The Hybrid Ring Fixator
Surgical Technique
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**Warning**

This description is not sufficient for an immediate application of the instrumentation. Instruction by an experienced surgeon in handling this instrumentation is highly recommended.
Subject to alternation.
Indications

The Hybrid Ring Fixator is designed for fixation of complex proximal and distal tibial fractures, particularly those involving the joint, when:

• soft tissue injuries preclude open reduction and internal fixation, or
• the fracture pattern does not allow placement of Schanz screws for construction of a standard external fixator frame.

Case Example: Proximal Tibial Fracture

35 year old woman involved in a MVA. Injuries included severe head and chest trauma and complex fracture of the proximal tibia involving the articular surface.

Pre-operative

Immediately postoperative
Indications

Case Example: Distal Tibial Fracture

40 year old man with distal tibial fracture and compromised soft tissues resulting from a fall.
Pre-operative planning

As with the operative approach to any fracture, careful preoperative planning is essential:

• Evaluate the need for distraction to aid reduction.
• Assess articular surface involvement.
• Plan and determine proper wire and Schanz screw placement.
Frame configuration is dictated by the fracture pattern and soft tissue injury, regardless of fracture location (proximal or distal tibia). This description of the surgical technique is limited to basic principles.

Notes regarding the surgical technique for distal tibial fractures may be found on page 20 and 21.

**Tibial plateau fracture**

1 Restore articular surface and stabilize

If required, use the large distractor across the knee joint. This provides ligamentotaxis and aids fracture reduction.

As with any intra-articular injury, good reduction of the joint surface must be achieved. This may require open reduction and bone grafting using a minimally invasive approach.

If interfragmentary compression is required to reduce the articular surface lag screws may be used (e.g. 7.3mm cannulated screws).
**Tibial plateau fracture**

**2 Determine wire position**

At least two wires should be inserted at the greatest possible angle to each other. The wires can be reduction wires with olive and/or Kirschner wires.

Wires should be placed within the anatomically safe zones (note the location of the peroneal nerve).

The two typical positions are:

A. Lateral to medial tibia (possibly through the head of the fibula)

B. Anterolateral to posteromedial tibia

If cannulated screws are already in position in the proximal fragment, position wires distally to the capsular attachment of the knee joint.
**Tibial plateau fracture**

3 Insert wires

Make a stab incision and insert a Split Protection Sleeve through the soft tissue to the bone. Manually push the wire through the sleeve until it contacts the bone. Using the ComPact Air Drive II, insert the wire into the bone. Monitor wire placement and direction with an image intensifier.

**Note:** When using a Reduction Wire, insert the wire until the "olive" contacts the bone surface (washers may be used in osteopenic bone).

When the wire has pierced the opposite cortex, remove the air drive and advance the wire through the soft tissues using gentle blows of the hammer, until equal amounts of wire protrude from both sides.

**Reduction wires may be used for:**

- Prevention of vertical shearing
- Reduction of small fragments
- Achieving secondary interfragmentary compression (possibly in connection with cannulated screws)
**Tibial plateau fracture**

**4 Apply ring**

Choose a ring of adequate size – at least two finger-breadths between ring and soft tissue. A 3/4 ring will allow clearance for knee flexion.

Loosen the ring-locking nuts (b) and wire-locking nuts (a) fully on two adjustable Wire/Pin Clamps.

Slide a clamp over each end of the wire by inserting the wire into the hole marked "wire" (the larger hole accepts Schanz screws).

Mount clamp onto the ring. Hook the upper jaw of the clamp on the ring, pull on the lower jaw to separate the jaws, and snap it onto the ring. Repeat this step on the opposite end of the wire.
Additional wires may be inserted easily by using a clamp as an aiming device. Mount an other adjustable clamp onto the ring and insert the wire through the clamp and the slotted protection sleeve and advance it through the bone.

This wire should be positioned at the greatest possible angle to the first wire.

**Alternative techniques:** First insert both wires, then apply the ring and the clamps.

All wires should be inserted before tensioning. If you require additional stabilization of the proximal fragment, insert a Schanz screw in the proximal fragment before tensioning the wires (see page 19).
**Tibial plateau fracture**

It is important to eliminate any bowing in the wires as this could cause soft tissue irritation. Adjust wire position within the clamp and finger-tighten wire-locking nuts.

Adjust clamp location on the ring to straighten wire and wrench-tighten the ring-locking nuts to lock the clamps to the ring.
**Tibial plateau fracture**

5  **Tighten and tension wires**

For the first wire, wrench-tighten the wire-locking nut on one side and finger-tighten the wire-locking nut on the other (tensioning) side.

**Note:** For reduction wires, wrench-tighten the wire-locking nut on the “olive end” of the wire.

To apply the tensioner to the wire, manually turn the fluted knob counterclockwise until the wire passes freely through the cannulation.

Advance the tensioner over the finger-tightened end of the wire until its concave end seats against the wire/pin vise.
Tibial plateau fracture

Turn the knob clockwise by hand until the desired tension is reached. If necessary, use the ratchet wrench to achieve the desired tension.

The amount of tension being applied to the wires is indicated by the position of the knob relative to the numbered lines etched on the tensioner body. Wires are generally tensioned to 100-130 kg.

**Note:** Take care to avoid pulling the olive through the cortex when tensioning reduction wires.

When the desired tension is reached, wrench-tighten the wire-locking nut. Turn the knob on the Wire Tensioner counterclockwise to release the wire. Tension additional wires using the same procedure.

