FRACTURE FIXATION IN OSTEOPOROTIC BONE

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LEARNING OUTCOMES

- Understand the factors influencing fixation in cortical and trabecular bone affected with osteoporosis
- What implant characteristics help with fixation?
- What aspects of surgical fixation are important?
- Understand basic metabolic bone work-up

Definitions

- Insufficiency fracture: bone fails with normal weight-bearing
- Fragility fracture: result of a fall from a standing height or less

CONTENTS

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- Osteoporotic cortical bone
  - Biomechanical properties
  - Choice of implants
  - Surgical technique

BONE MASS CHANGES DURING LIFE

- Peak bone mass is reached at age 25
- Heredity
- Medications
- Diet, tobacco, and alcohol
- Race / weight

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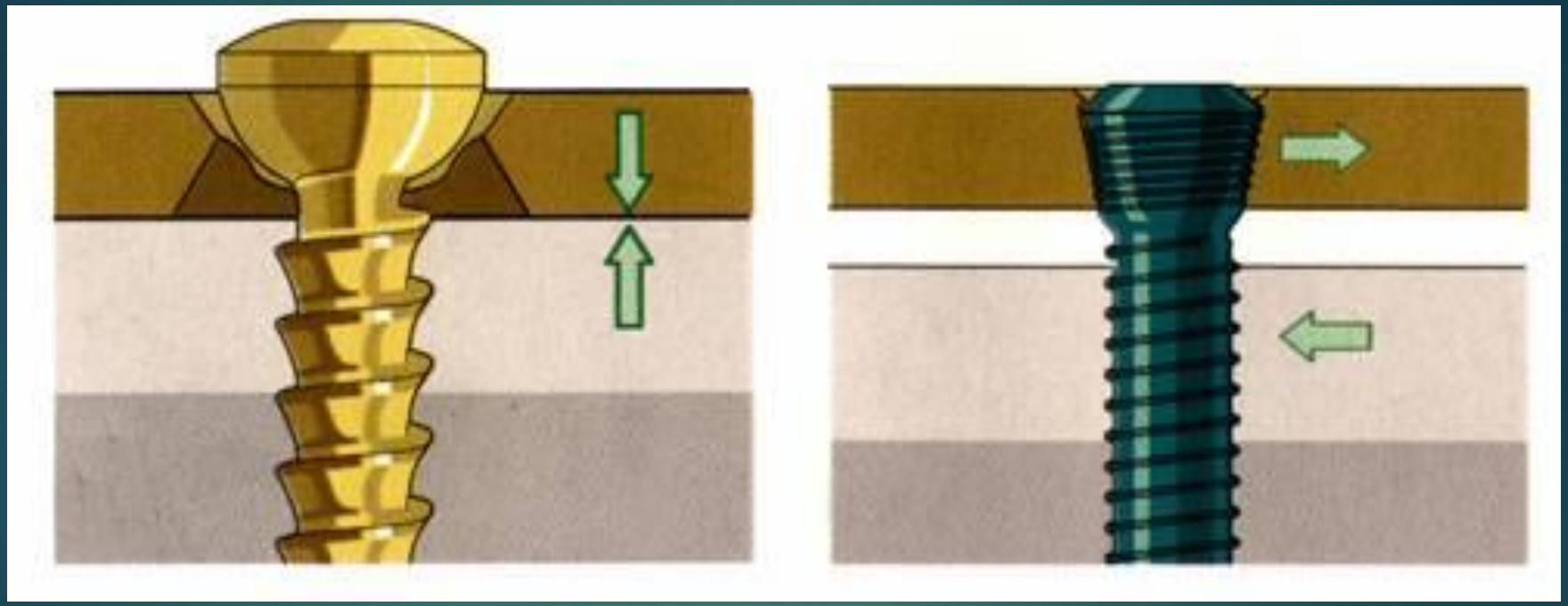
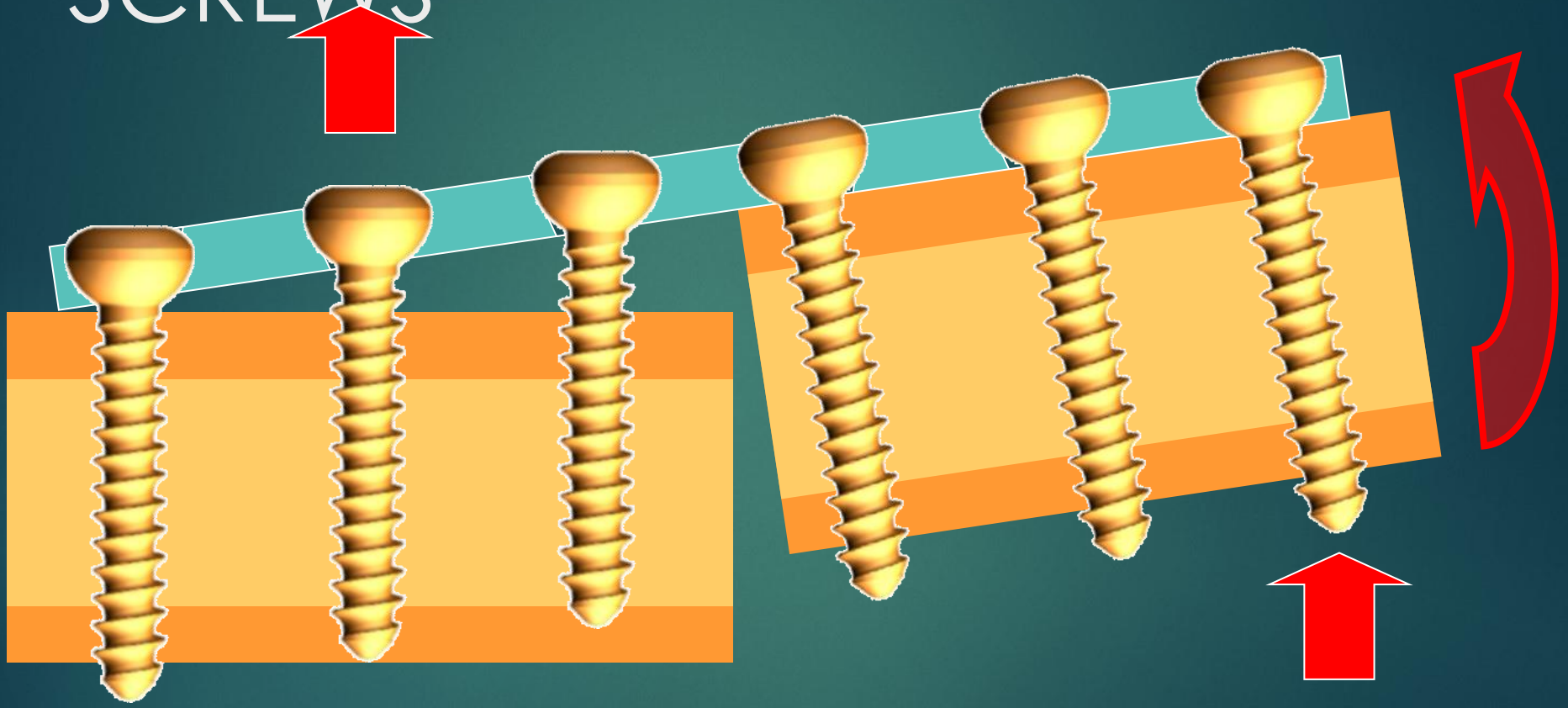
LOCKED-PLATE PRINCIPLE



