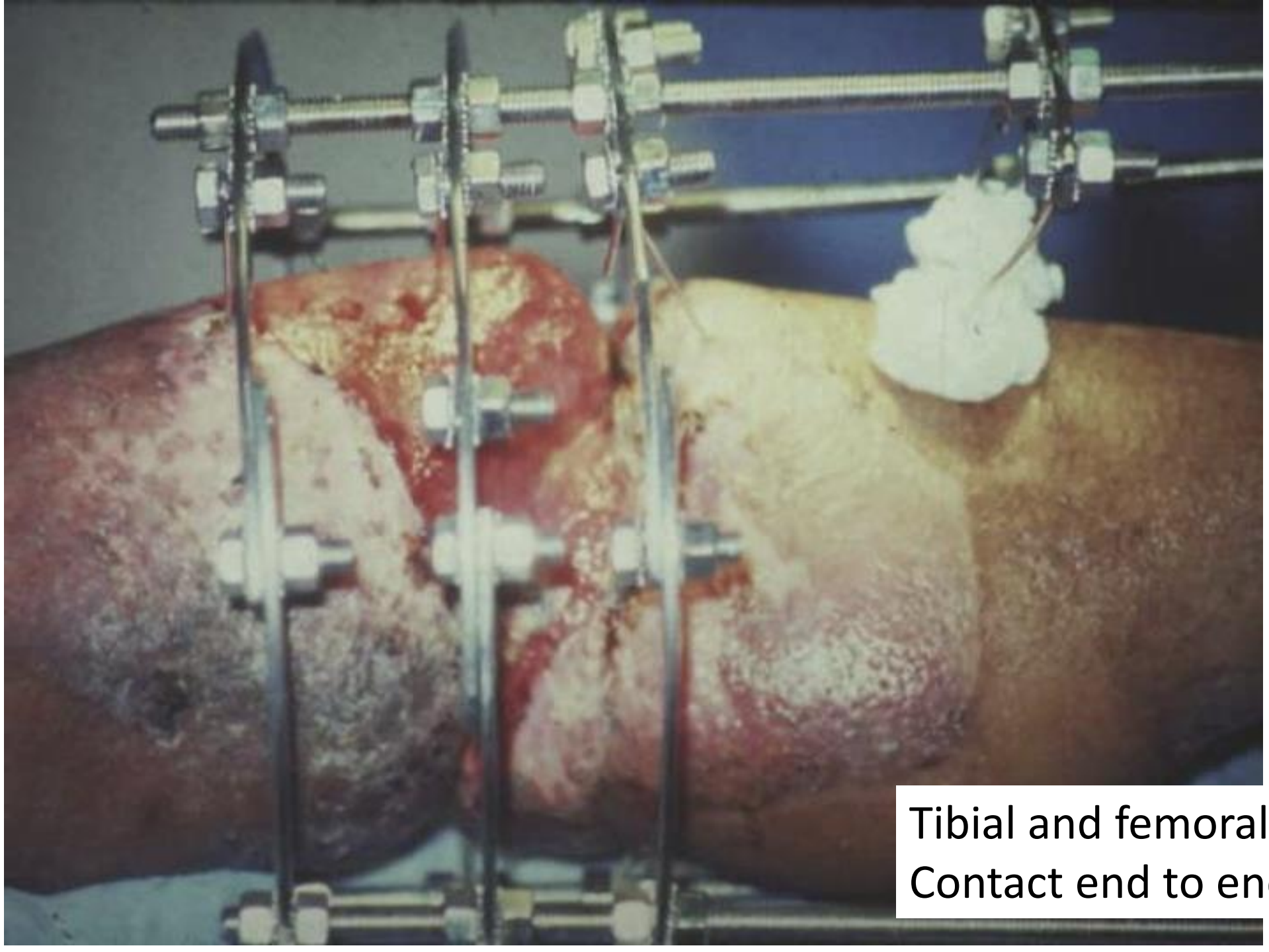
Femoral arteriogram

Gradual shortening 3 cms every day
Wound long distance 22 cms


Gradual shortening
3 cms every day


Gradual shortening
3 cms every day

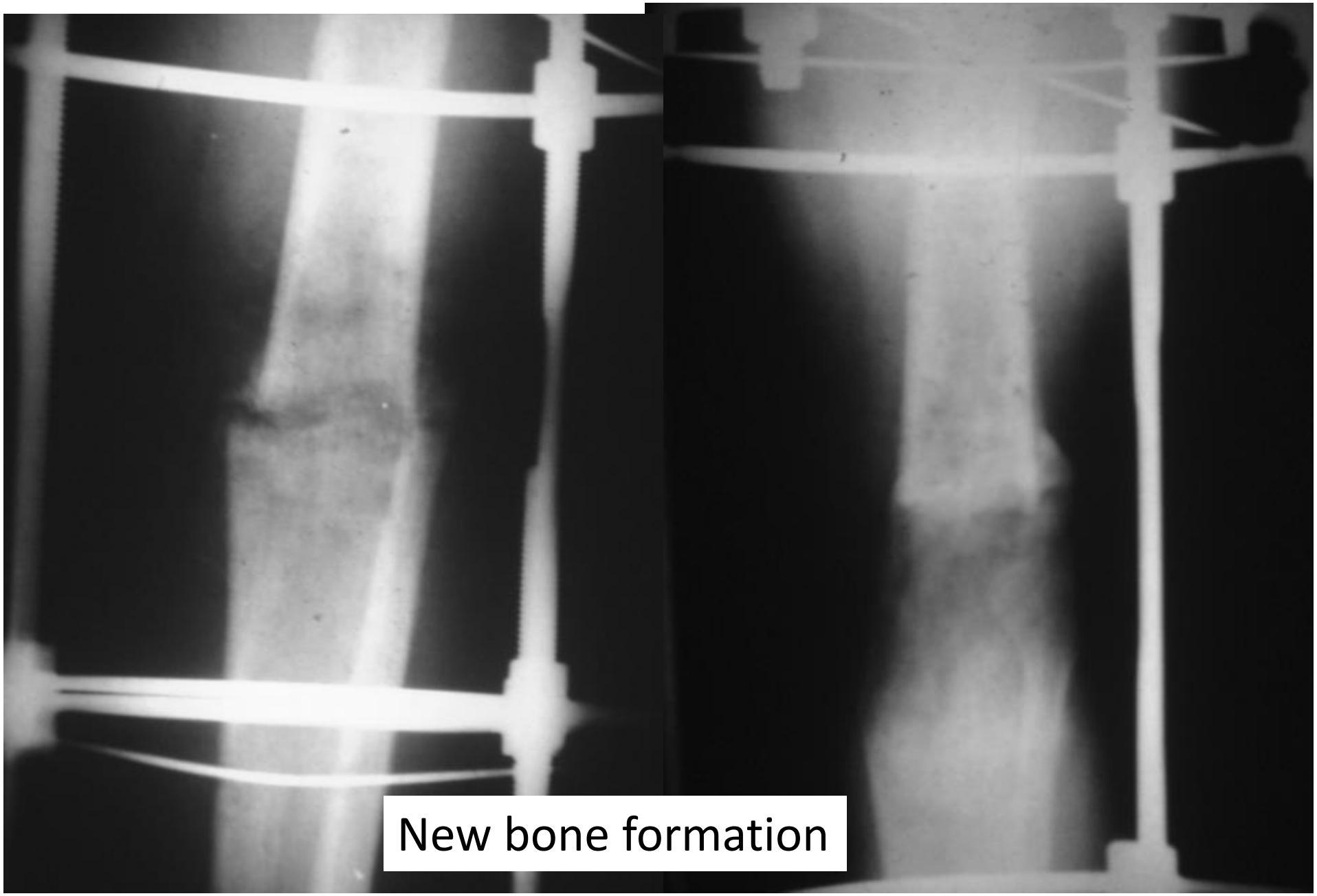

Tibial and femoral
Contact end to end

