Locking plates-Use and abuse

Anna Ekman

Södersjukhuset

Stockholm

Learning outcomes

- Indications
- Advantages and disadvantages
- Techniques

Locking plates

- May be site specific
- Anatomically contoured
- Complex instrumentation
- Mechanically different to conventional plates

Oblong screw hole allows for fine tuning of the plate position.

> Ulnar most proximal fixed angle k-wire is used to reference proper plate position as well as predict peg distribution when using the standard technique

> > Distal fixed angle k-wire hole used to reference proper plate position as well as predict peg distribution when using the distal first technique

> > > F.A.S.T. Guide " technology allows for easy drilling of fixed angle locking screws as well as indicates side specific implants by color coding

Locking pegs and screws provide a strong peg to plate interface

The distal end of the plate is contoured to match the watershed line and the topographic surface of the distal volar radius

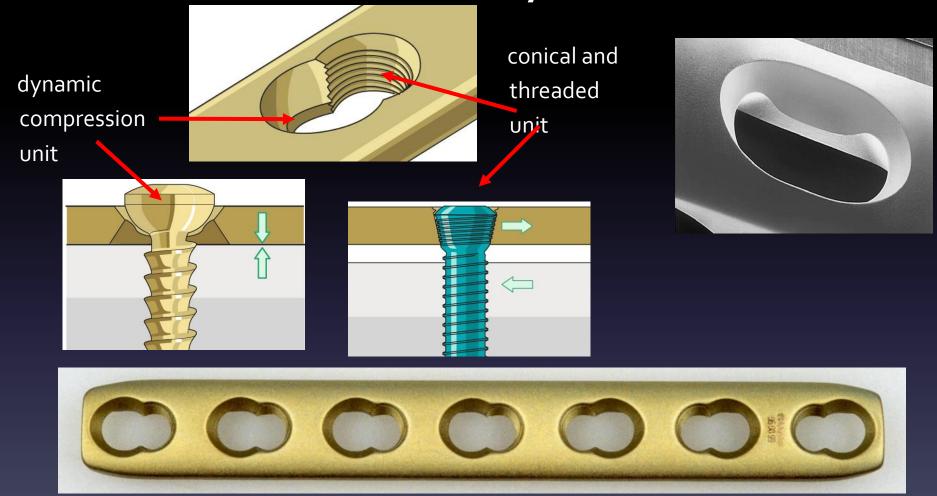
Threaded pegs available to secure fragments in the coronal plane

Anatomic design of the plate matches the topography of the distal radius and thus follows the "watershed" line to provide maximum buttress for volar marginal fragments

Proprietary divergent and converging rows of pegs provide 3 dimensional scaffold for maximum subchondral support

> Multi-directional threaded pegs allow for angulation within a cone of 20 degrees for maximum interoperative flexibility of locking screw placement

How do they differ?



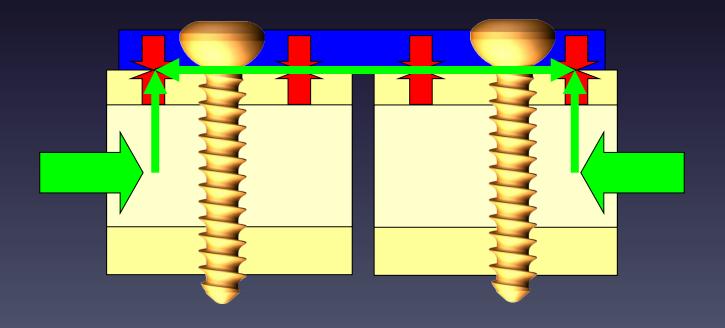
How do plates work?

