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NEW GENERATION DEVICES

Choice without Compromise

Sliding Humeral Osteotomy

Introduction:

The New Generation Devices Sliding Humeral Osteotomy Plate (SHO) is designed to provide the surgeon with an option for the management of medial compartment diseases of the canine elbow. The SHO may be of benefit in any case where decreasing loads in the medial compartment might result in decreased pain and enhanced healing. The procedure re-aligns the limb to shift the forces off of the area of cartilage damage and back on to healthy cartilage. This relieves the pain of grinding of bone on bone and gives the damaged joint an opportunity to heal. The sliding humeral osteotomy results in less joint pressure and is easy and straightforward to perform. Laboratory research along with clinical studies have indicated the sliding humeral osteotomy significantly decreases joint pressure in the medial side of the elbow joint. The SHO plate will accept cortical, cancellous or NGD locking screws.

Indications:

- The Sliding Humeral Osteotomy Plate is indicated for use with full or partial thickness cartilage loss of the medial compartment of the elbow
- The Sliding Humeral Osteotomy Plate is indicated for osteochondrosis dissecans of the medial aspect of the humeral condyle
- The Sliding Humeral Osteotomy Plate is indicated for fragmentation or fissuring of the medial coronoid process

Contraindications:

- The Sliding Humeral Osteotomy Plate is contraindicated in cases where visible damage to the cartilage of the lateral (humero-radial) compartment of the elbow joint is present.
- The Sliding Humeral Osteotomy Plate is contraindicated in cases with inflammatory, neoplastic, or infectious diseases of the elbow joint.
- As with all bone plates, the Sliding Humeral Osteotomy Plate is contraindicated for use when active infections are present at the implant site.

Note: *In dogs with a propensity for delayed bone healing, application of cancellous bone graft to the osteotomy site is recommended.*

Design Features:

- The SHO plate can address the management of medial compartment diseases of the canine elbow
- Combination compression and locking holes on either side of the osteotomy allow for stable fixation and compression of the osteotomy site
- The SHO plate technique allows the plate to be used to guide the osteotomy cut
- The SHO plate will accept either cortex screws, cancellous screws or NGD locking screws
- Universal plate design can be used for either the right or left sides
- Plates are available in a variety of sizes to accommodate varying anatomies, osteotomy step heights and breeds

Background:

Arthritis of the elbow joint is the most common cause of foreleg lameness in dogs. Most of the arthritic diseases of the elbow are considered forms of developmental elbow malformation (dysplasia). Elbow dysplasia refers to a group of congenital diseases of the elbows of dogs, which include:

- Fragmented coronoid process (FCP)
- Medial compartment disease (MCD)
- Osteochondrosis dissecans (OCD)
- Ununited anconeal process (UAP)
- Incomplete ossification of the humeral condyle

Fragmented Coronoid Process:

Fragmented coronoid process (FCP) is the most common form of elbow dysplasia in dogs. In this disease, a fragment of bone and cartilage of one of the bones of the elbow joint (ulna) is broken off. This fragment may be small or large and may stay in place or move about. More important, the rest of the joint may be normal or there may be additional cartilage damage, including OCD or severe full-thickness cartilage loss. Damage to the cartilage in dogs with elbow dysplasia is called medial compartment disease because it commonly results in severe erosion of the cartilage of the medial aspect of the joint.

Diagnosis of FCP and Medial Compartment Disease:

Diagnosis of FCP and MCP can be challenging. The diagnosis is initially based on a careful orthopedic examination. Examination findings with elbow dysplasia will show varying degrees of joint thickening, pain on joint manipulation, and loss of range of motion. X-rays are of limited use in the diagnosis of FCP since the fragment cannot be seen, and by the time visible changes can be appreciated, the cartilage of the joint may have already suffered damage. In fact, studies have confirmed that there can be severe cartilage damage in a joint despite normal images, therefore, it is not recommended to wait until there are x-ray changes to treat elbow diseases. The FCP fragment can be seen on a CAT scan, but this procedure requires general anesthesia, does not provide an opportunity for treatment and does not show the condition of the cartilage in the joint. Arthroscopy is recommended for the diagnosis of FCP because unlike a CAT scan, it allows accurate diagnosis and treatment of FCP as well as assessment of the cartilage of the joint. Traditional surgery is not recommended to diagnose FCP since the ability to see and treat diseases of the elbow with arthroscopy is far superior.

