Locked plate stabilization of problem fractures

Locking plates of various designs and specification are readily available commercially for fracture stabilization. All of these implants perform similarly, acting as angle stable internal fixators in regard to the plate-screw junction. There is a range of different mechanisms employed to achieve an angle stable locking connection between the plate and the screw, such as the locknut, threads on the screw head, or the conical coupling. The outcome and complications of appendicular diaphyseal fractures and osteotomies stabilized with locking plates in clinical patients have been reported in several studies over the last ten years. A recent study focused on complications found that locking implant-related complications occurred in nine percent of fractures (1). Some of these complications included plate bending and screw pull-out; all were in comminuted fractures stabilized by bridge plating. While locking plates have advantages for minimally invasive osteosynthesis of non-reducible shaft fractures, it is important to be aware that locking plate constructs are not immune to this particular complication when functioning as a bridging plate.

Locking implants may also have a place in the stabilization of sesamoid bone fractures. Fractures of large sesamoid bones, such as the canine and feline patella, and the equine proximal sesamoid bones are important clinical problems because they have a poor prognosis for uncomplicated healing. Repaired fractures of these bones are subject to large tensile loads; therefore the traditional recommended treatment has been tension band wiring, although the clinical results of this approach are often poor. Bone plates can also tolerate axial tensile loading well, and bone plate fixation of sesamoid bone fractures has been proposed in place of other methods.

Hybrid locking plate fixation of equine proximal sesamoid osteotomies sustained greater quasi-static loads to failure than lag screw repairs (2). These early results indicated that angle stable locking plate fixation might have a role in the stabilization of large sesamoid bone fractures. This concept was further extended by a new study published in this issue of the Journal that found that a canine patellar fracture model stabilized with a prototype locking plate tolerated greater cycles of loading than a pin and tension band wire repair (3).

Improved biomechanical stability of large sesamoid bone fractures might improve the clinical outcome. The sesamoid bones are composed of very dense compact bone that would favour secure implant fixation, but little is known about the biology of healing of these bones. Most sesamoid bones are intra-articular and therefore any overlying hyaline cartilage would preclude extra-osseous vascularization or periosteal osteogenesis, during fracture healing. The vascularity of the human patella is derived from two or three arteries that penetrate the cranio-distal aspect of the bone; perhaps this explains the occurrence of avascular necrosis of the base of the patella after mid-body transverse fractures in humans (4). However, there is an obvious lack of knowledge about the overall mechano-biology of sesamoid bone fractures and their repair.

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References