Load transmission

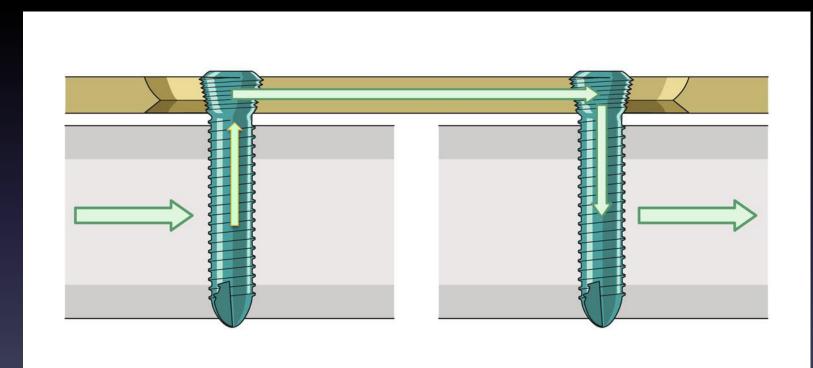
- Standard plate
 - Plate to bone compression
- Locking plate
 - Load through fixed plate-screw interface

Standard plate

- Function by:
 - compression of plate to bone
 - Dependent of purchase/bone quality
 - Load shared by plate and bone



Locking compression plate(LCP)



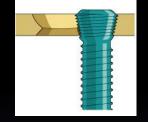
Load through the plate

Functions of locking head screws (LHS)

Always in combination with a

plate

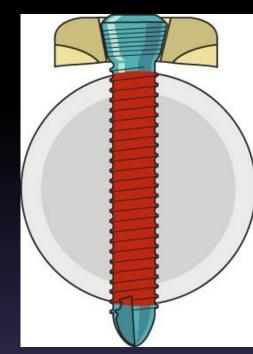
- Never as lag screw
- Never cross an unreduced fracture with a LHS





Unicortical or bicortical?

- Osteoporotic bone
 - Bicortical
- Normal bone
 - Probably bicortical



Features and advantages of LCP

- Axial and angular stability
- Cannot be over-tightened
- No primary loss of reduction
- No or less screw loosening, no or less secondary loss of reduction

Drawbacks of LCP

- Screw insertion is only possible in certain angles
- Loss of the feel for the quality of bone during screw insertion and tightening
- Screw jamming and difficult implant removal

Loss of feel





Modes of failure

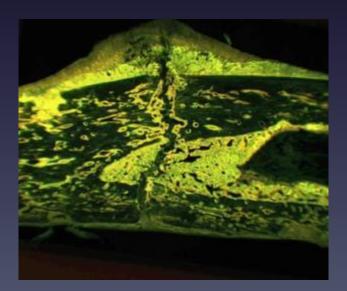




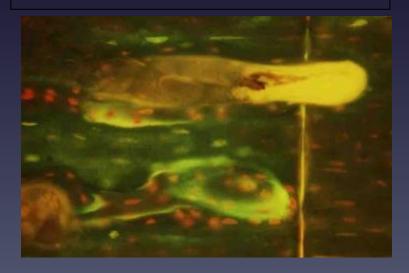
How do I use the plates? -Mechanical stability Respect principles of absolute and relative stability – regardless of implant

