TRAUMA

Mechanics of intramedullary fixation

Nail design

Tasks

Examine various nail designs; discuss the advantages and disadvantages of each

Learning outcomes

- Describe different nail designs and their mechanical characteristics
- Explain radial preload and corresponding concept of stabilization

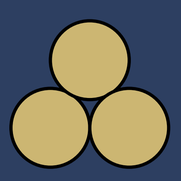
Take-home message

Nail designs

Slotted nail with cloverleaf section

Solid nail

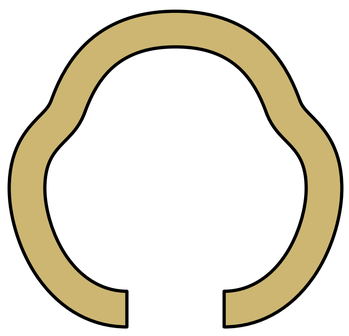
Cannulated nail

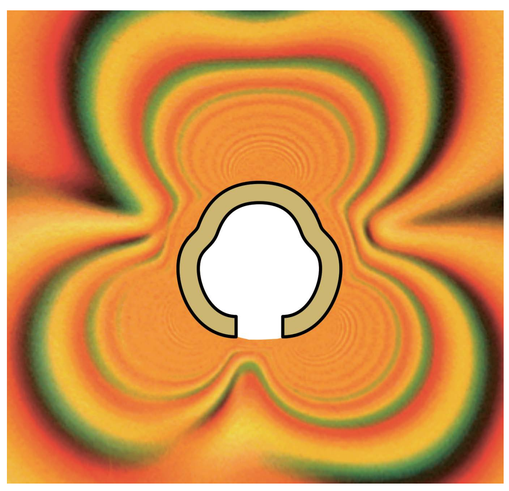


Elastic nails

Connection of nail to bone with radial preload needs

Slotted nail



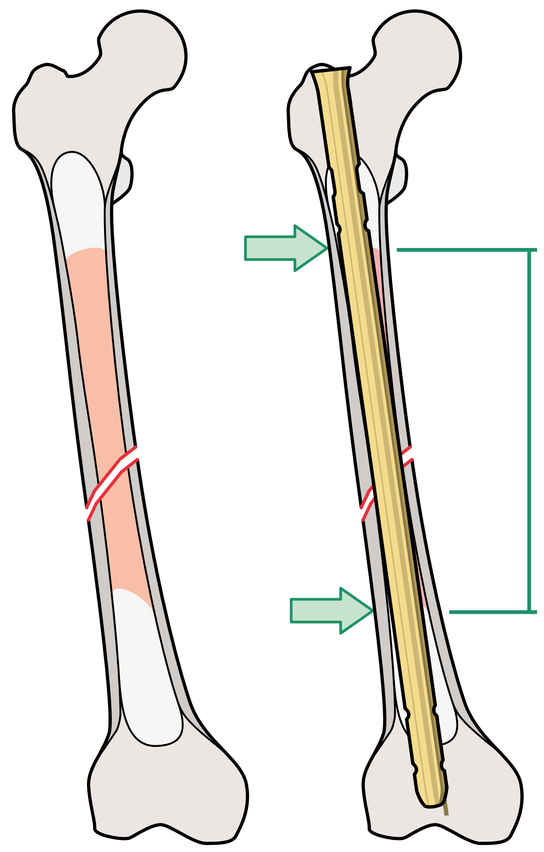


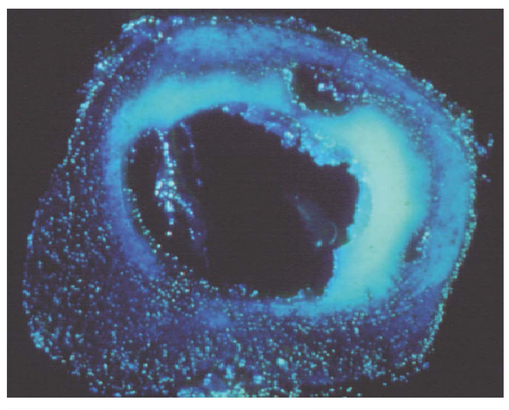
a slotted nail increases the radial preload

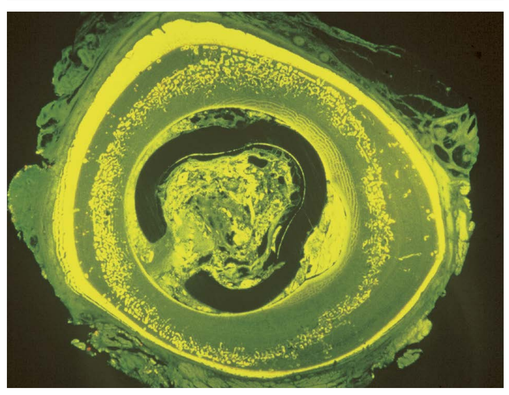
Reaming

Mechanics
Cylindrical medullary cavity
Long-distance contact between bone and nail