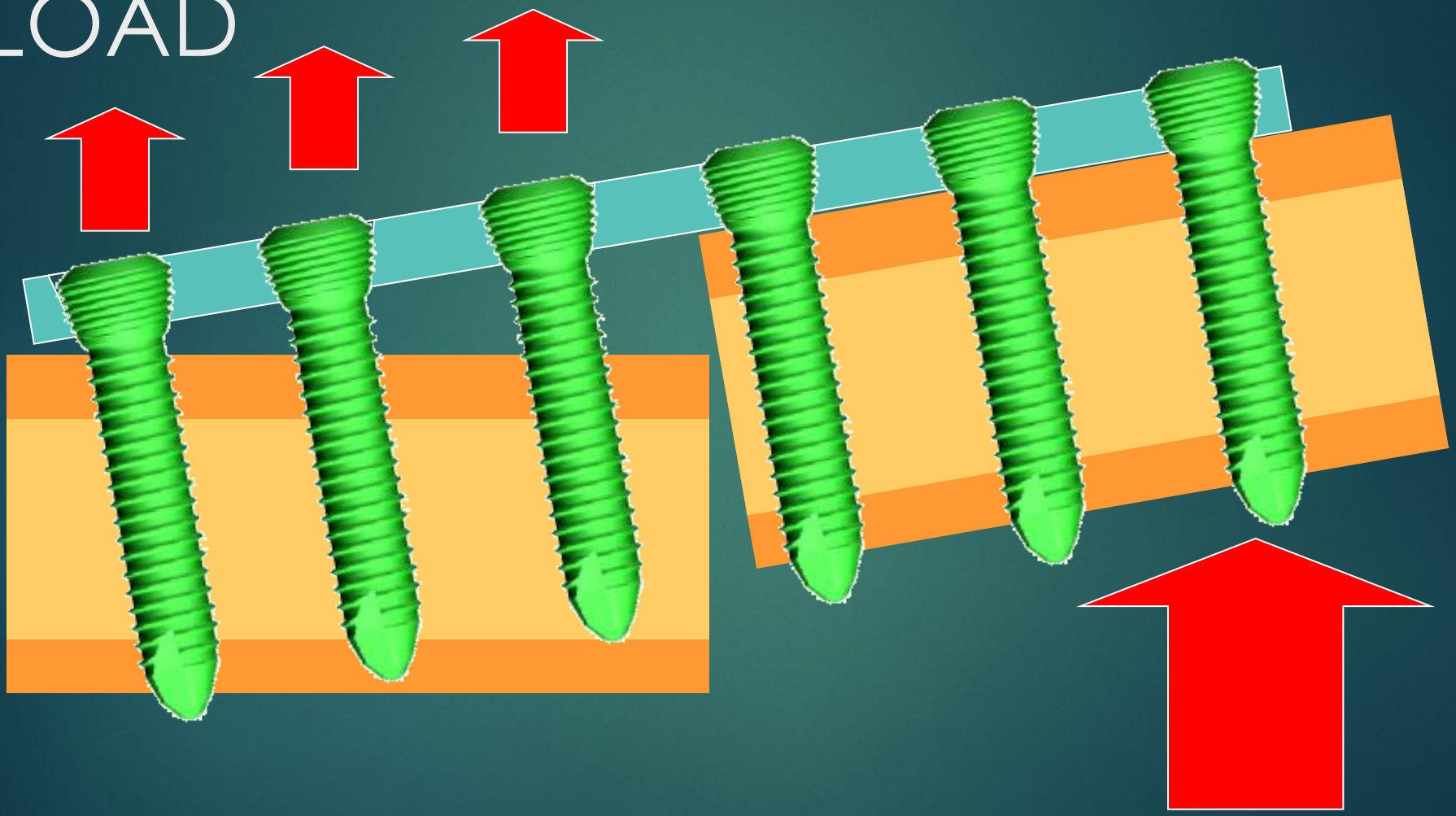
PULLOUT OF REGULAR SCREWS



by bending load

SHEARING CONVENTIONAL PLATE OR SCREW DOWN

RESISTANCE AGAINST BENDING LOAD



Resistance against bending load in locked

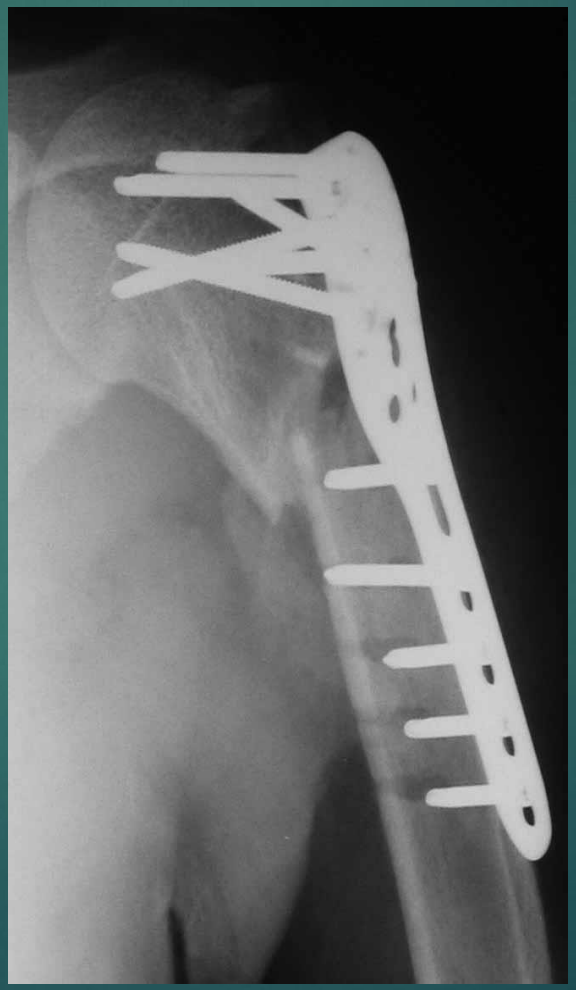


Plate-screw connection is solid
Screw-bone interface Fails as a unit

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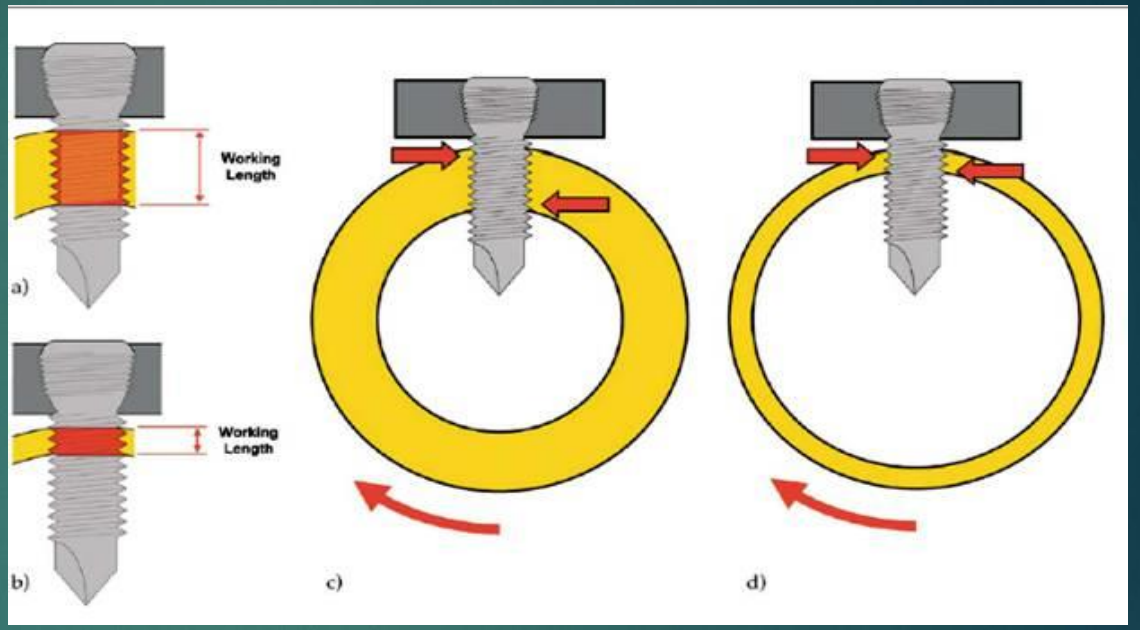
UNI- VS. BICORTICAL SCREW FIXATION

