THE SOP LOCKING PLATE SYSTEM

Karl H. Kraus, DVM, MS, DACVS, DAVBP
Professor of Orthopedic and Neurosurgery, Chief of Surgery
Iowa State University of Science and Technology
College of Veterinary Medicine

The SOP (String of Pearls) was designed to serve as a locking plate system for the veterinary and human orthopedic community. As with all locking plate systems, the SOP can be thought of mechanically as internal – external fixators. The SOP consists of a series of cylindrical sections (“internodes”) and spherical components (“pearls”). There are three system sizes which accommodate 3.5mm, 2.7mm and 2.0mm screws. Mechanical testing using ASTM standards has demonstrated that the 3.5 SOP is 50% stiffer, and has a bending strength (load at which the plate plastically bends) of 16-30% greater than the LCP, DCP, or LC-DCP. Plate pullout force is significantly greater than DCP plates, especially in flat bones such as the scapulae and mandible. The SOP be contoured in six degrees of freedom; medial to lateral bending, cranial to caudal bending, and torsion using specially designed bending irons. The plates can be used in pair as they are designed to nest together. The SOP plates accepts standard cortical screws. This greatly reduces cost of implant, and total implant costs are comparable to standard DCP plating. The disadvantage is that standard bone screws have relatively small minor diameters. Screw breakage is a concern if too few screws per bone segment are used. Typically four screws, either unicortical or bicortical, are recommended. It may be necessary to add a second SOP plate to achieve sufficient numbers of screws. The SOP system is strictly a buttress plating system. Fractures that are best treated with dynamic compression should be repaired with DCP systems. The plates are not luted to bone, and as such failure is not typically be screw pullout, rather implant breakage or bone slicing. Cold welding of the screw to the plate is not an issue as bolt cutters allow complete removal of a screw/pearl unit.

Applications in the appendicular skeleton include plate/rod repair of comminuted femoral fractures. This can be performed with minimally invasive techniques. The contourability and narrow profile of the SOP suit humeral fracture repair. Care must be taken to have sufficient numbers of screws in the distal fragment to prevent screw breakage. A medial and lateral, or two lateral plates can be used. Minimally invasive repair of comminuted tibial fractures with IM pin has been reported. Surgeons are repairing radius and ulna fractures, however if dynamic compression of simple fractures is indicated, then DCP plating system should be chosen over buttress plating systems. Pelvic fractures are an excellent indication, as the plates can be contoured over the uneven topography of the pelvis and acetabulum and can be paired.

The SOP provides veterinary surgery with a pedicle screw system for the thoracolumbar spine, or a locking anterior system for cervical stabilization/fusions. This uniquely offers a spinal stabilization system with reasonable cost and without potential drawbacks of PMMA. The SOP plates are commonly used in pairs with the screws engaging vertebral pedicles or bodies. If possible, 3-4 screws per vertebrae are engaged.

The SOP also provides an excellent and cost effective system for maxillofacial reconstruction. As the screws in the SOP system uniquely can be directed convergent or divergent, they are excellent at engaging the thin bones of the skull and mandible. Unlike maxillofacial reconstruction systems, the SOP cost is comparable to standard plates and screws. Plate pullout in flat bone is greater than plating that requires luting the plate to bone or strength or screw pullout strength. Plates can be applied without perfect contour if needed, and by pinhole approaches through soft tissues.