Biology
Necrosis of the inner two thirds of bone cortex







TRAUMA

Mechanics of intramedullary fixation

Conventional nailing

Tasks

Examine stability of different nail constructs

Learning outcomes

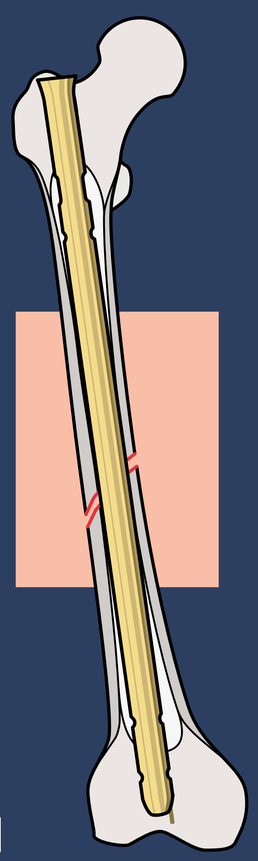
- Describe indications for nailing without interlocking
- Identify common problems using nails that are too short or too thin
- Describe possible problems of nailing without interlocking

Take-home message

Nailing without interlocking

Needs

- Nail with proper length and diameter



Prerequisites

- Fractures in middle third of diaphysis
- Partial contact between main fragments

Be aware of the need for adequate rotational stability

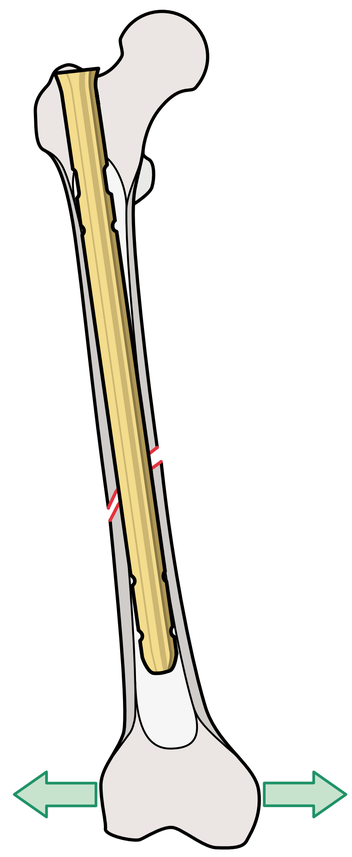
Nailing without interlocking

Requires a nail with proper length and diameter.
Should only be applied when treating fractures in the middle third of the diaphysis, where partial contact between the main fragments is possible. Even then, sufficient rotational stability is difficult to achieve.

Residual instability

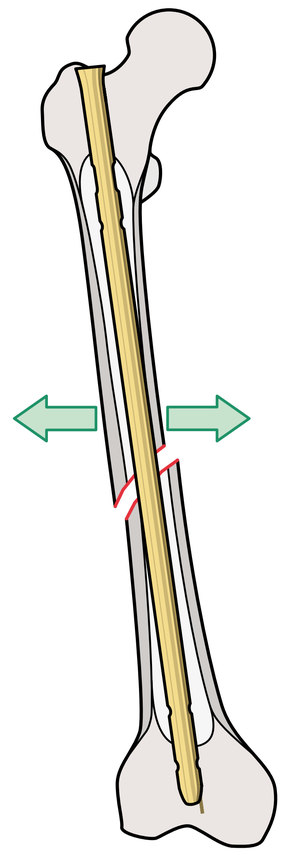
Nail too short

- Nail does not engage in the distal metaphysis
- Distal fragment unstable



Nail too thin

- No contact between nail and bone in fracture zone
- No radial preload
- Instability at fracture site



TRAUMA

Mechanics of intramedullary fixation

Interlocked nailing

Tasks

Examine stability of different nail constructs

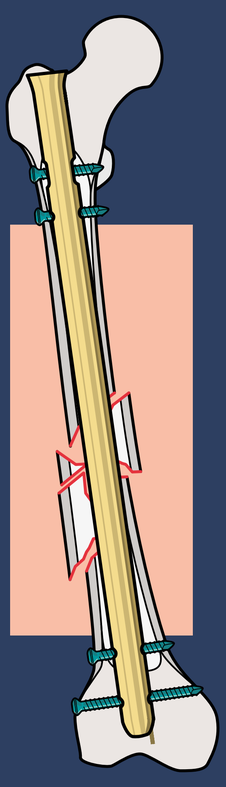
Learning outcomes

- Describe different nail locking options and possible influences on stability of fixation (dynamic locking, static locking)
- Explain elastic stable intramedullary nailing