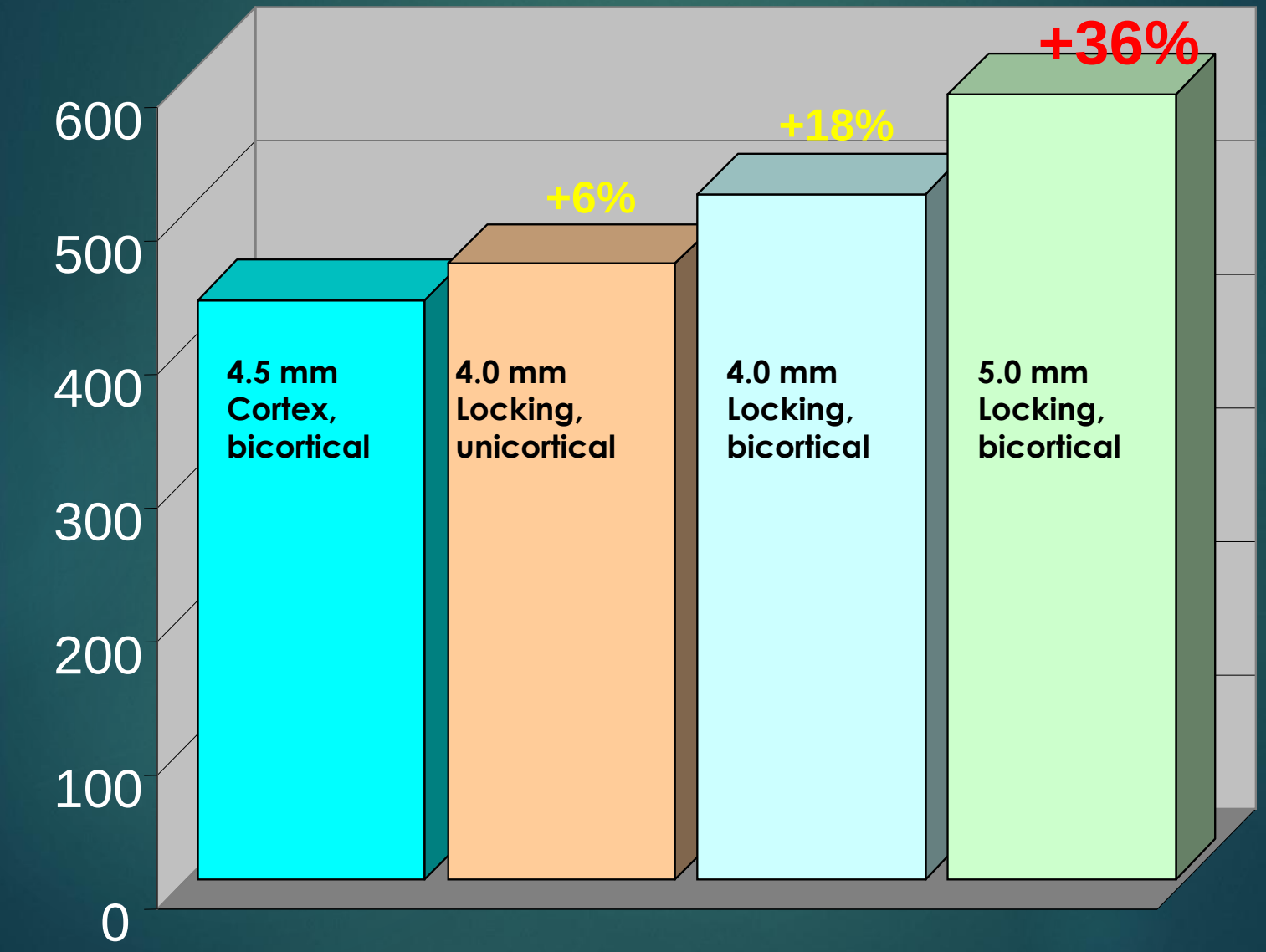
FAILURE WITH UNICORTICAL SCREWS



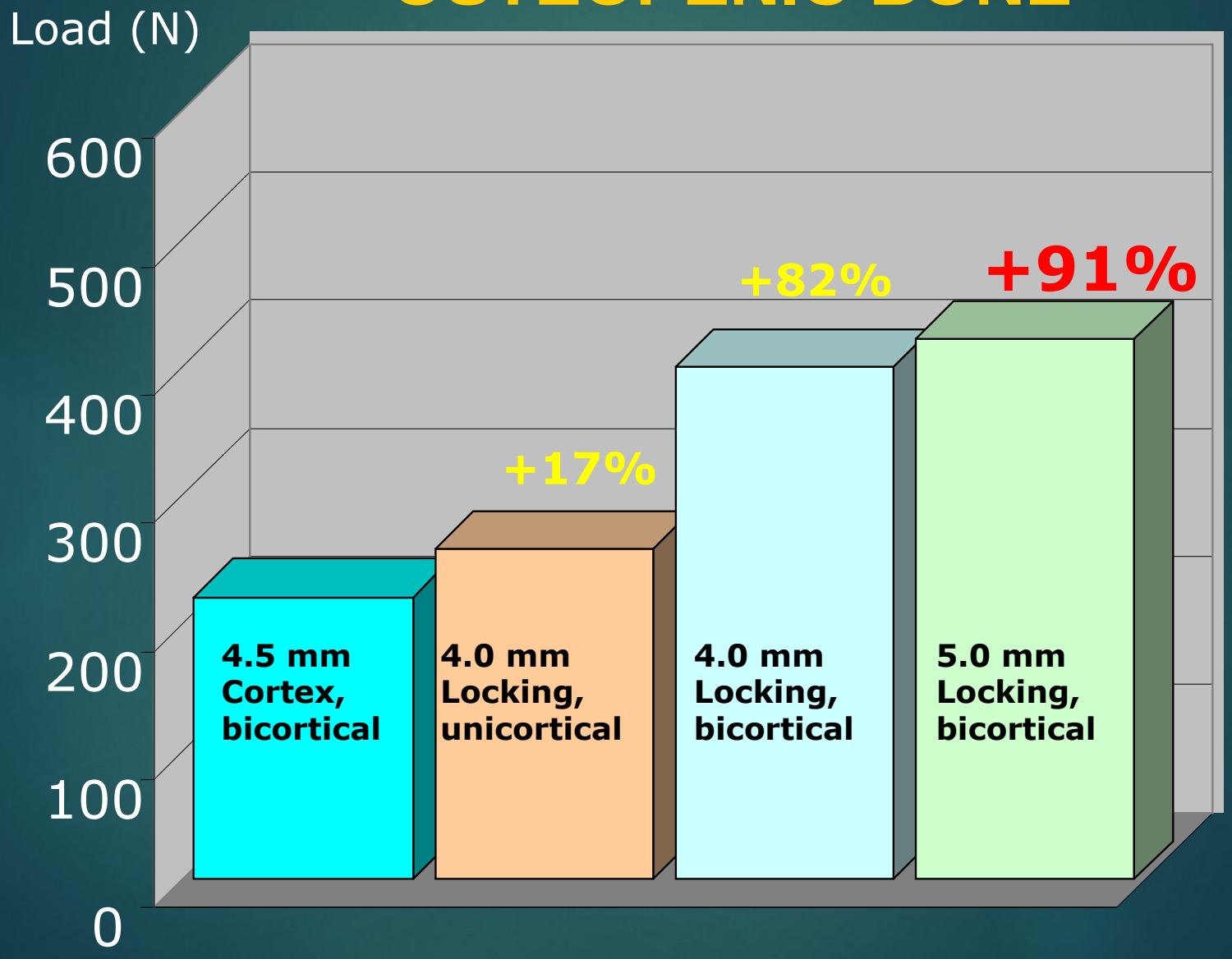
Thin cortices: choose screw diameter as large as possible


