IMPeek

PEEK into the future.

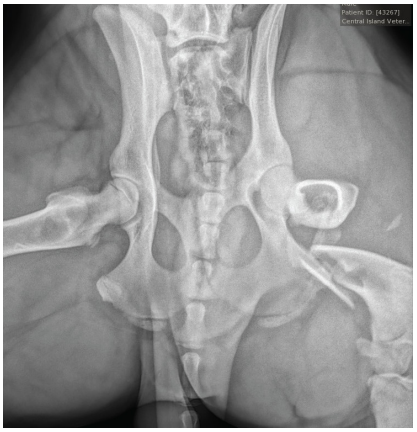
Comminuted mid-diaphyseal fracture in a 30kg dog using IMPeek™

This clinical report focuses on a 10 month old, male, intact 30kg Labrador X who escaped from the yard and was lost for several hours before being found by a good Samaritan. He was presented to the local veterinary emergency hospital and diagnosed with a grade 1 open, mid-diaphyseal, comminuted left femoral fracture. He was stabilized and transferred for surgery several days later.

A standard lateral approach was made to the left femur. The open wound was debrided en bloc until healthy, clean tissue was observed. Bone fragments that had lost all soft tissue attachments were resected. The fracture hematoma was left in situ where possible. Open reduction and internal fixation were then performed.

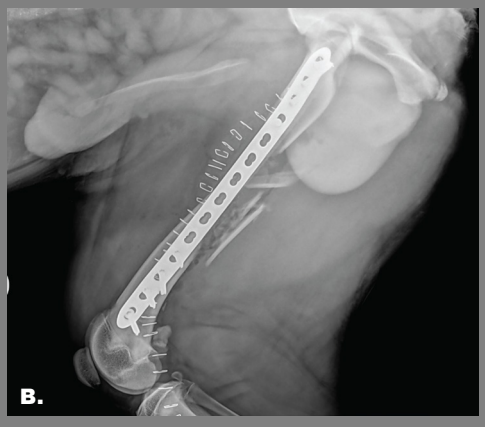
First, a 1/4" Steinmann pin was inserted proximal retrograde until it exited the intertrochanteric fossa. The Steinmann pin was then removed and a 6 mm diameter IMPeek™ rod (~66% of internal diameter) inserted from proximal normograde across the fracture defect and into the distal segment to re-establish bone length. The tip of the IMPeek rod is rounded and when pressed into the distal cancellous bone, provides distraction of the fracture ends and helps to re-establish bone length.

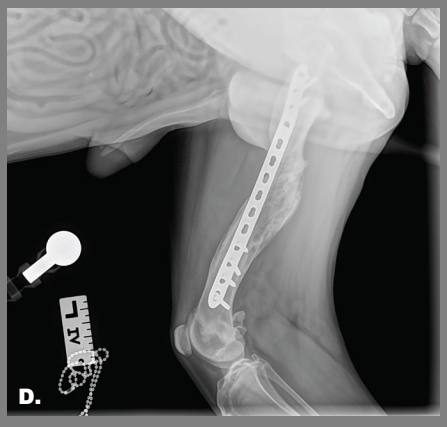
A fourteen hole Synthes LCP™ was then contoured to the lateral femur and affixed in a bridging fashion with 1 distal cortical screw and 3 distal bicortical locking screws. Proximally, 3 bicortical locking screws and a single monocortical locking screw were placed. Intentional attempts to drill through and engage the IMPeek™ rod was not performed, however 2 locking screws distally and proximally did happen to pass through the rod and were respectively threaded into the IMPeek™ rod, thereby creating a locking plate and interlocking rod construct. The proximal aspect of the rod was cut flush at the level of the greater trochanter with a sagittal saw and lavage.



A left, proximal humeral cancellous bone autograft was then obtained and packed into the fracture defect. The soft tissues were closed at both sites routinely and post operative radiographs (A and B) obtained showed excellent limb alignment and implant positioning.

The patient was walking on the limb with sling support the day after surgery. Eight weeks after surgery the bone had healed with bridging callus, although additional remodelling is expected (C and D).





As you can see from the radiographs above there is maintenance of the limb length and alignment, along with stable implants and completely bridged fracture gap by maturing callus. Despite these very encouraging radiographs, the dog's limb use is only fair as the dog had effectively been crated with no active rehabilitation being performed. Nevertheless, with appropriate rehabilitation and analgesia, the functional outcome of this repair is still expected to be excellent in the long term.