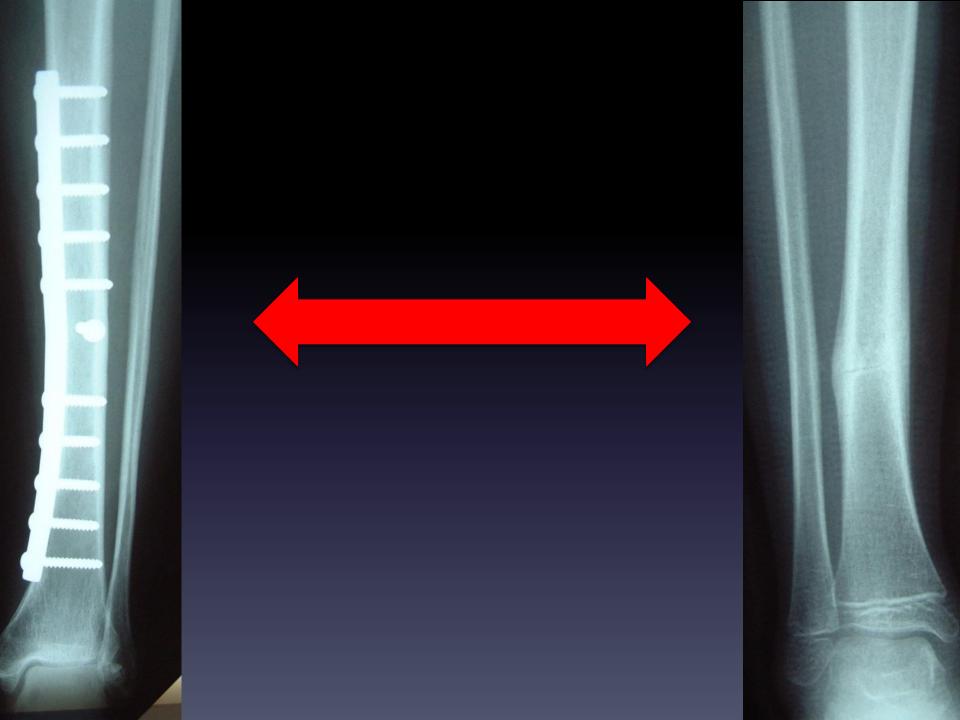
• Relative stability

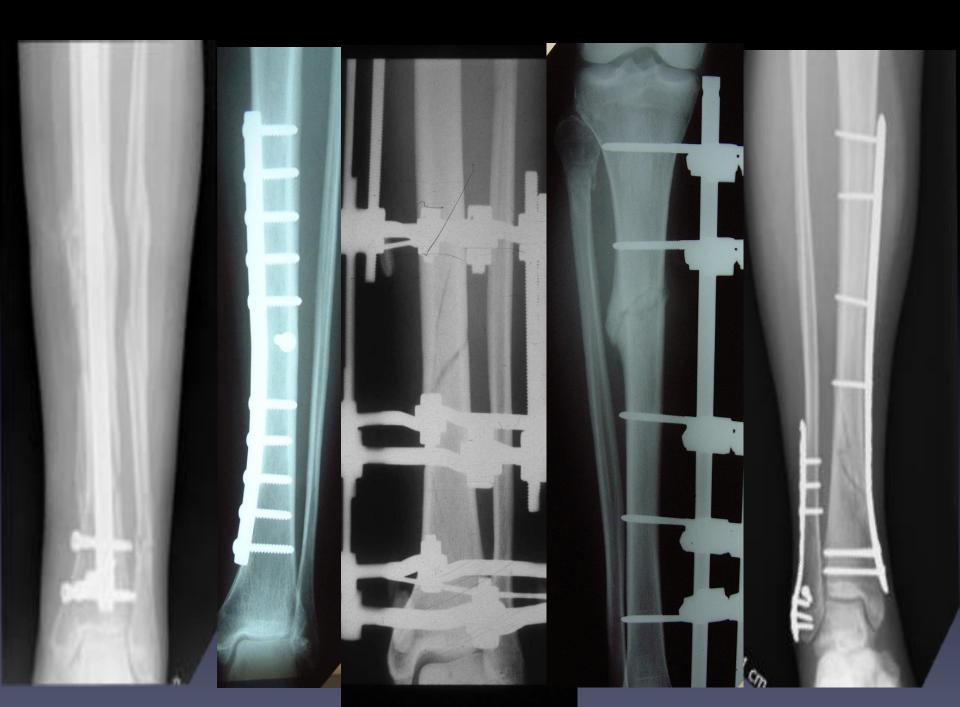
• Callus



- Absolute stability
- Compression
- Direct bone healing

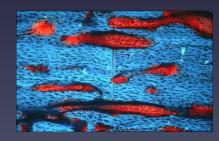






Planning and decision making

- The stability of the fracture fixation determines bone healing
- How much stability is necessary? Absolute or relative stability
- What kind of bone healing is best for the type of fracture?
 Direct or indirect bone healing
- Which are the technical limitations? (eg, iatrogenic trauma)



direct bone healing



indirect bone healing

Locking plates

- Mechanically stiffer than non locked plate
- Best used in bridging mode
- Aiming to work with relative stability
- Too stiff for simple fracture patterns?

