Fracture Morphology and Fracture Management

Our first issue of VCOT for this year contains several papers pertaining to the study of fracture morphology, and the stabilization of fractures with bone plates (1-3). In addition, Herten and colleagues describe the characterization of mesenchymal stem cells isolated from bone marrow by a point-of-care device; these cells had osteogenic potential that could be expected to contribute to the repair of fractures and osseous defects (4).

Stability of conventional bone plate fixation of fractures relies on friction between the screw head, the plate and the underlying bone. Conventional plates need to be accurately contoured to exactly match the surface topography of the bone underlying the plate, so that the plate makes good contact with the bone. If the plate contouring is imprecise, then final tightening of the screws can result in translation of the bone fragments and loss of reduction at the fracture site.

By contrast, locking bone plates rely on a rigid interaction between the screw head and the hole in the plate. Accurate plate contouring is not necessary because direct contact of the plate with the underlying bone is not required. Apart from the saving in intra-operative time that is normally required for plate contouring, this feature of locking plate fixation might result in less disturbance of bone blood supply.

Several different mechanisms have been developed to produce a rigid, locking interaction between the screw and the plate for locking plate fixation. One of the earliest was a threaded locking nut connecting the bone screw to the plate in the Polish technique of Zespol osteosynthesis (5). The Zespol plate can be applied as an internal or an external fixator. A more popular design is one with external threads on the screw head that engage a threaded round hole in the plate, such as that found in the No-Contact Plate, and the Locking Compression Plate® (6, 7). Another recent innovation is a Morse-type conical coupling, incorporated into the Fixin plate (8).

In this issue of the Journal is a report about a clinical and radiographic study of canine appendicular fractures stabilized with locking plates that utilize the conical coupling system (2). It was found that 89% of fractures reached clinical union without complications. Fixation failure was mainly due to plate bending and breakage.

In the case of imperfectly reduced fractures, both conventional and locking plates function as a buttress plate, and are subject to cyclic bending loads in the region of the fracture gap, resulting in plate bending or plate fatigue and breakage. One limitation of the Fixin plate is that the round hole, conical coupling design of the plate does not allow generation of static interfragmentary compression in two-piece diaphyseal fractures. The presence of small fracture gaps, even those less than 1 mm, can eliminate load sharing between the plate and bone, and increase the risk of fatigue failure of the plate. Therefore when buttress function is anticipated, then the use of a thicker plate, double plating, or plate rod fixation should be considered; also application of plates with an empty screw hole in the region of the fracture should be avoided. Some of these strategies were successfully employed in the cases described by Nicetto and colleagues (2).

The novel use of a locking bone plate in the successful treatment of a tibial fracture in young grey seal is also described in a case report, and highlights the challenges of managing complications, rehabilitation and follow-up fracture evaluation in a wild animal (3).

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References