Slide
16

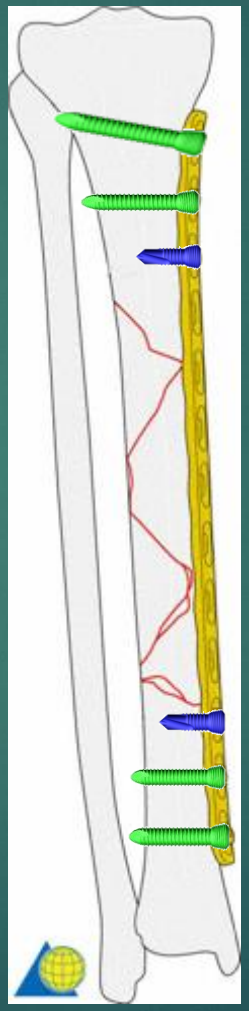
BIOMECHANICS: NORMAL BONE

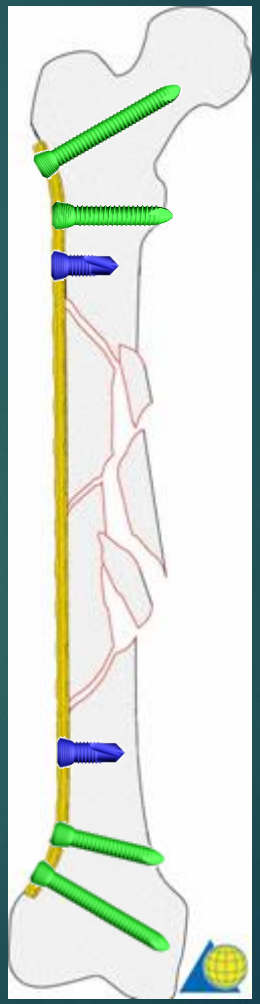


BIOMECHANICS: OSTEOPENIC BONE



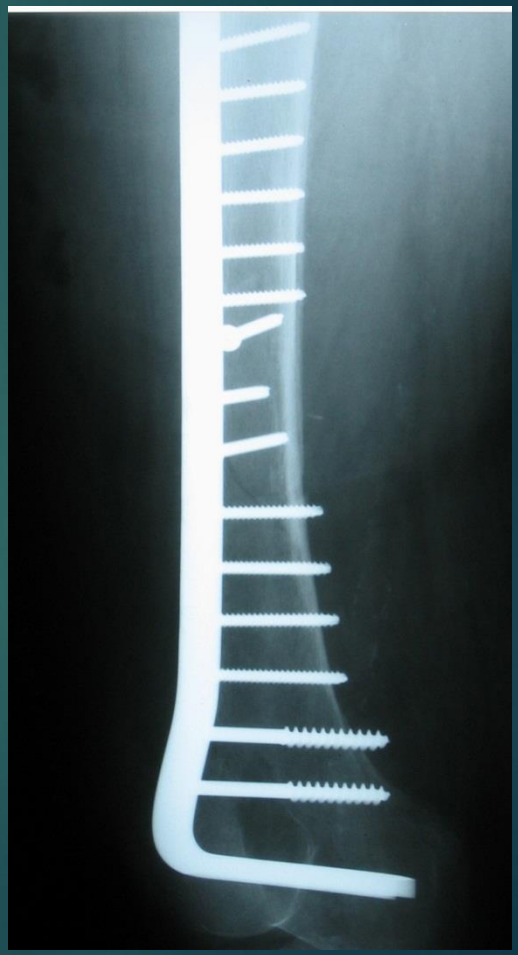
BRIDGING WITH LOCKED IMPLANT





CONCEPTS OF PLATE FIXATION IN OSTEOPOROTIC BONE

- ? compression technique
- Bridge plating useful
- Neutralization plates useful
- Long plate for bone protection



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  - Biomechanical properties
  - Choice of implants
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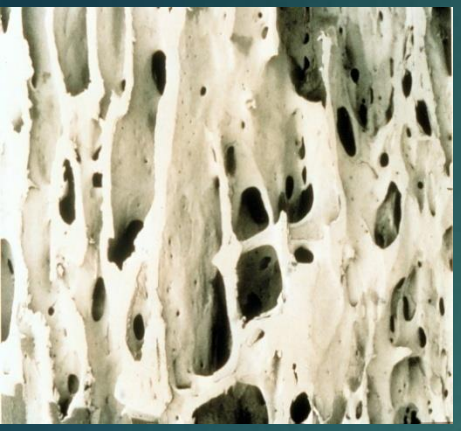
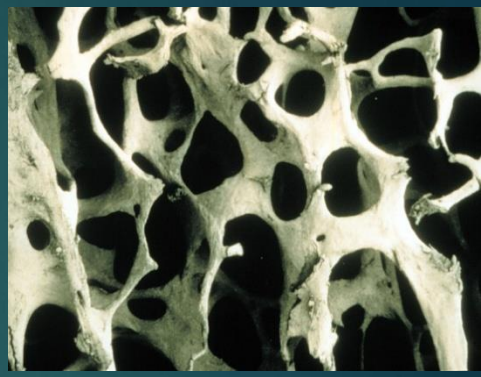
OSTEOPOROSIS



Normal bone



Osteoporosis

In osteoporotic metaphyseal bone:

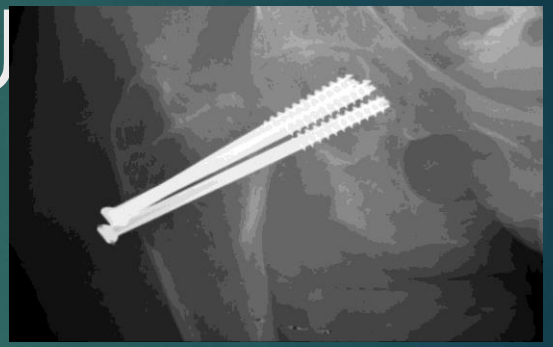
- Fewer trabeculae for screws to engage
- Loss of critical bony interconnections
- Thinner internal support

SIGNS YOUR PATIENT HAS POOR-QUALITY BONE

- Poor dentition: teeth are formed similarly to bone
- Multiple vertebral compression fractures
- Previous hip, radius, or tibial plateau fracture
- End-stage renal disease
- On steroid therapy
- Anticonvulsant use

