This article looks at the most important factors in treating tibial plateau fractures and indications for the use of locking plates.

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Proximal tibial fractures: indications for the use of locking plates

Fractures of the tibial plateau are caused by a combination of axial loading and bending forces resulting in several fracture patterns, the most common being either a multifragmentary wedge fracture or articular surface depression. The result is a decrease in the joint surface area available for weight bearing and axial malalignment.

Understanding the injury by a careful assessment of the patient, the limb and the radiographic examinations (plain x-rays: AP, lateral, and oblique, as well as the CT scan and its reformations) is mandatory so that an acceptable treatment plan may be developed. The most important factors in the treatment of tibial plateau fractures are:

• Joint dislocation or subluxation
• Articular surface fragmentation and depression
• Meniscal lesions
• Ligament lesions with consequent joint instability
• Malalignment
• Soft-tissue conditions

These factors are probably cumulative in negatively influencing the prognosis and resulting in arthritis and instability. The treatment goal is to obtain joint congruity, axial alignment, and sufficient stability to allow for early functional rehabilitation.

Angular-stable fixation
The new locking plates allow angular stability and improved purchase in osteoporotic bone. Depending on the plate type they may be used in either the locking mode (LISS and LCP) or as a standard plate (LCP). This provides the opportunity to use these new implants in different plate functions of fixation:

• Neutralization plate (LCP)
• Locking compression plate (LCP)
• Internal fixator or “locked splinting” (LISS, LCP)
• “Antiglide” or buttress—(usually LCP, but LISS will work)
• Bridging plate (LCP, LISS)

As well, the locking plates may be applied so as to avoid compression of the periosteal vessels and hence limit the disruption to the blood supply to the cortex.

Therefore in the preoperative tactic, it is necessary to plan:

• The approach
• The steps and the instruments for reduction
• The method of osteosynthesis
• The choice of implants based on the function necessary to stabilize the different fracture pathoanatomies
**Pathoanatomy of the fracture and locked plate indications**

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**Split fractures**  
*(Schatzker Type I, Müller AO/OTA 41-B1)*

This is a simple joint fracture with the potential for meniscal entrapment at the fracture site. Reduction may be performed in a direct open or arthroscopic manner. Fracture fixation requires independent lag screw compression beneath the joint surface and either a fracture apex screw with washer or a buttress plate. Locking plate use for this pattern is uncommon except with osteoporotic bone.

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**Joint depression fracture**  
*(Schatzker Type III, Müller AO/OTA 41-B2)*

Fractures with pure depression are rare. Normally the joint is elevated through a cortical window in the metaphysis and the reduction controlled arthroscopically or with image intensification. The window is packed with a bone void filler and buttressed with a nonlocking mode plate. Independent rafter screws are placed next to the reduced joint surface to help support the reduction. In young people lag screws are sufficient.

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**Split depression**  
*(Schatzker Type II, Müller AO/OTA 41-B3)*

This fracture pattern requires an open direct reduction to assure that the depressed joint surface is reduced and stabilized with some form of bone void filler (cancellous bone or bone graft substitute). Fracture stability is achieved by lag screw compression across the split fracture line with the screws placed close to the reduced joint surface to act as support. The axial forces are buttressed with a plate. As there is no angular instability, no locking is necessary unless the bone is osteoporotic, and usually a LCP 3.5 is used or uncommonly a LISS plate.

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**Medial plateau fracture**  
*(Schatzker Type IV, Müller AO/OTA 41-B1.2, B2.3, B3.2)*

Fractures of the medial tibial plateau are generally considered occult knee joint dislocations or subluxations as the femur displaces medially and posterior with progressive internal rotation. An injury to the popliteal artery may be present and arteriography or another form of arterial imaging should be considered. Through a direct reduction technique using a posteromedial approach, the joint is reduced and stabilized with lag screws. Joint depression when encountered is reduced and stabilized as with the lateral plateau fractures. A buttress plate is mandatory to neutralize the medial axial forces or else secondary displacement will occur. Usually a locking plate function is not necessary except with osteoporotic bone.
Multifragmentary tibial plateau fracture leading to vertical instability.

Treatment by direct articular reduction using 5.0 mm compression screws and application of a bridging LSS-plate. The whole procedure was performed using the less invasive technique.

Postoperative result: Fast callus formation and return to full function after 4 months.

Complete proximal intra-articular tibial fractures
(Schatzker Type V, Müller AO/OTA 41-C1)
These are simple fractures of both tibial plateaus with simple extension to the metaphyseal region. As a consequence, reduction can be achieved easily with axial traction. Through a posteromedial approach, the medial plateau is reduced and stabilized first as it provides the guide to the right length of the limb and allows the various stresses necessary for the reconstruction of the lateral tibial plateau. Fracture stability is achieved by lag screws between the two plateaus and buttress plates on both sides. Generally it is not necessary to use angular stable fixation as the reduction is anatomical and stable, and also, the dual plating will prevent collapse. In selected cases, if the medial plateau is undisplaced it's possible to fix the medial plateau to the lateral plateau with lag screws and buttress the lateral plateau with a locking plate using locking screws to prevent the potential secondary varus collapse of the medial plateau through angular stable fixation.

Multifragmentary complete intraarticular proximal tibial fractures
(Schatzker Type VI, Müller AO/OTA 41-C2-C3)
These are multifragmented articular fractures of both plateaus with extension to the metaphysis and diaphysis. These fractures will require a direct reduction of the joint surfaces and support by a bone void filler. After reducing the fracture through a mini-arthrotomy (TARPO approach), the medial fracture is fixed and then the lateral plateau built back to the medial side transforming itself from an intra-articular to extra-articular fracture. The metaphyseal component and diaphyseal extension are reduced by distraction and stabilized with locking type plates. The surgeon must determine in the preoperative tactic the function of each screw inserted—whether locked or not. In these fractures it is common to use locked screws as position screws so as to help support the joint reduction. As locked screws they will provide more stability than the nonlocking position screws as they are angular stable.
Conclusion
After an atraumatic anatomical reduction including elevation of the impacted articular surface with bone defect filling, stable fixation of the construct may require the use of angular stable fixation. This will be determined by the fracture pattern, the need to enhance the stability of the reduction, the need for articular surface support and the quality of the bone. The more fragmented the extraarticular fracture component and joint surface is, the greater the need for locking plates, as well as with those patients with poor bone quality.
a  Spiral fracture of the tibial metaphysis.
b  Treatment by using two compression screws in the tibial plateau and a LISS bridging plate in a neutralization function.
c  Healing process postoperatively.

Recommended reading


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