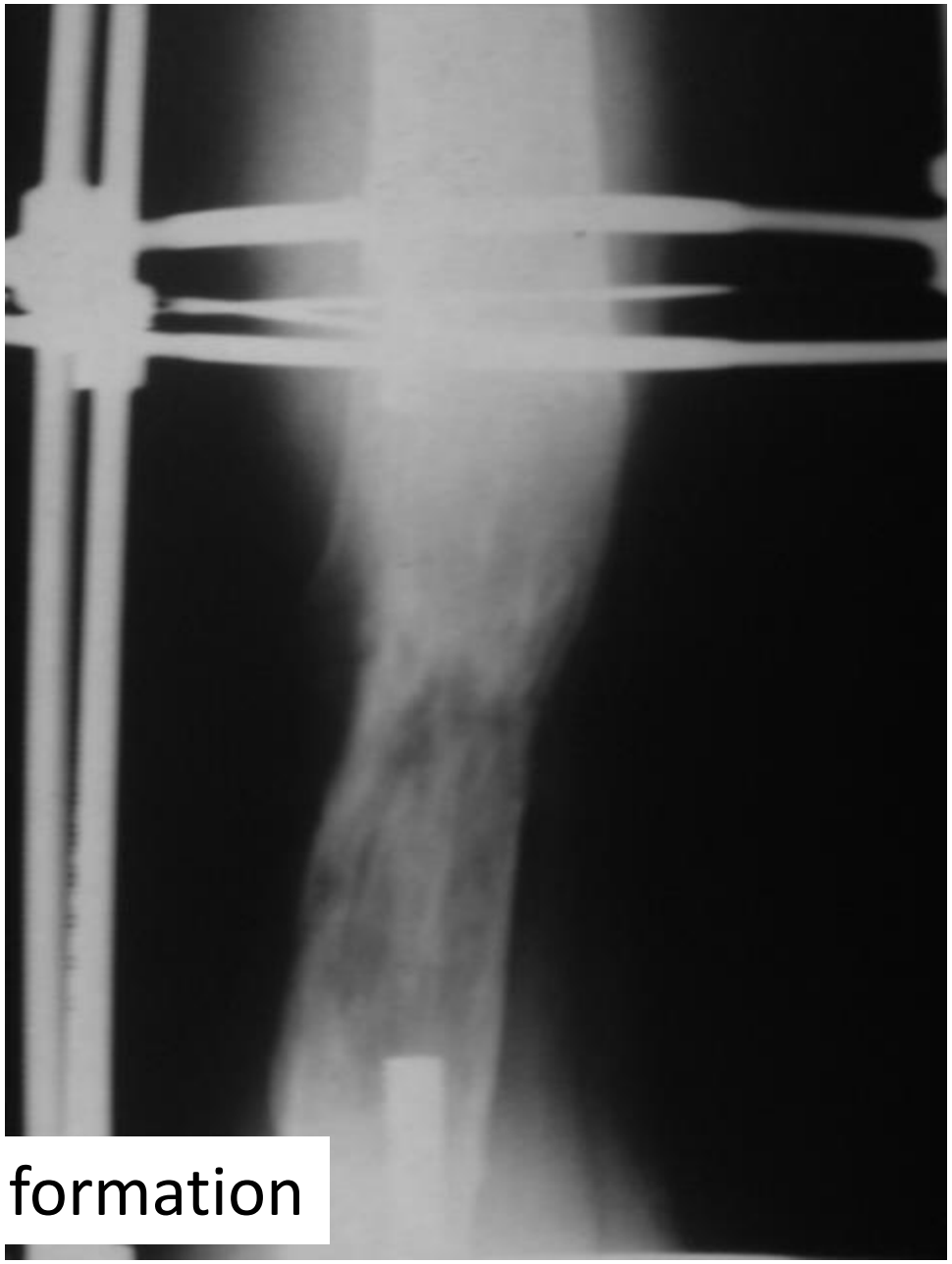

Tibial and femoral
Contact end to end

Soft-tissue
Healing

Tibial and femoral
Contact end to end

3 weeks in compression


New bone formation



New bone formation

Reestablished normal length of the limb