OSTEOPOROTIC TRABECULAR BONE: CLINICAL CONSEQU

- Cut out
- Loss of screw fixation
- Spontaneous fractures



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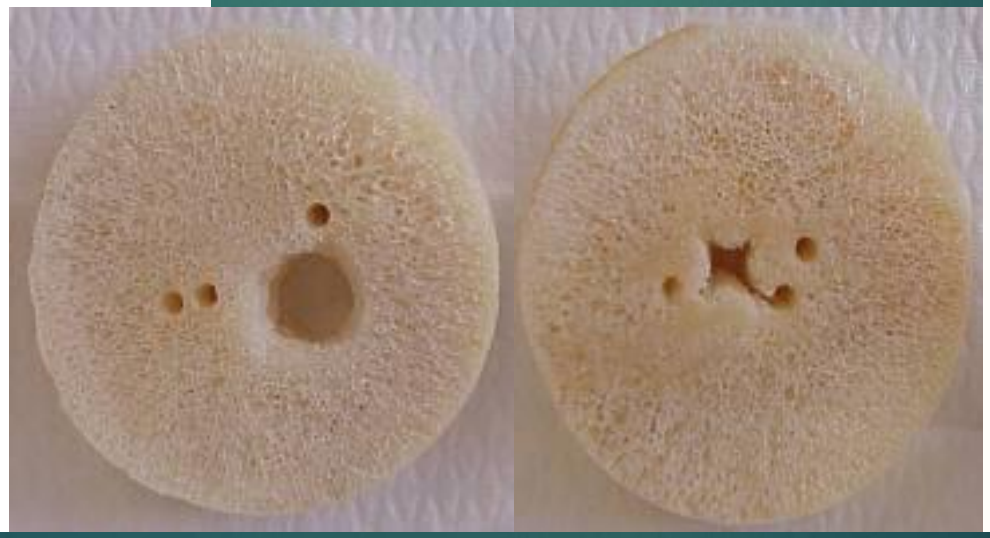
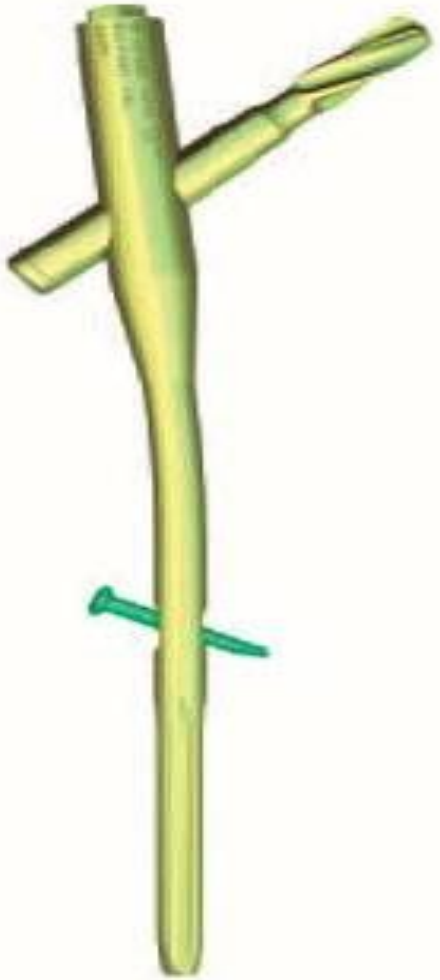
Flat surface, increased area





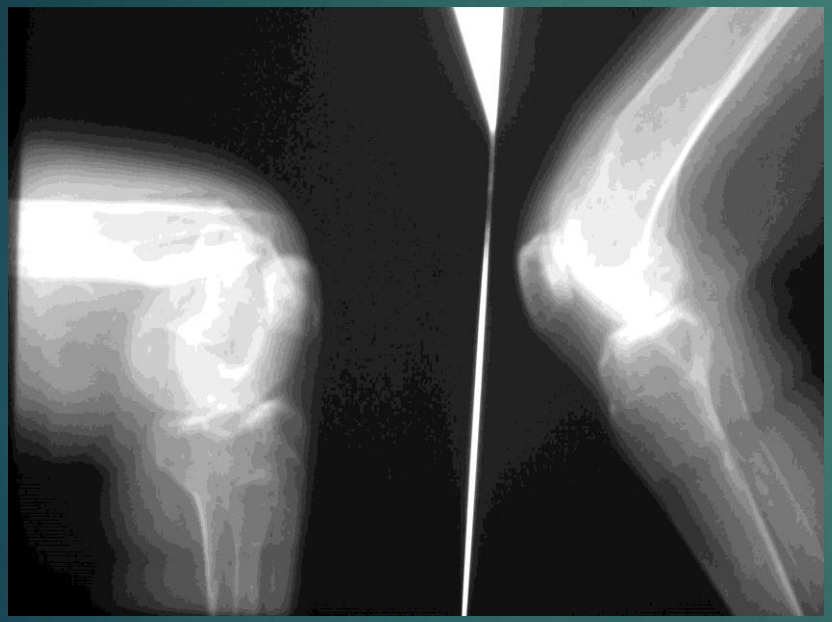
Lag screw

Less loss of bone with helical blade (right)