Arthroscopic view of a fragmented coronoid

Treatment of FCP

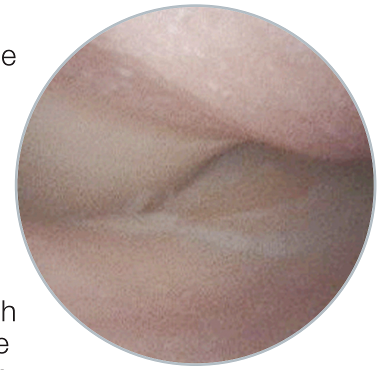
The basic principle of management of FCP is removal of the fragmented bone and cartilage. Arthroscopy is the fastest, most effective, and least invasive method for fragment removal. Traditional surgery does not provide the visualization or ease of working within the joint and requires much larger incisions. Arthroscopic treatment of FCP takes between 15 and 30 minutes per elbow and many dogs may be treated on an out-patient basis.

Prognosis with FCP:

The prognosis following arthroscopic treatment of FCP varies tremendously based primarily on the condition of the cartilage in the joint. In mild cases where a small fragment is removed, examination of the rest of the joint typically shows healthy white cartilage with little wear. For these dogs the prognosis for return to normal activity is good. Most dogs return to normal activity over a few weeks to two months with little to no lameness. They may need infrequent anti-inflammatory medications or rest for short bouts of lameness, but at this time there is no evidence that more fragments will occur in the joint and the progression of osteoarthritis in these cases appears to be slow.

FCP and Medial Compartment Disease:

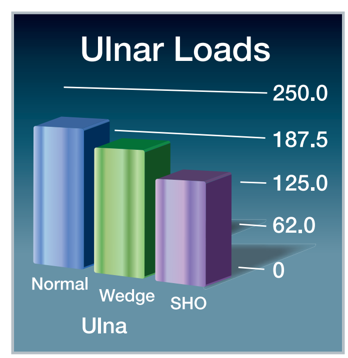
The prognosis for more severe cases of FCP is less certain. In these cases the fragment may be large and there may be significant cartilage damage to the point that, in the worst cases, all of the cartilage on the inner (medial) side of the joint may be worn away. This is termed Medial Compartment Disease and unfortunately can occur in dogs as young as one year of age. Dogs with Medial Compartment Disease will likely have some degree of lameness even after arthroscopic removal of the fragmented coronoid process. Arthroscopy may also include techniques called microfracture or abrasion arthroplasty which are intended to promote cartilage healing, although significant cartilage healing with these techniques alone is unlikely. Dogs with medial compartment disease usually require more continuous medical treatment of osteoarthritis and owners should consider additional treatment options. One of the advanced surgical treatments of MCD is the Sliding Humeral Osteotomy, or at last resort, total elbow replacement. Total elbow replacement may be indicated when the cartilage is severely damaged throughout the elbow joint, however, the effectiveness of replacement has been limited.



Arthroscopic view of worn cartilage in the elbow joint

How SHO works:

Medial Compartment Disease results in painful destruction of cartilage and eventual grinding of bone on bone. As the cartilage destruction progresses the joint collapses on the side of cartilage damage, further contributing to the cartilage damage and pain. In order to stop the progression of cartilage damage and decrease the pain, pressure on the damaged portion of the joint must be decreased. The SHO realigns the limb to shift the forces off of the area of cartilage damage and back on to healthy cartilage. This relieves the pain of grinding of bone on bone and gives the damaged joint an opportunity to heal. In comparison to a complex wedge osteotomy, the SHO is simpler to perform with fewer complications. Various studies have demonstrated that the SHO significantly decreases pressure in the medial side of the elbow joint. Clinical studies have been performed to design a bone plate and screw system that results in superior osteotomy stability.



Graph showing reduction in joint loads following SHO

Note: *Although this technique contains descriptions of a particular surgical procedure, it is only to be used as a tool for licensed educated medical professionals. Ultimately, the surgeon should be guided by their own professional judgment in making any final determinations regarding product usage and technique.*

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Surgical Technique:

1. Preparation

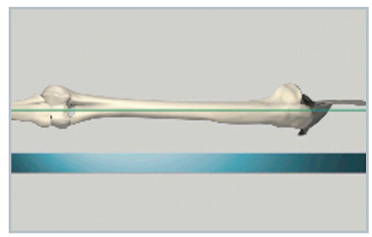
Cranio-caudal (in dorsal recumbence) and mediolateral radiographs of the humerus should be obtained with the patient under general anesthesia. Use of a magnification indicator placed at the level of the humerus allows for the most accurate measurement.