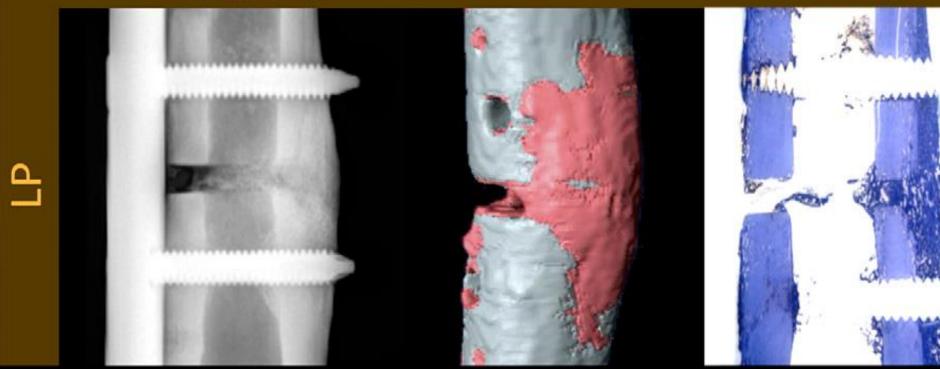
Fracture healing – locking plates

- Higher rate of delayed union
- Asymmetric callus

Radiography

CT

Histology



Non-union machine



Hybrid fixation

Combination of compression and bridging with one plate

 A combination of both methods is possible when two_different fractures occur in the same bone.

As in;

• Articular fracture with additional metaphyseal/diaphyseal fracture

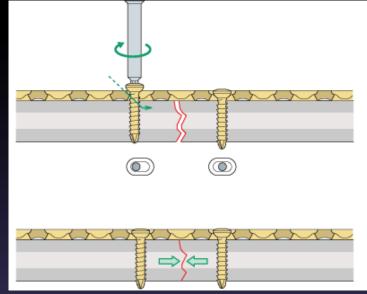


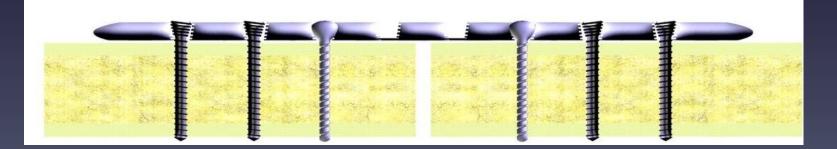
Hybrid bridging w locked plates

- Indirect, closed, reduction
- Long plate- Working length
- Fixation with LHS/CS only on main fragments
- Elastic fixation to achieve relative stability



Fracture surgery first "Compress (lag) before lock"





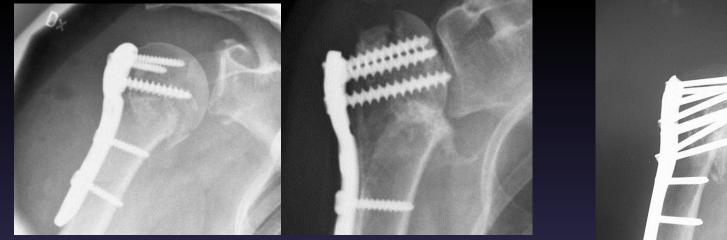
LCP cannot compensate for bad surgical technique







Or for bad biology





 20-30% complications in the elderly

[Launonen Acta 2015]

Principle failure– 41% "major treatment failure"





Indications for locked plating

- Peri-articular fractures
- Osteoporotic fractures
- Osteotomy with opening wedge
- Multifragmentary fractures
- Periprosthetic fractures

Pre-operative planning

- Plan according to principles
- Plan reduction technique/s
- Selection of implants
- Sequence of screw insertion
 - Standard then locking
- Function of screw used

Contouring

٥

2

1

300/MG

Screw placement

3

R

Locking plates - advantages

• Minimally invasive insertion

• More reliable fixation in osteopenic bone

Locking plates - disadvantages

Delayed union

• Asymmetric callus

Summary

- Locking plates offer enhanced stability
- Anatomically shaped
- Secure fixation in osteopenic bone
- Careful selection and insertion of implants