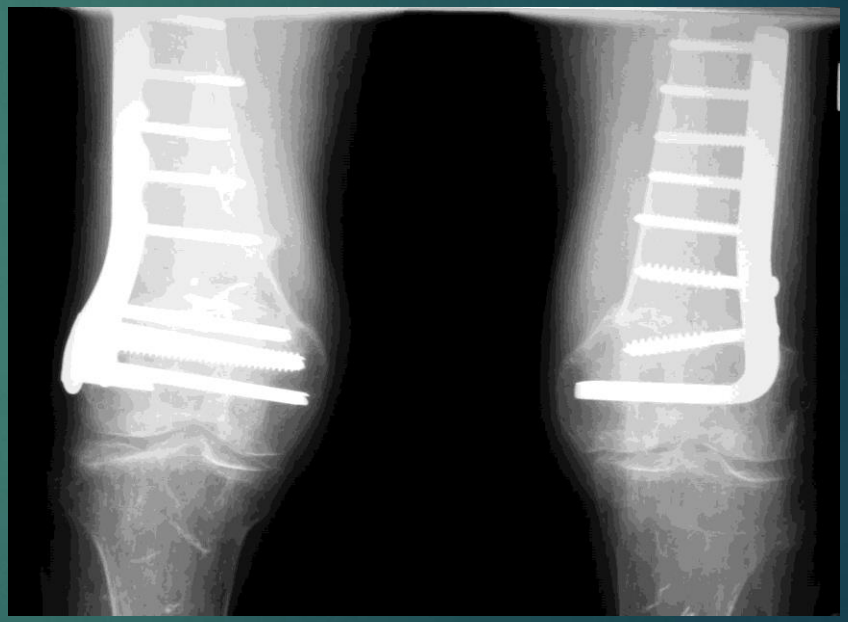
Helical blade

CHOICE OF IMPLANT: ONE FIXED ANGLE VS. MANY

Elderly woman who fell down one step

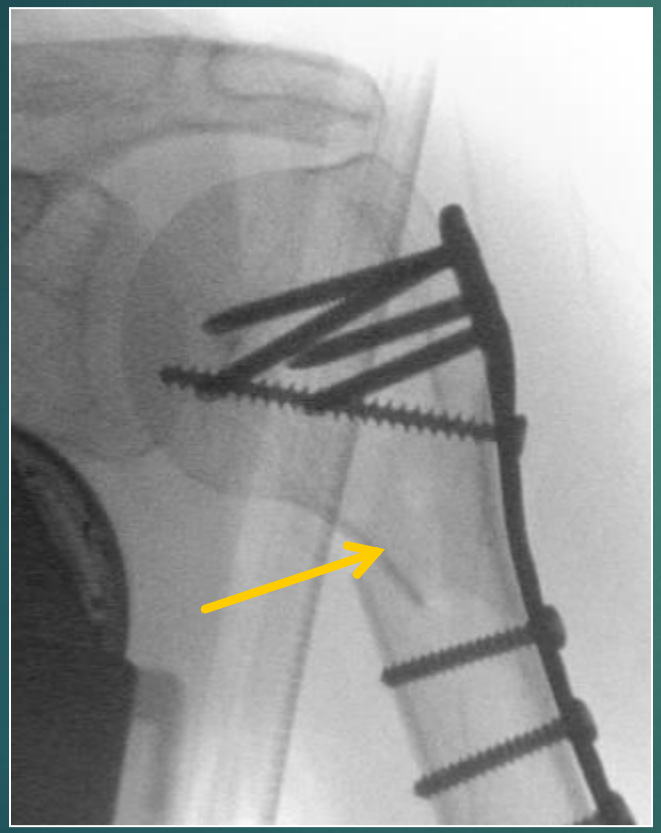


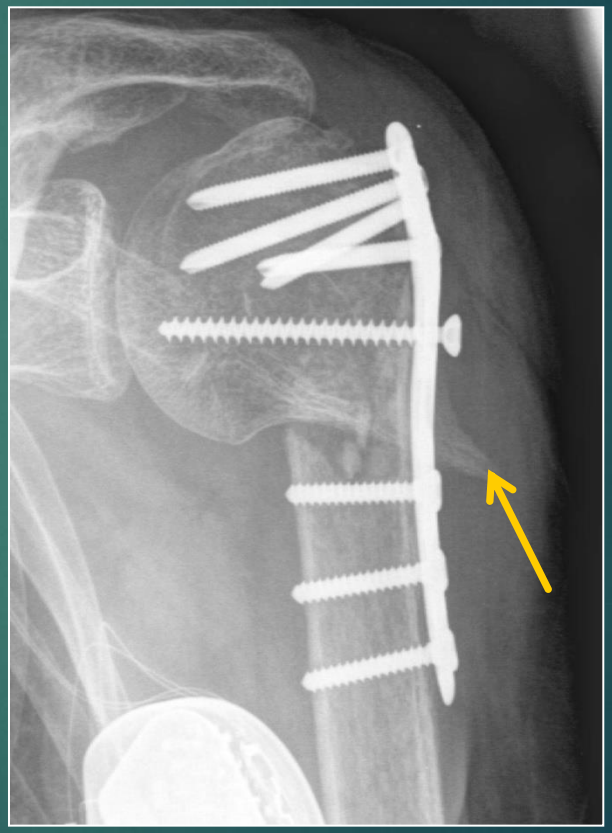
One fixed angle with blade plate



