

External Skeletal Fixation (ESF)

Technique for fracture repair in animals

Introduction

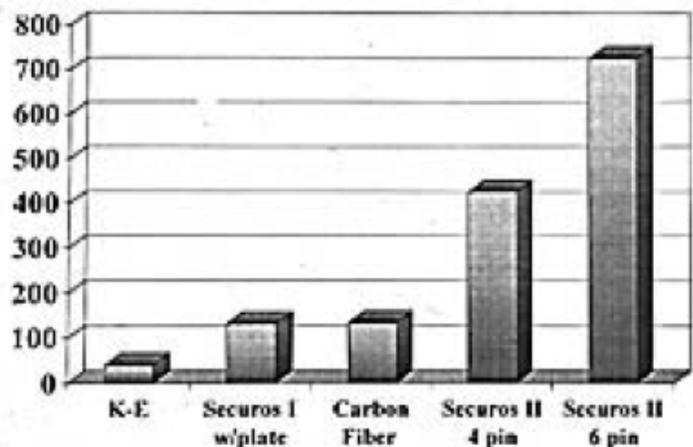
External Skeletal Fixation is a versatile and effective technique for fracture repair in animals, rigidly stabilizing fractures while maintaining a biologic environment for rapid osteosynthesis. Veterinary researchers have defined optimal application constructs using type II fixators with full pins whenever possible (Brinker 1985, Bouvy and Markel 1993), pre-drilling fixation pin pilot holes (Clary & Roe 1996), and using positive profile threaded pins (Bennet & Egger 1987, Anderson & Mann 1993,1996).

Securos Surgical is committed to enabling the veterinary surgeon to easily apply engineering principles to the art of external fixation, has designed the Securos Surgical external fixation SYSTEM. Fixator clamps are NOT pre-placed on connecting rods, but rather, snapped on to the

connecting rod wherever you want, even between installed clamps. Positive profile threaded (trans)fixation pins are easily added to type I, II, and III fixator constructs, even at re-check examinations; fixation pin pilot holes are drilled using tissue-protecting sleeves and with the pin placement (aiming) device both full and half pins in type I and type II constructs are accurately placed to either side of the fractured limb. Fixator components are interchangeable with the medium and the small Securos Surgical system. Securos has two different styles: the TITAN and the U CLAMP system. Both have the ability to add or remove pins without disrupting the existing construct. The TITAN system is used with Carbon Fiber or Aluminum connecting rods, providing a lighter weight construct. The U CLAMP system is used with Stainless Steel connecting rods. Securos Surgical transfixation pins are made of a material which has greater stiffness than regular IM pins, although both are typically 316L stainless steel. The normal Steinmann pin has a modulus of about 140,000 pounds per square inch, whereas the Securos transfixation pins have a modulus of about 210,000. Further the Securos positive profile pins provide a buttress thread profile with a 2% press fit.

Biomechanical Testing has shown that design of the Securos external fixator clamp results in optimal fixator pin to connecting bar rigidity, reducing pre-mature pin loosening.

Axial Stiffness (N/mm)



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Rules for Applying External Fixators

(Kraus KH, Fox SM, et.al., Small Animal Fracture Repair A case-based Approach. CRC Press. 2017)

1. The appropriate external fixator (EF) type is generally dictated by the size of the (trans)fixation pin allowed: the major diameter of the fixation pin should approach, but be no greater than 20% of the diameter of the bone being stabilized.
2. Full pins (penetrating both the cis- and trans-cortex) should be used when possible. Alternatively, double connecting rods with half-pins (Type 1b configuration) can be used.
3. Three pins should engage bone on each side of the fracture.
4. Positive profile pins should be used and pilot holes for fixation pins should be pre-drilled.
5. Pins should be placed perpendicular to the long axis of bone when possible.
6. Pins should be placed near the ends of the bone, as well as close to the fracture.
7. Large connecting rods should be used.
8. Clamps should be placed close to, but not touching, the skin

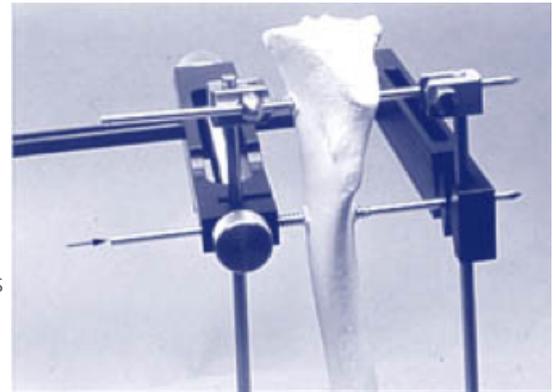
It's as easy as 1, 2, 3!

