

When to use locking implants?

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Locking plates: A variety of different veterinary locking plate systems is commercially available: the Compact UniLock (Synthes), locking compression plate (LCP; Synthes), String-of-Pearls (SOP; Orthomed), Fix-in (Traumavet S.r.l.), and Advanced Locking Plate System (ALPS; Kyon) systems. Locking plates have been compared to external fixators, with regard to their mechanical properties, hence have been called «internal fixators».

Those internal fixators provide a number of biological and many technical advantages in comparison to other existing fixation methods. Nevertheless, further laboratory investigations into the biomechanical parameters, particularly of metaphyseal fractures with joint participation, are needed as ex-vivo studies have yielded conflicting results. The effects of combining both the compression and locked screw principles should further be addressed.

The use of locking plates has been particularly advocated for treatment of juxta-articular fractures (short metaphyseal segments), fractures of long osteoporotic bones, fractures treated according to minimally invasive plate osteosyntheses (MIPO) principles, applying the concept of «biological osteosynthesis» and periprosthetic fractures. Due to the «fixed» angle between screws and plate, without the need of friction forces between the two elements, expected «adequate» stability is acquired with less screws in comparison with conventional systems. Stress relaxation, a phenomenon at the origin of progressively decreasing stability with conventional plates and screws, particularly in osteoporotic bone where implant failure from screw pullout under bending conditions is a major concern, is not an issue anymore.

- Less screws allows a longer working segment of the plate hence less rigidity (relative stability) of the construct which may contribute to a more rapid healing of the fracture site, avoiding the stress shielding effect.
- For the screw is not pressed against the plate, hence the plate is not pressed against the cortices; the periosteal blood supply underneath the plate is preserved which is in favor of the healing process.
- For the plate is not pressed against the bone, precisely contouring the plate to the shape of the bone is not required, a feature which makes the locking plate particularly useful during MIPOs.
- As the screw heads are locked into the hole, the bone threads can no longer be stripped during insertion of the screws. Unrelated to the locking technology per se, locking screws happen to have a larger core diameter than their counterparts in conventional screws (hence a much greater strength in bending (200%) and shear (100%). Due to the increased contact surface between the bone and the screws, the stress at the screw/bone interface decreases, an advantage for both bone and screws. Furthermore, the screw heads are conical (compared to hemispherical in conventional screws) allowing a better distribution of forces between screw heads and threaded holes.

Locked plating in osteoporotic femoral diaphysis can improve fixation strength under axial compression but may reduce fixation strength in bending and torsion compared to conventional plating! In axial loading, the fixed-angle stabilization explains higher strength of the LCP, whereas stiffness is comparable. Bi-cortical screws perform better than mono-cortical ones; in torsion failure of bi-cortical screws occur just underneath the plate, where screws are bridging the elevation between the plate and the bone.

For the clinical use of the locking compression plates (LCP) as a locked internal fixators in bridging plate techniques and MIPO, two or three screws on either side of the fracture are recommended for femoral and tibial fractures, which are mainly loaded in compression. The position of the first screw near the fracture and the additional screw depends on the fracture gap size. In simple fractures with an interfragmentary gap smaller than 2 mm, one or even two plate holes near the fracture gap should be omitted to allow fracture motion and bone contact to occur.

For comminuted fractures, three screws are recommended on either side of the fragment with two screws as close as practicable to the fracture site. In plate osteosynthesis of the humerus and the forearm of human patients, where mainly torsional load predominates, three to four screws in each main fragment are recommended, as torsional rigidity depends more on the number of screws than axial stiffness. Three screws can be placed as described above with the fourth screw in any position. If the plate must be placed at a distance from the bone for anatomical reasons, the screws should be positioned closer to the fracture site to improve construct stability.

The combined use of bridging method (locking screws) and compression method (conventional screws) like in LCPs, allows the surgeons to address, with the same implant, articular fractures with a multifragmentary fractures extension into the diaphysis or segmental fractures with two different fracture patterns (one simple and one multifragmentary).

Interlocking nail: Interlocking nail (ILN) osteosynthesis is considered as the treatment of choice for most long bone diaphyseal fractures in people. It has gained increasing acceptance in veterinary orthopedics particularly with the emergence of the angle-stable (AS) ILN, eliminating the slack between the locking screws and the nail, hence improving the mechanical performances of the whole construct. Such AS-ILN can be used to treat diaphyseal fractures of the femur, humerus and tibia but also metaphyseal and non articular epiphyseal fractures. One case of radius and ulna fracture has been reported.

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