Why use IMPeek in this case over a steel rod?

This case perfectly highlights some of the benefits of IMPeek over traditional steel rods.

- The blunt tip design allows for distraction of the fracture.
- The largest possible rod diameter can be inserted, which helps to reduce plate strain and the risk of implant failure. This is particularly important if you think you will have undersized implants or a non-compliant patient/owner.
- The large rod is not an impediment for bicortical screw purchase. If you drill through the rod (intentionally or not) you can get your screw purchase in 2 cortices as well as through the rod, creating an interlocking rod/plate construct! If you miss the rod by chance, you are still likely to get bicortical purchase.
- The IMPeek rod is flexible meaning over-reduction is less of an issue in long bones. Also, with an modulus of elasticity similar to cortical bone, there may be some biomechanical advantages in cases where elastic plate osteosynthesis is being utilized.
- Cost effective. Inexpensive rod, with no special equipment or aiming devices needed.
- The rod is cuttable, drillable and autoclavable.
- If cortical screws are being used exclusively, then if they engage the rod proximal and distal to the fracture they can form an interlocking rod construct, with the additional strength of a plate.
- The radiopacity of the rod allows for viewing of the fracture and plate without impedance of additional metal artifact, making minimally invasive techniques and fracture post op monitoring easier.

FAQ

Q: What is PEEK?
A: PEEK is an acronym for poly-ether-ether-ketone. This is a biocompatible, inert thermoplastic used in millions of implantable medical devices every year in humans and animals. PEEK is commonly used in everything from spinal fusion cages to bone anchors. PEEK is autoclavable and exceptionally well tolerated in the body - just like stainless steel or titanium implants.

Q: How strong is IMPeek compared to stainless steel?
A: IMPeek is carbon fibre reinforced, which means that it is very resilient. It can't compare to steel for sheer strength, but it has a modulus of elasticity and stiffness comparable to healthy cortical bone. This is a good thing, as it mimics the biomechanical properties of bone more closely than metals. Bone healing is a delicate balance between just enough stiffness and too much flexibility. IMPeek helps to bridge that gap. IMPeek rods and bone plates combined are actually stronger and stiffer than traditional metallic plate-rod constructs (Beierer et al. Vet Surg, 2014 Nov;43(8):1032-8. doi: 10.1111/j.1532-950X.2014.12254.x)

Q: How do you use IMPeek rods?
A: IMPeek rods are best used intramedullary to aid traditional bone plates in plate-rod constructs of long bones, as they are strongest in this location, but they can be used in other modes. The main benefit of IMPeek rods is that they are cuttable, drillable and can have screws cut their own thread into them to create an interlocking construct. Your imagination is the limit.

Q: How do you sterilize IMPeek rods?
A: Autoclave. This is the most simple, easy and effective. The rods are capable of withstanding temperatures in excess of 170C, so the standard autoclave temperature of 132C will not affect the rod's integrity.

Q: Why use IMPeek rods instead of regular stainless steel?
A: Stainless steel is cheaper and effective, but it also has its limitations. Metal rods and pins interfere with bone plate screws, which means you would potentially have to compromise screw angle, screw or pin size, choose between mono or bicortical bone purchase or leave the hole empty. With IMPeek rods you never have to compromise - just drill and screw, all the way through!

Q: What happens when you drill through the IMPeek rod?
A: When you drill through the rod you will feel resistance similar to drilling through very dense cortical bone. This will generate moderate amounts of heat, so ALWAYS lavage copiously when drilling.

Q: What about the IMPeek debris?
A: Studies on wear debris in dogs and cats is lacking, however total joint replacements in people are often lined with PEEK, and these have looked at the effect of wear debris on local tissue. Negative local effect on healing and cytotoxicity were not identified (Stratton-Powell et al, Clin Orthop Relat Res. 2016 Nov;474(11):2394-2404. doi: 10.1007/s11999-016-4976-z.). When compared to UHMWPE, PEEK debris is considered to exceptionally well tolerated within the body.

Q: Can you see IMPeek rods on radiographs?
A: Absolutely! We had IMPeek designed with minimally invasive osteosynthesis in mind. You can differentiate the density of the bone, metal and IMPeek easily on radiographic images. Furthermore, because the IMPeek rod is mostly carbon fibre and PEEK, there is minimal to no imaging artifact on CT and MRI.