

Intraarticular proximal tibia fractures:

A bicondylar fracture




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Knee Fractures

SPORTS RELATED



Ullevaal University Hospital
Trauma Unit

The challenges:

- Classification
- Fracture treatment in high velocity cases
- Soft tissue injuries
- Results and complications
- Ullevaal guidelines

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Tibia condylare fractures:

- 1% of all fractures
 - 8% in elderly
- 55- 70% laterale plateau
- 10- 23% medial plateau isolated
- 10- 30% bicondylare

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Schatzker 1979

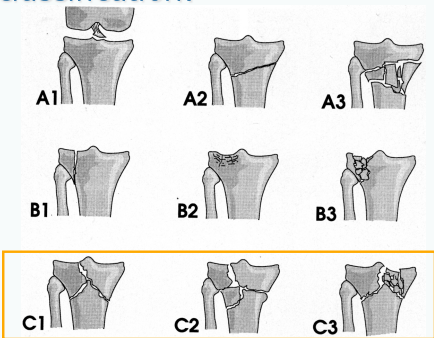


I II III IV V VI

Leveling → Flattening

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AO classification:



A1 A2 A3

B1 B2 B3

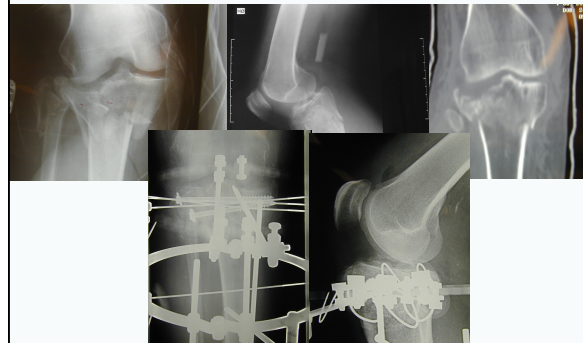
C1 C2 C3

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M 42 car accident



An alternative



Controversies

- Surgical treatment?
- Non-surgical?
 - Brown 1988, JOR
 - Rasmussen 1973, JBJS
 - Kettelkamp 1988, Clin Orthop

Controversies

- 1980 →
 - Trend towards surgery
- 1990 →
 - New techniques
 - MIPO
 - Exfix
 - Intramedullary nails

Controversies

- Low energy injuries:
 - An abundance of reports with good results from surgical and conservative approaches
- Mid and high energy:
 - Usually surgical approach

Schatzker

- Immobilization >4 weeks results in stiffness
- ORIF **and** immobilization results in even more joint stiffness!
- The knee joint must be mobilized early regardless of approach!
- As long as ROM is good, later surgical interventions are possible

Schatzker

- Impacted joint fragments cannot be repositioned with traction alone
- Depressed joint surface areas will not repair with hyaline cartilage, depressed areas stay depressed.

Schatzker's principles of treatment

- Fractures with instability = ORIF
- Normal joint surface can only be achieved through open exposures and reposition
- Anatomic reposition and stable fixation is necessary for cartilage repair
- If OREF is indicated, but cannot be done due to the condition of the patient, the patient should be treated with distraction and early motion.

Treatment goals:

- Stability
- Joint congruency
 - Maximal contact between the joint areas
- Avoid compartmental overload
 - Normal joint axis



Diagnostic approach

- Skeletal injuries
- Soft tissue injuries
- Additional injuries
- Mechanism of injury
- Radiographs
- CT with reconstructions
- Angiography
- Compartment pressure measurements
- Arthroscopy

Additional ligament injuries

- Laterale plateau fractures:
 - MCL/ ACL
- Medial fractures:
 - LCL/ ACL/ PCL/ n. peroneus/ a. poplitea



Planning:

- Additional injuries-multitrauma
- Neurovascular injuries
- Soft tissue status
 - Open-closed injury
- Degree of depression of the joint
- Degree of condylar separation
- Degree of comminution
- Stability-ligamentous injuries

Surgical treatment

- Absolute indications:
 - Open fracture
 - Compartment injury
 - Vascular injury
- Relative:
 - Lateral fractures with instability
 - Most medial fractures with instability
 - The majority of dislocated, bicondylare fractures