High-energy complex limb injuries

Female Pat.
28 yrs
Labor injury
Hand amputation

Forearm exposed fracture
Loss of soft-tissue
Bone Infection
Forearm non Union

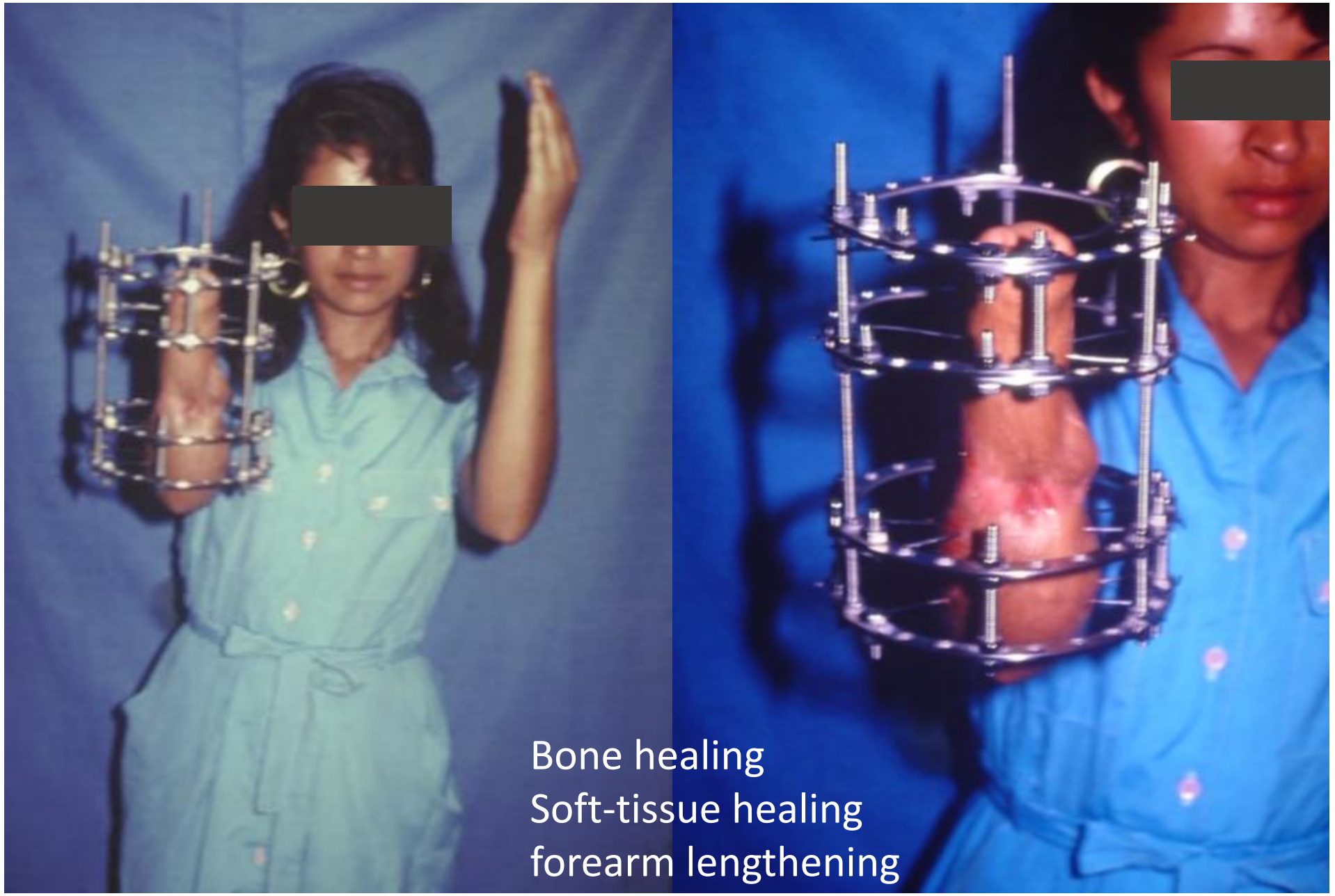
Check list

Forearm fracture
Exposed fracture
Loss of soft-tissue
Bone necrosis

Wide debridement

Necrotic bone
Infected Soft-tissue
Unstable hardware
Should be removed

End to end Contact
3 weeks
Compression
Distraction


Bone healing
Soft-tissue healing
forearm lengthening

Disadvantages of Bone lengthening

"Long term placement of an external fixator"