1. Use the Securos pin placement device and drill guide to accurately pre-drill the most proximal and most distal pilot holes in the respective epiphyses. A fixation pin can be placed to either side of the opposite connecting rod in type II fixators. Hole depth can be measured with a standard depth gauge.

2. Insert a positive profile fixation pin through the pin placement device. This aligns the pin with the pilot hole. Either 3.2mm (1/8th inch) or 2.4mm (3/32nd inch) positive profile threaded pins can be used. Securos fixation pins have the standard thread characteristics of 4.5mm and 3.5mm orthopedic screws and are self-tapping.

3. Snap on the Securos fixator clamp by sliding it over the fixation pin and onto the connecting rod. Insert and tighten the clamp bolt. It is ideal to tighten the bolt to 7.34 Nm of torque. Securos offers a precision torque wrench for this purpose.

- Contrary to intuition, the 'U' shaped clamp does not squeeze down on the connecting rod, as did the old KE clamp.
- The bevel on the head of the holed-pin interferes with the connecting rod; making a 'spot weld' dent in the connecting rod.

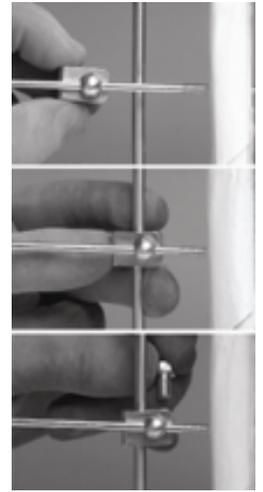


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ESF Product Instructions

Applying the Securos Fixation Clamp:

1. After the transfixation pin is placed, slide the pin into the appropriate hole on the head component (bullet shaped).
2. Take the U component and put it together with the head component (keeping the head component on the pin).
3. Slide the two engaging components down the transfixation pin (approaching the connecting bar).
4. Once the clamp is going over the connecting bar, you will notice that the head component hits the connecting bar and restricts the bar from seating into the U portion of the clamp.
5. At this point, gently use your thumb (not the one pushing down the clamp) to push the fixation pin away from the clamp. This will allow the clamp to snap over the connecting bar.
6. Finger tighten the bolt and then apply two thirds of a turn using the standard wrench or nut driver.
7. Construct the rest of the frame in the same manner.
8. Apply final tightening using the torque wrench (optional).



Using the Securos Pin Placement Device in Type I Configurations:

1. Apply the most distal and most proximal transfixation pins into the associated long bone epiphyses using the pin placement/aiming guide.
2. Attach the connecting bar to both the proximal and distal pins.
3. Loosely secure the clamp bolts once the fractured limb is reduced.
4. Remove the sliding component of the aiming device by removing the stainless steel knob.
5. Put the aiming device over the connecting rod, making sure that it hits the stainless steel back of the cup shaped component of the through rod (you may have to adjust the stainless steel back by using another connecting bar).
6. Adjust the aiming device so that when you drill you will have good bone purchase (you may test this by probing through the aiming device into the soft tissue using a K-Wire).
7. Tighten the large knob on the far end of the aiming device.
8. Place the drill sleeve through the aiming device down to the bone surface (you can use a Steinmann Pin to direct the drill guide to the bone).
9. Make sure the aiming guide is tight; Drill your fixation pin hole.
10. Remove the drill sleeve and place the fixation pin through the aiming device into the drilled hole. Insert the pin with low RPM.
11. Repeat for all pin locations with 3 or more pins on each side of the fracture.

Note: If intramedullary pins are used in conjunction, size of the IM pin should be ≤ 30 to 50% the diameter of the medullary cavity.

Using the Securos Pin Placement Device in Type II Configurations:

1. Apply the most distal and most proximal transfixation pins in the standard way.
2. Attach the connecting bar to the proximal and distal pins.
3. Tighten the bolts.
4. Open the aiming device as much as possible by loosening the knob and sliding the rail.
5. Place the aiming device over the connecting rod, making sure that it hits the stainless steel back of the cup shaped component of the through rod (you may have to adjust the stainless steel back by using another connecting bar).
6. Slide the rail such that the aiming device just sits on the opposite connecting bar (IMPORTANT: do not apply excessive pressure). Adjust the aiming device so that when you drill you will have good bone purchase (you may test this by probing through the aiming device into the soft tissue using a K-Wire. You can flip the entire aiming device so that you are drilling on the opposite side of the connecting bar).
7. Tighten the large knob on the far end of the aiming device.
8. Place the drill sleeve through the aiming device down to the bone surface (you can use a Steinmann Pin to direct the drill guide to the bone).
9. Ensure the aiming guide is tight; then drill your transfixation pin hole.
10. Remove the drill sleeve and place the transfixation pin through the aiming device into the drilled hole. Insert the pin with low RPM.
11. Repeat for all pin locations with 3 or more pins on each side of the fracture.