Timing

- Acute with vascular injury and compartment
- Open fractures during day time ASAP- preerable definitive soft tissue treatment simultaneously.
- The alternatives are traction or overbridging exfix

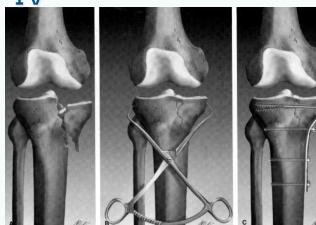
Preop planning:

- Adequate diagnostic procedures
- All necessary equipment
- Surgical technique
 - reposition
 - fracture fixation
- Experience
- Day time surgery

Preoperative planning

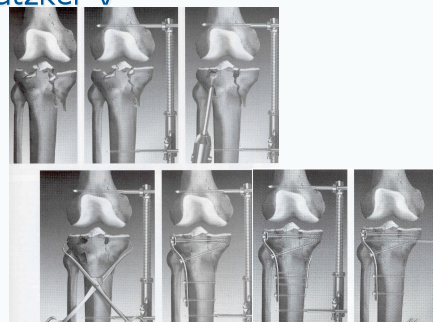
- | | |
|-------------------|------------------|
| • Reposition | • Fixation |
| – open? | – plates |
| – percutaneously? | – Ex fix systems |
| – distractor | – nail |
| – arthroscopy | – other ? |
| – imaging | |

Schatzker IV

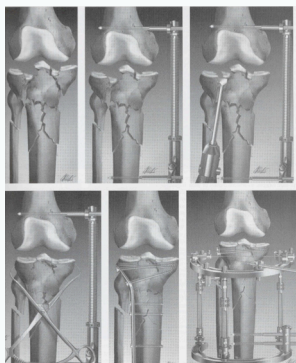


- Frequently eminence fractures and LCL
- Obs vasculare and nerve injuries

Schatzker V



Schatzker VI



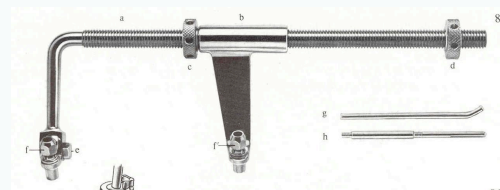
Soft tissue treatment:

- Open fractures:
 - 1. Primarily coverage if possible
 - 2. Primary revision and serial revisions until final coverage within 6 days.

Approaches:

- Percutaneously
- Open techniques:
 - Straight anterior or two
 - Full thickness flaps
 - Transverse arthrotomy under the menisci
 - Keep or reconstruct the menisci
 - Wedge fractures may be dislocated to improve the approach to fixed depressed fractures
 - Do not use Mercedes incision
 - Tibial tubercle tenotomy
 - Quadriceptstenotomi

Reposition

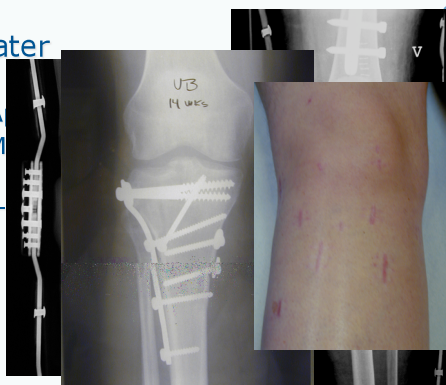


Fixation:

- Plates
- Ex fix systems
- Intramedullary nail
- LISS
- LCP

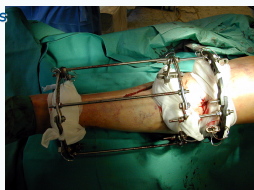
Plater

- A
- M

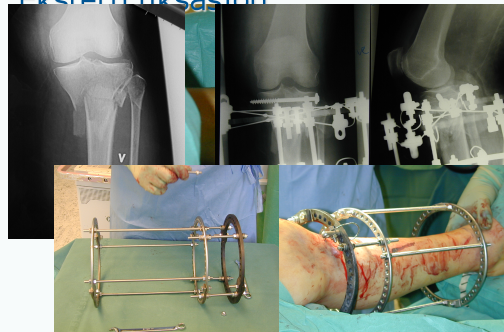


Ex fix:

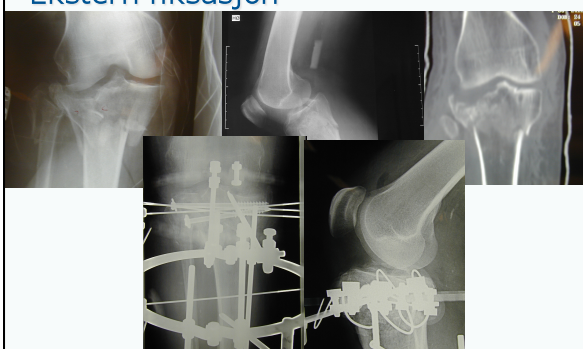
- alone
- Combined with mini osteosynthesis
- Avoid apex pins close to the joint
 - Stamer 1994: 13 % infections
 - Whittle 1995 (unpubl.): 7 % infections, 7 % malunions



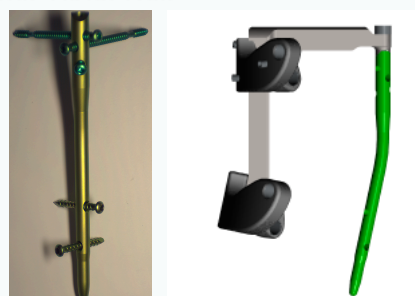
Ekstern fiksasjon



Ekstern fiksasjon

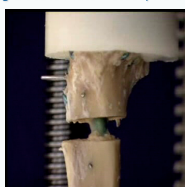


PTN Proximal Tibial Nail



Results

Axial Loading Double Plate Osteosynthesis (900 N)



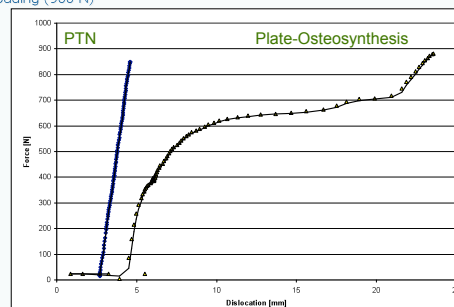
- Elastic biomechanical behavior
- Only minor fracture gap movement

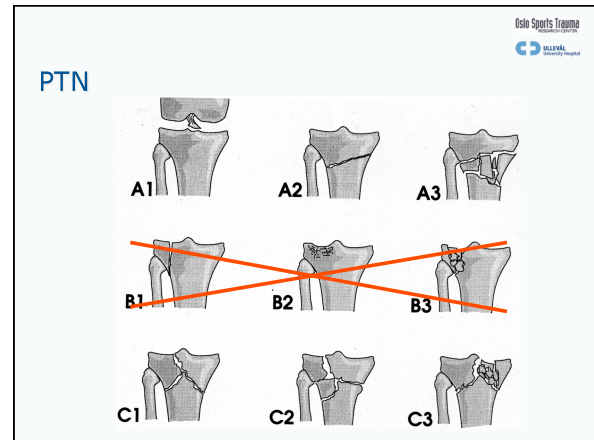
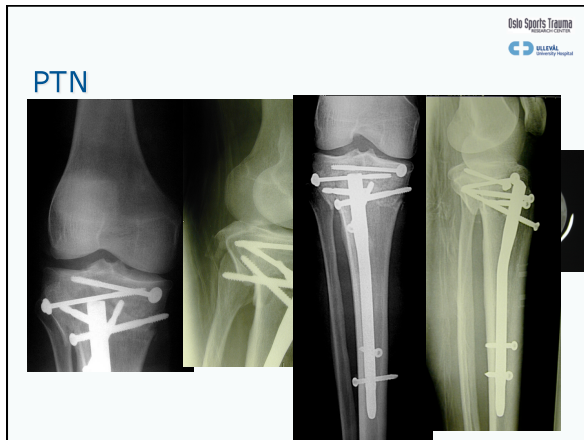


- Mechanical failure
- Tilt of the proximal fragment
- Cortical contact dorsally

Results

Axial Loading (900 N)





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LCP Locking Compression Plate 2001 LCP

Introduction of the Locking Compression Plate.

The experience gathered in all the cases treated with angular stability or with dynamic compression led to the development of the combination hole. As a result, the new Locking Compression Plate System was created. The LCP provides the surgeon with the choice to carry out internal fixation using either standard screws or locking head screws or a combination of both.