Note: *It is important to ensure that the humerus is positioned parallel to the tabletop and away from the body-wall when dorsal recumbence cranio-caudal radiographic projections are obtained.*

On the mediolateral radiograph, estimate the appropriate placement of the bone plate and the osteotomy on the medial aspect of the bone. The step of the bone plate is ideally placed on the center of the bone. The plate should be placed so that there is no interference of the last screw (#8) with the supracondylar foramen. After determining the location of the osteotomy, measure the diameter of the humerus in a medio-lateral direction at this location on the cranio-caudal radiograph. The diameter of the bone must be a minimum of 14mm for the use of a 10mm step plate, and a minimum of 10mm for use of the 7mm or 7.5mm plate. Surgical templates are available for all SHO plate sizes.

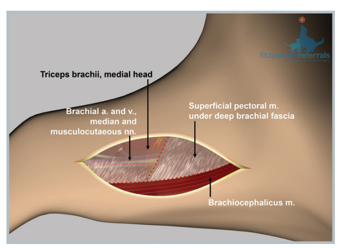
2. Patient Positioning

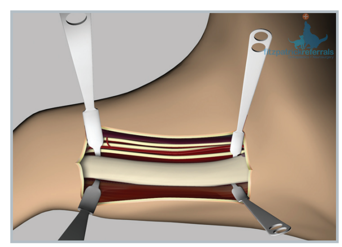
The patient is placed in dorsal recumbence with the operated limb abducted and held or secured in place over a block or pad so that the humerus is parallel with the floor with no internal or external rotation. Placement of the elbow in flexion and observation of the level of the antebrachium aids in prevention of internal and external rotation. The epicondylar axis of the distal humerus should be perpendicular to the floor.



3. Surgical Approach

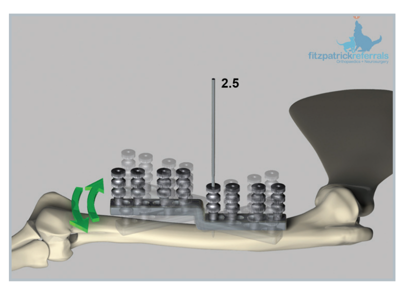
Perform a standard medial approach to the medial aspect of the humerus. *(An Atlas of Surgical Approaches to the Bones and Joints of the Dog and Cat by Donald Piermattei and Kenneth A. Johnson).* The extent of the approach will depend upon the patient's size. Place Hohman retractors from cranial and caudal to the humeral metaphyses at the proximal and distal aspects of the incision.





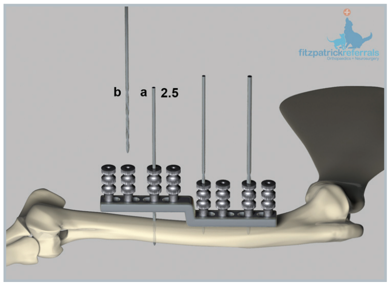
4. Positioning the SHO Plate

At a minimum, preload the SHO plate with drill guides in holes #2, #4, #6 and #7. Slide the plate proximally and distally to determine correct position. The step of the plate is placed on the center of the bone so there is no interference of the last screw (#8) with the supracondylar foramen. Position the 4th screw hole in the center of the diaphysis. Drill through the cis cortex ONLY with a 2.5mm drill bit. Rotate the plate about the drill bit to ensure the plate holes are centered over the bone. Leave the drill bit in place.

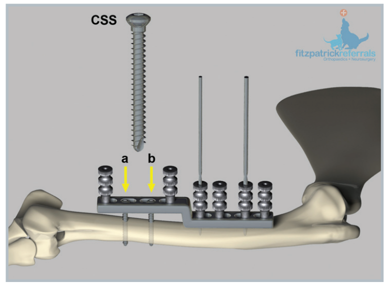


Surgical Technique:

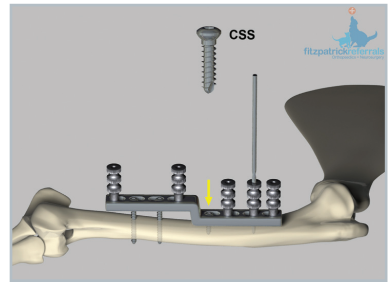
5. Plate Application



Drill hole #2 with a 3.2mm drill bit for a 4.0mm locking screw and leave the drill bit in place. Drill holes #6 & #7 with a 2.5mm drill bit for a 3.5mm cortex screw.