.- Pin problems

.- BOTHERSOME of external fixation

Conclusion

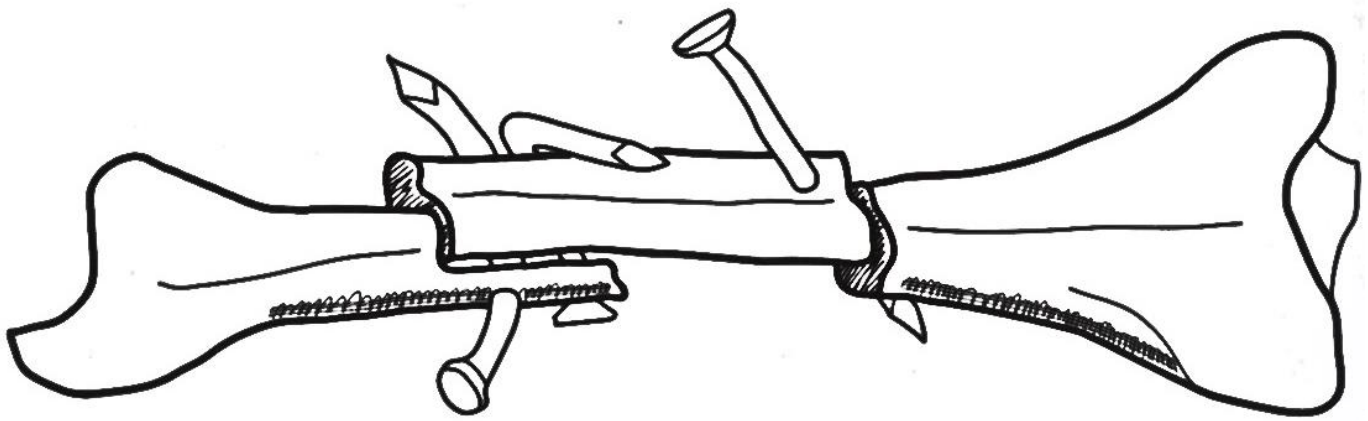
The mesenchymal tissue between the ends of a non-union retains the capacity to form Osseus tissue

Distraction is osteogenic (histogénic)

Transversal Distraction decreases the time of treatment

The tensión stress effect stimulates neo osteogenesis at the site of non-union

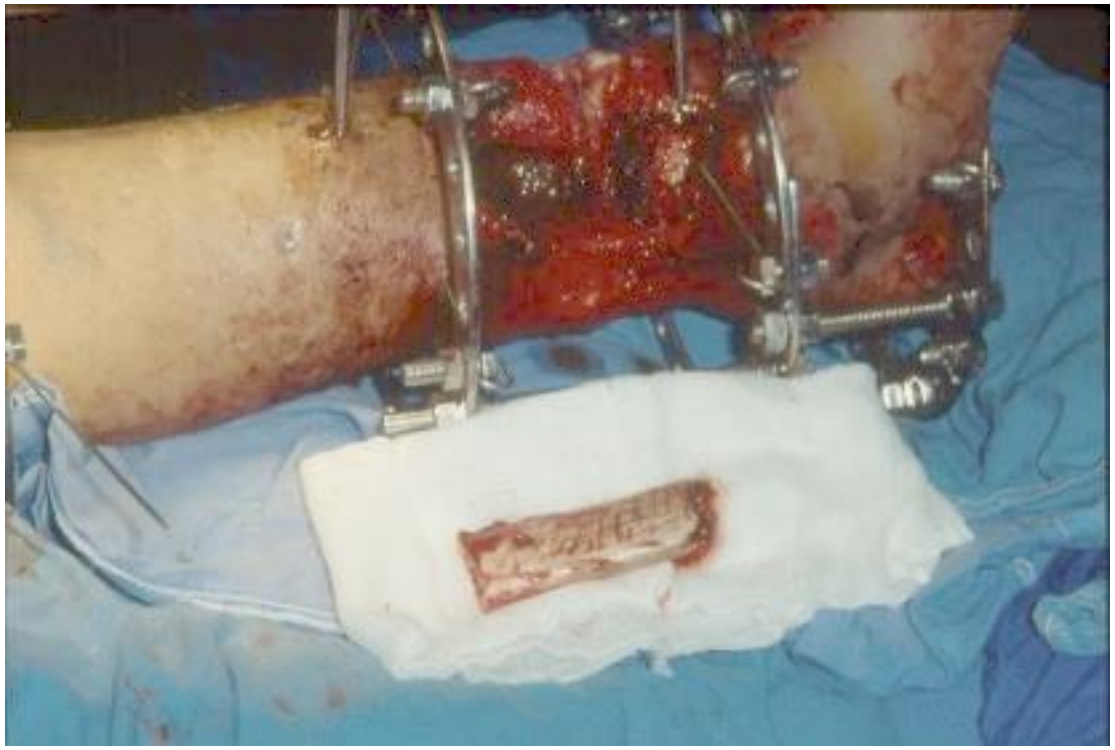
Take Home Message



Recalcitrant Bone infection

The most critical factor

successful treatment



The quality of the surgical débridement

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Thanks for

Your attention