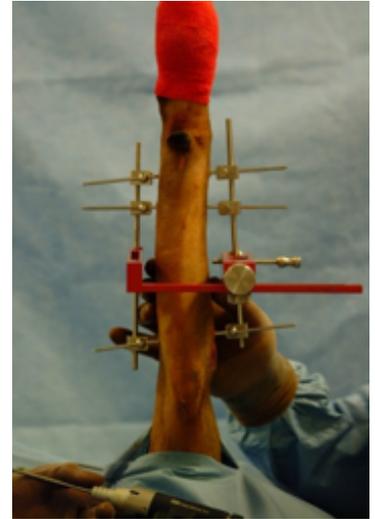
Note: If intramedullary pins are used in conjunction, size of the IM pin should be ≤ 30 to 50% the diameter of the medullary cavity.

Securos Double Clamp Instructions: (Securos Double Clamps work differently than the KE type double clamps.)

1. Securos double clamps are a 'hybrid' of your existing Securos U clamps.
2. Take two U Clamps and remove the hex head bolt from one and the hex head bolt and head unit from the other.
3. Place the two clamps so that the smaller holes are face to face.
4. Place the normal Head unit in one of the larger holes and the longer double clamp bolt in the other.

Torque Wrench Instructions: (Pre-Set for appropriate torque) (Cannot be sterilized!)

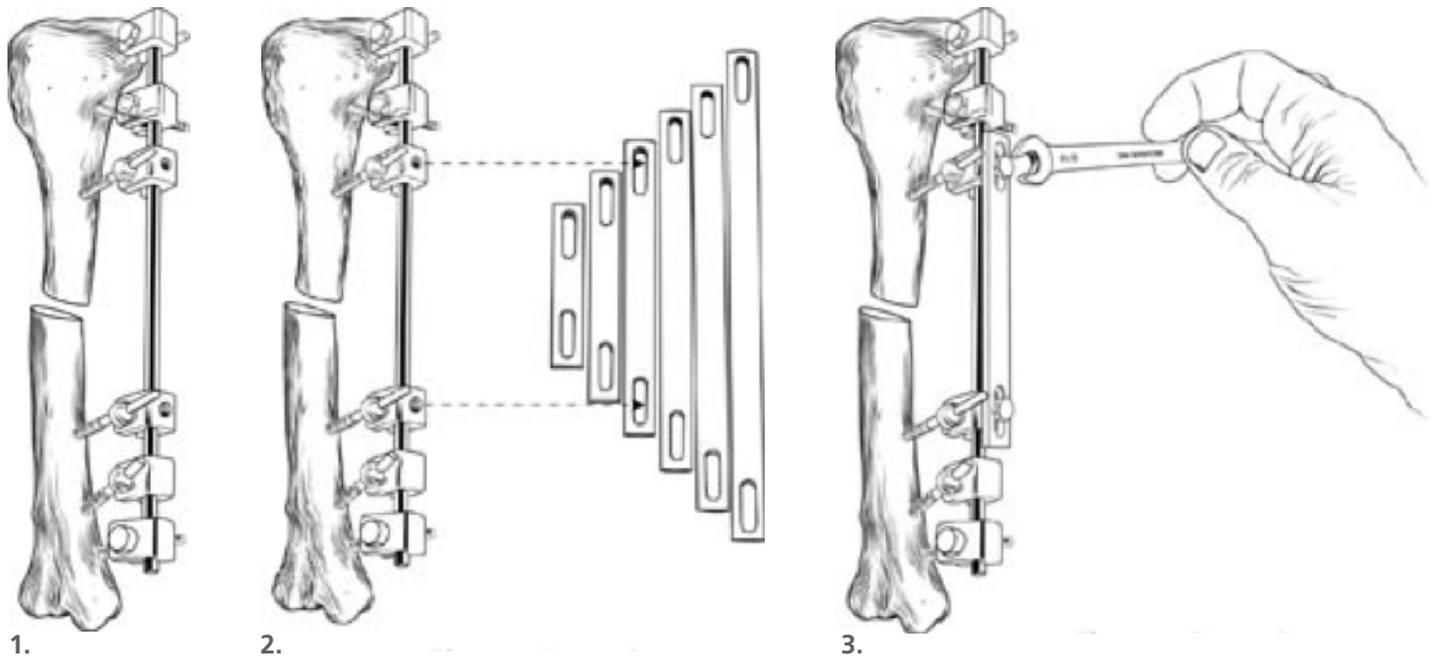
1. Assemble the fixator construct. Tighten the bolt first by finger and then with a standard wrench or nut driver (two-thirds turn).
2. Once the fixator is completely assembled use the torque wrench to apply the final tightening.
3. Place the torque wrench over the bolt head.
4. Hold torque wrench at the end of the handle.
5. Turn until you feel a click. (torque wrench clicks when it reaches appropriate torque)
6. Tighten all bolts of the construct.