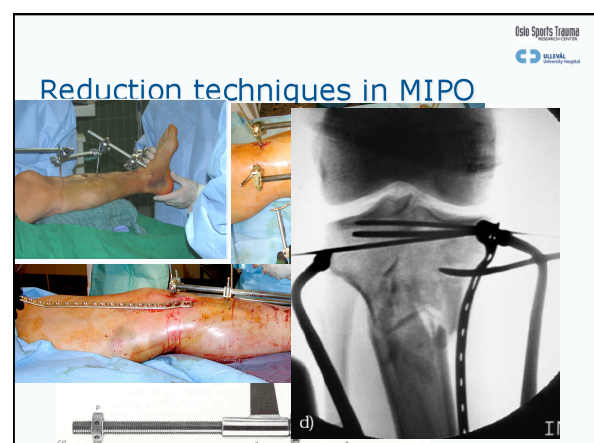
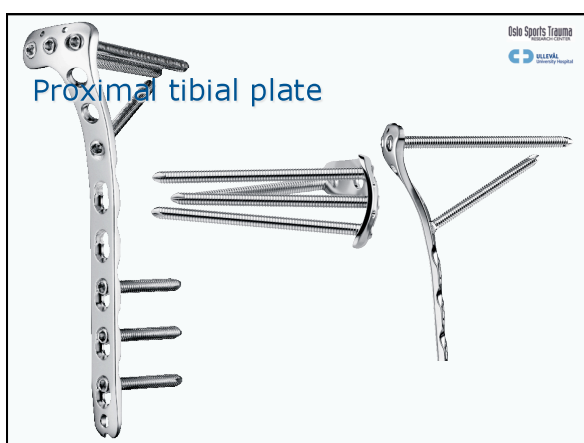
AO/ASIF has set a further milestone in its quest to find better solutions for the surgeon and for the patient.

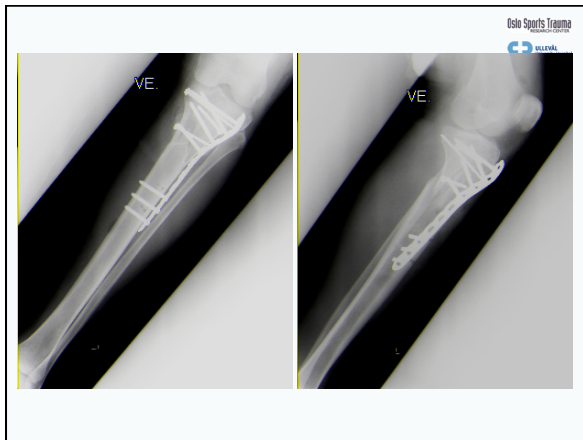
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Fixed angle devices

- Offer better stability
- Allow less invasive introduction
- Indirect reduction techniques
- Technically demanding