Take-home message

Dynamic interlocking

Requires partial contact between main fragments



Static interlocking

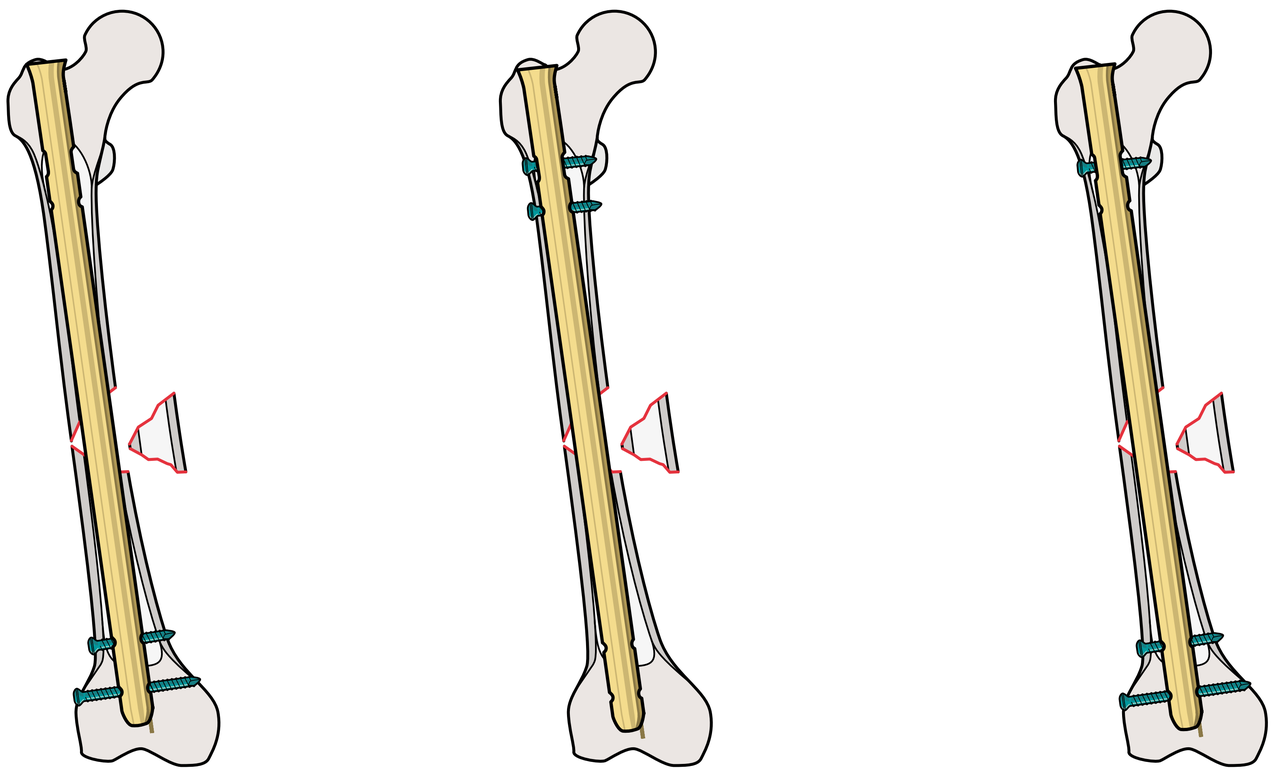
In case of no contact between main fragments

Dynamic interlocking

Only distal screws
Nail can stick out proximally

Only proximal screws
Nail can perforate knee joint

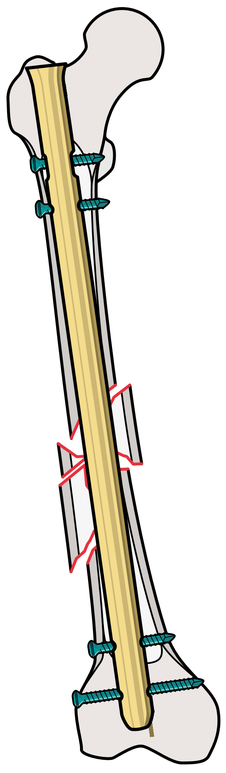
Distal and proximal screws
Proximal screw through dynamic hole allows controlled dynamization



Static interlocking

Distal and proximal screws

- Control of length
- Control of axis
- Control of torsion



Elastic stable intramedullary nailing

- For diaphyseal and metaphyseal fractures in children
- Minimally invasive
- Elastic nail
- Different diameters
- Precontouring needed