External Skeletal Fixation (ESF)

Augmentation System

Instruction:

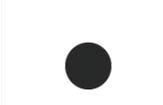
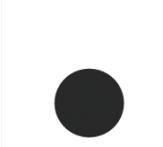


1. The modified clamps are used in place of the standard clamps for increased security of the fixation pins closest to the fracture. The modified clamps work exactly like the standard clamps.
2. The distance between the two clamps closest to the fracture is compared to the series of plates to determine which plate to use. The chosen plate is applied to the inner two clamps with bolts. Occasionally, the plate will need to be twisted with wrenches or plate bending irons to ensure it lies flat on the clamps.
3. The bolts for Augmentation plates have the same head size as the clamp bolts, but are slightly shorter and marked. The Augmentation plate works with the connecting rod to form a rod and beam construct that results in over 400% increase in stiffness (resulting in an axial stiffness of over 150 N/mm). The Plate can be removed during fracture healing once an initial callus has formed so as to dynamize the fracture. This system allows one to change the frame stiffness without removing pins, therefore maintaining integrity of the bone/pin interface.

External Skeletal Fixation

Clamps			Connecting Rods			
						
001366 - Large ESF Clamp	001369 - Small ESF Clamp	001368 - TITAN Large ESF Clamp	002356 - TITAN Small ESF Clamp	1/8" (3.2mm)	3/16" (4.8mm)	.374" (9.5mm)
Pins						
Part Number	Description	Shank Diameter	Thread Diameter	Thread Length	Overall Length	Recommended Drill Bit
001396	Mini End-Threaded ESF Pin	1/16" (1.6mm)	5/64" (2.0mm)	.50" (12.7mm)	3.5" (88.9mm)	1.5mm
						
001397	Mini Center-Threaded ESF Pin	1/16" (1.6mm)	5/64" (2.0mm)	1.0" (25.4mm)	5.0" (127mm)	1.5mm
						
001801	Small End-Threaded ESF Pin	3/32" (2.4mm)	.132" (3.4mm)	1.0" (25.4mm)	3.5" (88.9mm)	2.4mm
						
001802	Small Center-Threaded ESF Pin	3/32" (2.4mm)	.132" (3.4mm)	1.0" (25.4mm)	5.0" (127mm)	2.4mm
						

External Skeletal Fixation

Clamps			Connecting Rods			
						
001366 - Large ESF Clamp	001369 - Small ESF Clamp	001368 - TITAN Large ESF Clamp	002356 - TITAN Small ESF Clamp	1/8" (3.2mm)	3/16" (4.8mm)	.374" (9.5mm)
Pins						
Part Number	Description	Shank Diameter	Thread Diameter	Thread Length	Overall Length	Recommended Drill Bit
001398	Medium End-Threaded ESF Pin	1/8" (3.2mm)	5/32" (4.0mm)	1.50" (38.1mm)	5.0" (127mm)	3.2mm
001399	Medium Center-Threaded ESF Pin	1/8" (3.2mm)	5/32" (4.0mm)	1.50" (38.1mm)	7.0" (177.8mm)	3.2mm
001803	Large End-Threaded ESF Pin	5/32" (4.0mm)	3/16" (4.8mm)	2.25" (57.2mm)	7.0" (177.8mm)	4.0mm
001804	Large Center-Threaded ESF Pin	5/32" (4.0mm)	3/16" (4.8mm)	2.25" (57.2mm)	8.0" (203.2mm)	4.0mm