Multiple fixed angles, longer implant

VARUS COLLAPSE
DUE TO LACK OF MEDIAL BUTTRESS





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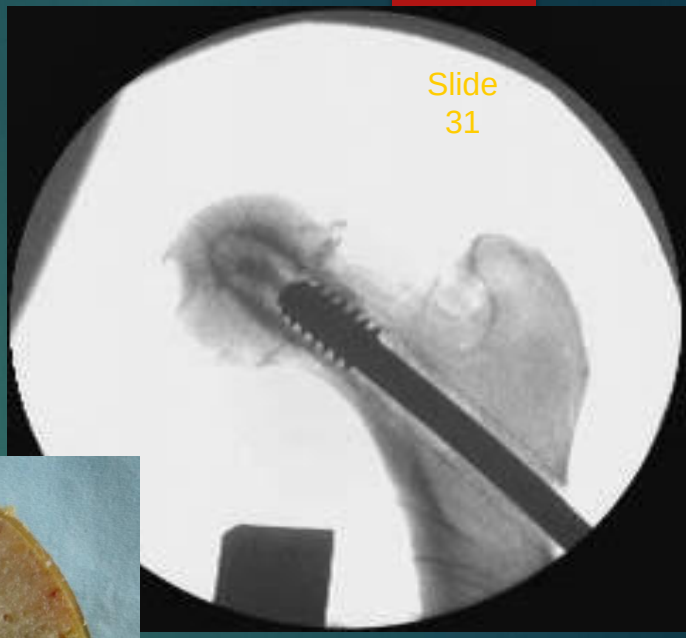
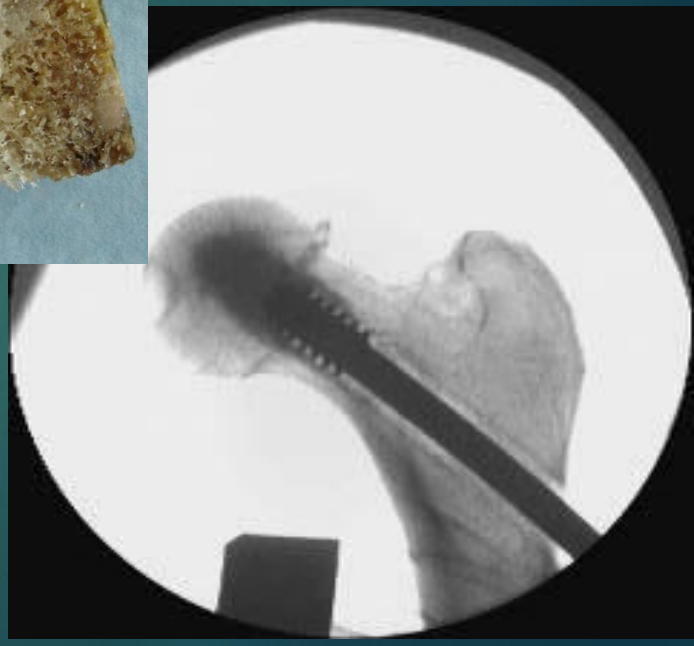
INTRA-OP IMPACTION