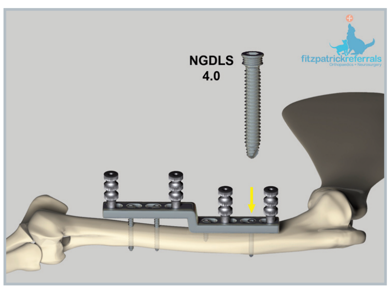


Insert two 3.5mm cortex screws into holes #6 & #7 using screws long enough to engage the trans cortex. Only tighten these screws until they engage the plate.
Do not over-tighten screws in hole #6 & #7.

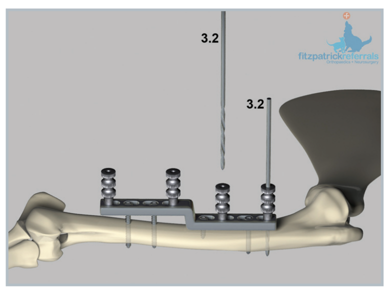


Remove the drill bit and drill guide from hole #4 and insert a unicortical 3.5mm cortex screw.

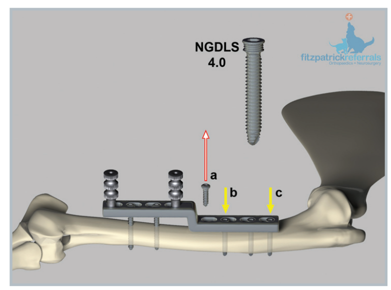
6. Proximal Screw Application



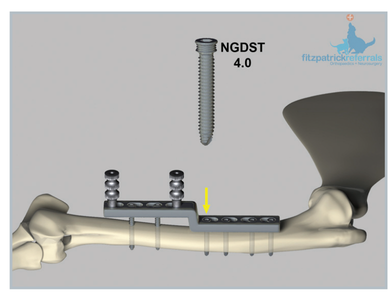
Drill through the trans cortex of hole #2. Remove the drill guide and insert a 4.0mm locking screw.



Drill holes #1 and #3 with a 3.2mm drill bit using the appropriate drill guide.



Insert 4.0mm locking screws into holes #1 and #3. Remove the unicortical cortex screw from hole #4. Insert a drill guide into hole #4 and drill with a 3.2mm drill bit.



Insert a 4.0mm locking screw into hole #4.

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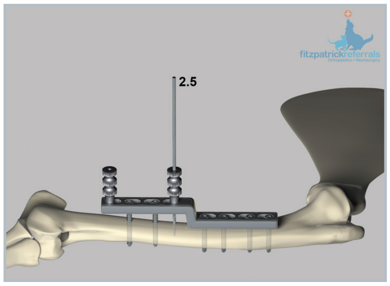
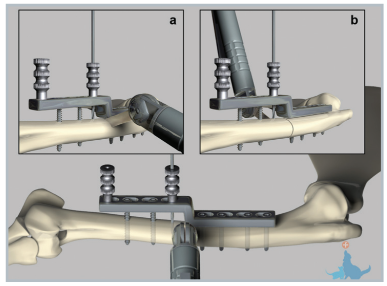
Surgical Technique:

7. Creating the osteotomy

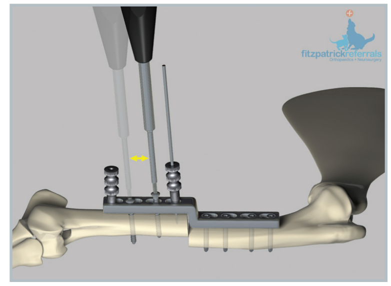


Drill hole #5 with a 2.5mm drill bit. Leave the 2.5mm drill bit in place.



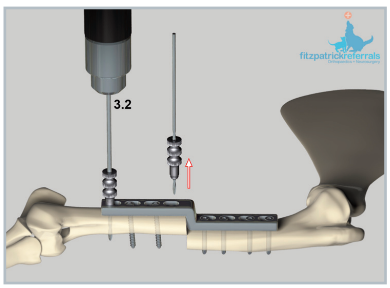
Using the plate step as a guide, create a transverse osteotomy.