From: Cole PA, Injury 2003





LISS
Less Invasive Stabilization system
1990 LISS

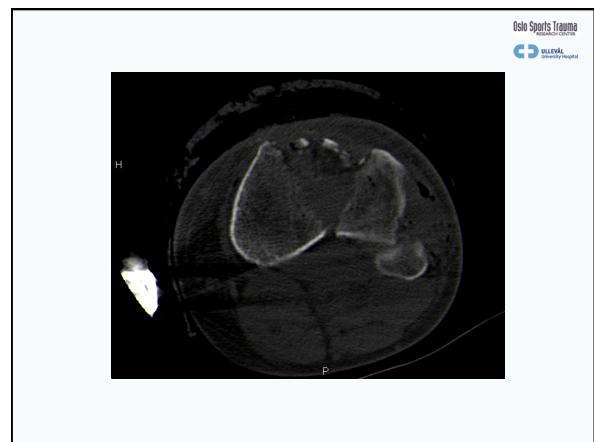
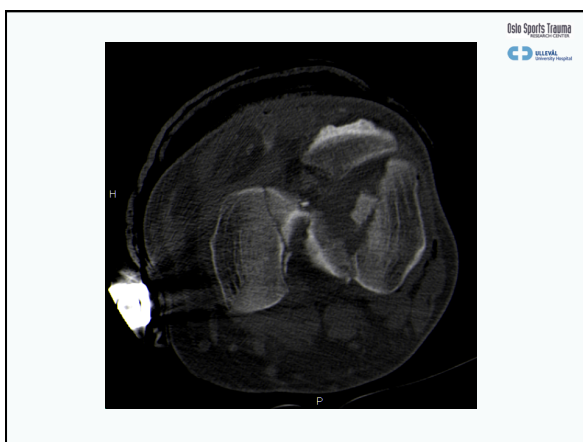
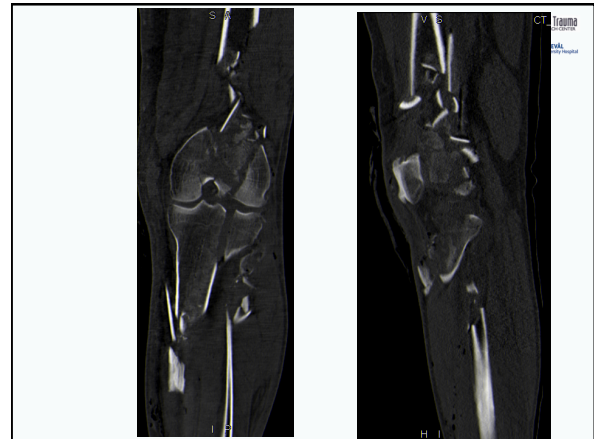
Development of the Less Invasive Stabilization System (LISS).

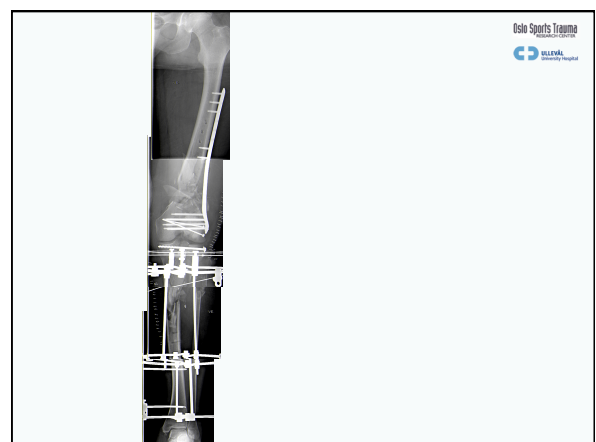
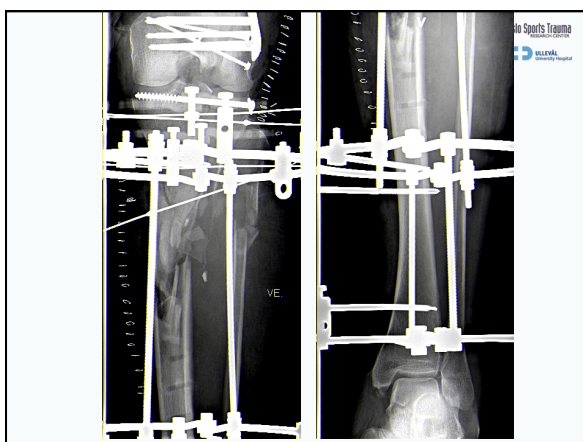
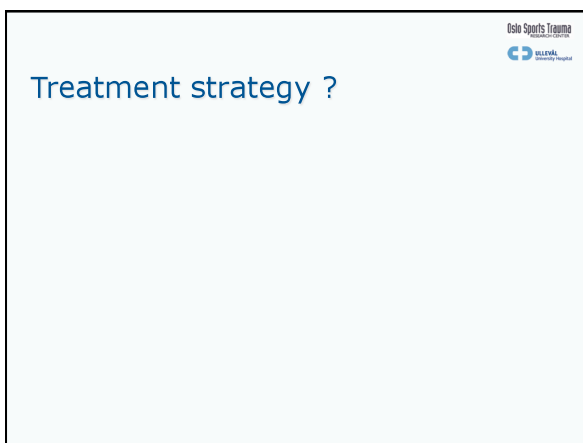
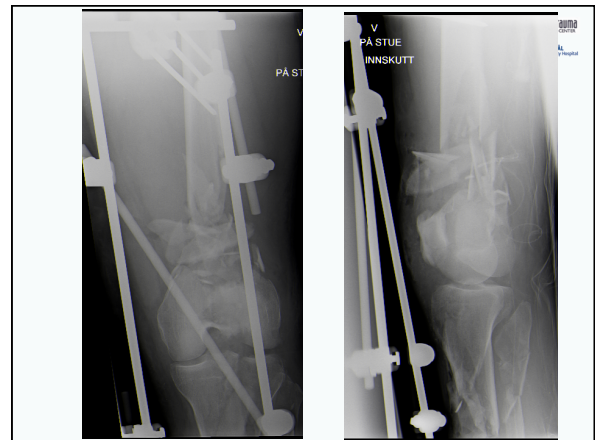
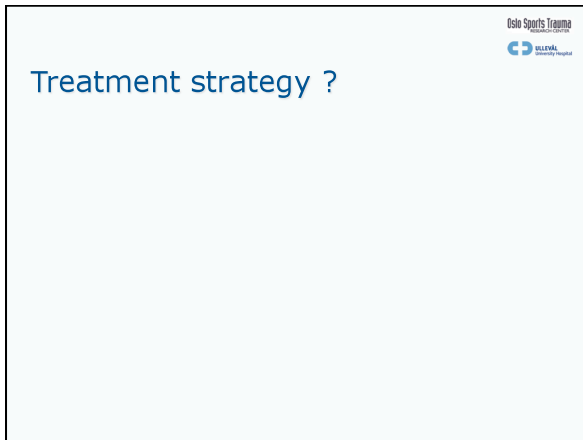
Thanks to an insertion guide, this revolutionary system permits the use of a more soft-tissue friendly surgical technique. In addition, the self-drilling screws with angular stability enable an easy placement and an extremely stable internal fixation in multifragmentary fractures of the distal femur and the proximal tibia.

