Introduction

The role of mechanical stability in fracture fixation has evolved from the period of inadequate implant fixation, to the era of ORIF (open reduction and internal fixation) as popularized by the AO, and finally to the concept of biologic fixation (Schatzker and Tile 1996).

Unstable fixation often leads to catastrophic results such as delayed union, non-union or loss of reduction. Absolutely stable anatomic fixation usually results in primary bone union achieved by direct haversian remodeling (George et al; 2005).

Plate fixation, initiated 100 years ago by Belgain Albian who originated the term osteosynthesis. Has historically been an integral part of surgical fracture management. In 1949 Lambotte`s Scholar and Ropert Danis introduced the first compression plate. This was the basis of the original compression plate of Muller and Mathys which featured round holes and removable tension device. In 1969, the dynamic compression plate (DCP) was introduced integrating the compression mechanism into a newly designed plate hole. Further studies showed that any plate which is compressed over a large contact area of bone surface interferes with the underlying vascularity of bone. The resulting development of the under cuts of LC-DCP (low contact DCP) design however only partially solved this problem (Perren 2002).

Locking-plate technology has changed internal fixation techniques for many fractures. The locking plate technique has evolved from using all-locked screws with a non-anatomically contoured plate to a newer concept of using a “hybrid plate”: a mixture of locked and AO-type non-locked screws with a more anatomically contoured plate. This construct permits the utilization of compression screws, which enhance fracture reduction and interfragmentary compression, while retaining the biomechanical advantages of locking screws. Studies have shown that hybrid plates allow the flexibility to use a compression technique for the simple fracture and fixed angle locking technique for comminuted portions (Messmer et al; 2003).

Locking internal fixators allow for callus formation through increased flexibility in stabilization. Additionally, they do not depend on the screw purchase in bone and as a result are more advantageous in comminuted and osteoporotic fractures (Danielle and Tarun 2007).

The threaded screw concept of locked plating devices is designed to use a mechanical interface between the plate and the screw, rather than a friction fit between the plate and the bone, to bear the loads and stabilize the construct. As the screw is advanced the final 3 to 4 turns, the male threads on the screw mate with the female threads on the plate to form a mechanical lock between the two. The idea for this locking design concept being that this construct will provide axial and angular stability and therefore not permit screw back out, screw toggle, or many of the causes of hardware failure in osteosynthetic applications. Additionally, because compression between plate and bone is not required, there will be less disruption to the cortical blood supply (Kiner et al; 2007).

Locking plates convert shear stress to compressive stress at the screw–bone interface; fixation is improved because bone has much higher resistance to compressive stress than shear stress. In locked plates, the strength of fixation equals the sum of all screw–bone interfaces rather than that of the single screw's axial stiffness or pullout resistance as seen in unlocked plates (Cordey et al; 2000).