8. Plate translation

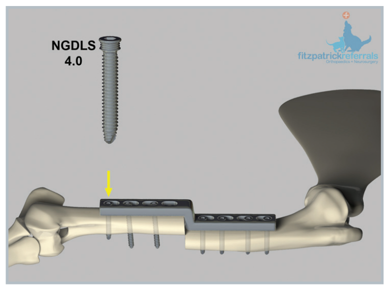


Loosen drill guide in hole #5. Tighten screws #6 and #7 alternately to translate the distal segment toward the plate.

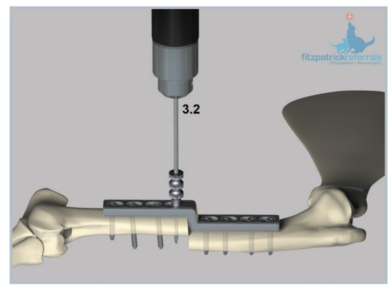
9. Distal Screw Placement



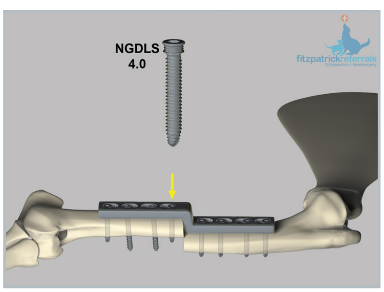
Remove the 2.5mm drill bit and guide from hole #5. Insert a drill guide into hole #8 and drill with a 3.2mm bit.



Insert a 4.0mm locking screw into hole #8.

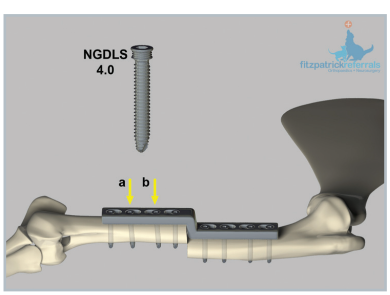


Drill hole #5 with a 3.2mm drill bit for a 4.0mm locking screw.



Insert a 4.0mm locking screw into hole #5.

10. Replace Translation Screws



Remove the 3.5mm cortex screws from holes #6 and #7. Drill with a 3.2mm bit without using the drill guide. Insert the appropriate length 4.0mm locking screws. These screws will cross-thread as they are not perpendicular to the plate.

11. Closure

Standard fascial, subcutaneous and skin closure techniques are employed.

Sliding Humaral Osteotomy Plate Ordering Information

Plates

Cat#	Description	Step	Length
SHO3.5-10	3.5mm SHO Plate	10mm	104mm
SHO3.5-7.5	3.5mm SHO Plate	7.5mm	104mm
SHOM3.5-7.0	3.5mm Mini SHO Plate	7mm	86mm

Screws

Cat#	Description	Length
CBS3.5-xx	3.5mm Cortex Screws	10mm-40mm in 2mm increments
CBS3.5-xx	3.5mm Cortex Screws	40mm-60mm in 5mm increments
STCBS3.5-xx	3.5mm Self-Tapping Cortex Screws	10mm-40mm in 2mm increments
STCBS3.5-xx	3.5mm Self-Tapping Cortex Screws	40mm-50mm in 5mm increments
LSTCBS3.5-xx	3.5mm Locking Self-Tapping Screws	10mm-40mm in 2mm increments
LSTCBS3.5-xx	3.5mm Locking Self-Tapping Screws	40mm-60mm in 5mm increments
LSTCBS4.0-xx	4.0mm Locking Self-Tapping Screws	20mm-40mm in 2mm increments
LSTCBS4.0-xx	4.0mm Locking Self-Tapping Screws	40mm-50mm in 5mm increments

Instruments:

Cat#	Description	Length
LDG3.5S	Locking Drill Guide for 3.5mm Screws	30mm
LDG3.2	Locking Drill Guide for 4.0mm Screws	30mm
DBQC2.5	2.5mm Drill Bit with AO Quick Coupling	110mm
DB2.5	2.5mm Drill Bit	95mm
DBQC3.2	3.2mm Drill Bit with AO Quick Coupling	145mm
DB3.2	3.2mm Drill Bit	130mm

US Patents 7,722,653 and 7,695,472
EU Patent 1468655

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