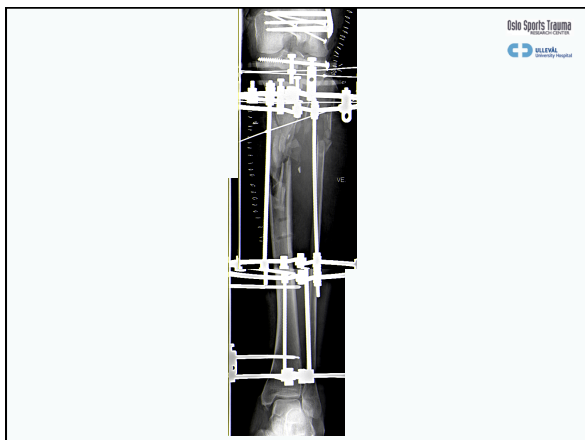
These features have proved their worth particularly in osteoporotic and peri-prosthetic bone fractures.

Case

- M 42
- MC accident sept 2004
- Single injury
- Femur IIIA open
- Tibia closed
- Obvious compartment syndrome

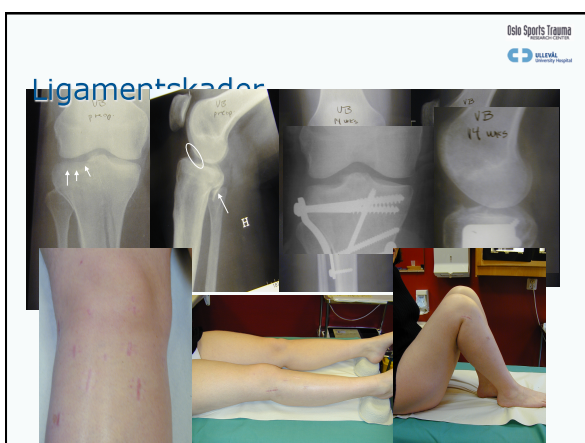






Ligament injuries:

- Frequent (30-70%)
- Under diagnosed
- Repair bony avulsions
- Usually do not repair midsubstance tears
 - Exception for knee dislocations
 - Exception for the posterolateral corner



Conclusions

- Day- time surgery
- Less invasive techniques
- Avoid open double plating



Conclusions

- The most important prognostics are:
 - Stability
 - Alignment
 - Early mobilization
- Aim of surgery is to restore these factors