Augmentation to Improve Screw Fixation

Enlarges the bone implant surface area

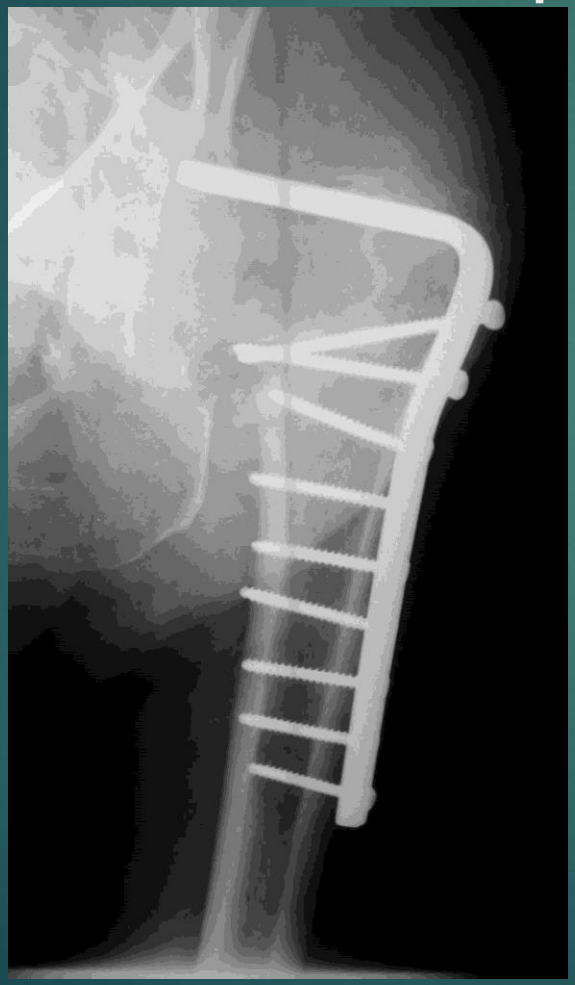


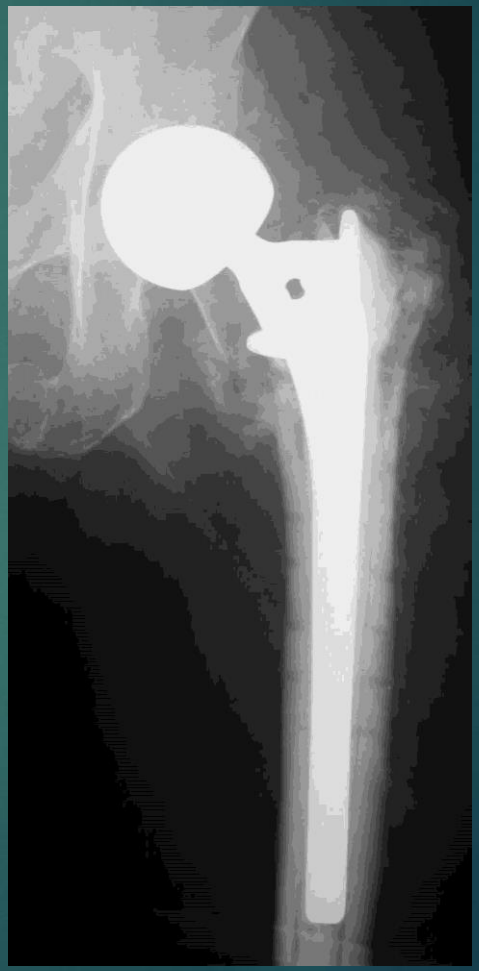


NOT FDA APPROVED!

Augmentation in practice

If bone is very poor, consider prosthetic replacement





DON'T FORGET THE SOFT TISSUES

The wound must heal also

Skin is also 98 years old

Basic Osteoporosis Work-up: Metabolic

- 25-OH vitamin D level
- Intact PTH level
- Calcium
- Phosphate
- TSH
- Albumin level

Radiologic Work-up OF OSTEOPOROSIS: DEXA Scan

- DEXA is gold standard
- T score is comparison to normal young bone
- Z score is comparison to peers
- Treat with fragility fracture and osteoporosis, osteopenia

Vitamin D Repletion

- Vitamin D2 50,000 units PO
- Level 0–10 ng/dL: 3 times / week
- Level 11–20 ng/dL: 2 times/week
- Level 21–32 ng/dL: 1 time/week
- For 6–12 weeks, then recheck level
- Maintain with vitamin D3 1200 IU/day

Treatments
After Vitamin D repletion

- For viable patients:
- Bisphosphonates
- Selective estrogen receptor modulators (SERMs)
- Parathyroid hormone

- Don't forget the bone itself: treat the osteoporosis or refer

TAKE-HOME MESSAGES

- Age & bone quality affect cortical and trabecular bone in different ways
- Absolute stability often not possible
- Principles of fixation:
  - Angular stability
  - Fracture reduction
  - Long bridging plates
  - Enlarged surface area of implant / bone
  - Augmentation
  - Prosthetic replacement