**Alternative option:** Use of the back-up wire tensioner

Twist the hexagonal nut counterclockwise. Slide the back-up wire tensioner over the wire until its concave end seats against the wire/pin vice. Tighten the wing nut to secure the wire. Turn the hexagonal nut clockwise using the 11mm ratchet wrench until the desired tension has been achieved. To remove the wire tensioner, turn the wing nut which secures the wire counterclockwise.
**Tibial plateau fracture**

Use the Bending-Cutting Pliers to trim excess wire, leaving 3 to 4 cm of wire to allow later retensioning, if needed.

Bend wire ends using the Bending-Cutting Pliers.

Place protective caps on wire ends.
6 Complete frame

Anterior frame

Insert Schanz screws (Seldrill or Standard) into the tibial shaft as determined during preoperative planning. Using standard External Fixator components and technique, couple the Schanz screws to a unilateral anterior frame.

The carbon-fibre rod should extend proximally for connection to the ring. For maximum stability, increase Schanz screw spacing within the distal fragment and keep the rod as close to the bone as possible.

**Note:** Finger-tighten open, adjustable clamps on the rod at this time and provisionally reduce the distal fragment to the reconstructed proximal fragment.
Tibial plateau fracture

Attach ring to anterior frame

Remove the ring-locking nut (a) and loosen the rod-locking nut (b) on a Ring-to-Rod clamp. Note: the rod-locking nut can only be loosened, not removed.

Slide the clamp onto the rod with the rod-locking nut (b) positioned externally for easy access.

Insert the threaded post (c) into an accessible hole in the ring.

Replace the ring-locking nut on the threaded post and finger-tighten.
Tibial plateau fracture

Fracture reduction
Use the ring and rod as “handles” to manipulate the fragments and reduce the fracture.

Maintain the reduction manually while an assistant wrench-tightens both nuts on the Ring-to-Rod Clamp.
**Tibial plateau fracture**

7 Additional stabilization options

Stability may be increased using the following frames.

Delta frame

Tringular frame

Additional Schranz screw (avoids procurvatum by counteracting the pull of the patellar tendon).
The Hybrid Ring Fixator – Surgical Technique

Distal fractures of the tibia

1 Distract

If necessary, the large distractor may be placed across the ankle joint to provide ligamentotaxis and aid fracture reduction.

In the case of an associated distal fibular fracture, first fix this fracture by plating to restore correct length, rotation and alignment.

2 Restore articular surface

Fixation of the articular surface using cannulated screws (interfragmentary compression) is highly recommended.

Use bone graft as needed in severe articular defects.

3 Determine wire position

Two typical wire positions, as noted on diagram:

A. Lateral to medial tibia
B. Anterolateral to posteromedial tibia

The basic wire positioning guidelines for distal tibial fractures are:

• Use a minimum of two wires, with the greatest possible angle between wires.

• Position wires within the zones for safe pin placement.

• Place wires proximal to interfragmentary screws within the distal fragment.
Distal fractures of the tibia

4 Complete frame

Construct a Hybrid Ring Frame in the same manner as described for proximal tibial fractures.

Use delta frame to increase stability, if necessary.
Summary of basic steps

Basic construction principles apply for all Hybrid Ring Fixator frames

1) Insert first wire

2) Attach ring to first wire and insert further wires

3) Tension wires
Summary of basic steps

4) Trim wires, bend out of the way and place protective caps on the wire ends

5) Construct anterior frame and attach to ring construction. Reduce fracture.
Maintenance of wire tensioners

The wire tensioner and back-up wire tensioner should be cleaned after every use and lubricated with sterilizable SYNTHES® Special Oil:

1. Open the cannulation fully by twisting the fluted knob (or hexagonal nut in the case of the back-up wire tensioner).
2. Applying circular movements, use the stylet 2.0mm dia. (319.360) and the cleaning brush 2.1mm dia. (319.270) to remove any dirt from the cannulation.
3. Clean the housing with a soft brush.
4. Rinse the instrument carefully with water.
5. Dry the instrument with a soft cloth.
6. Insert 4 - 6 drops of sterilizable SYNTHES® Special Oil into:
   - every lateral opening
   - the opening on the concave end while maintaining the wire tensioner in a vertical position
7. Distribute the oil by twisting the hexagonal nut or fluted knob several times fully in a clockwise direction and then counterclockwise. Repeat this two or three times.
8. The instrument can then be sterilized in the usual manner.

Inadequate cleaning or lubricating after every use may lead to impaired performance or a shorter instrument life.
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Product Information

1 Rings

1/1 Rings
393.731 115mm ID
393.735 165mm ID
393.721 205mm ID

3/4 Rings
393.732 115mm ID
393.734 140mm ID
393.736 165mm ID
393.722 205mm ID

1/4 Ring
393.737 165mm ID

2 Wires

Etched lines identify diameter:
1 line = 1.8mm
2 lines = 2.0mm
Spiral etching indicates “olive-end” of reduction wire for wire removal.

Wires with spade point tip
292.380 1.8mm diameter, 350mm length
292.400 2.0mm diameter, 350mm length

Reduction Wires with spade point tip
292.390 1.8mm diameter, 400mm length
292.410 2.0mm diameter, 400mm length
Product Information

3 Clamps

Adjustable Wire/Pin Clamp (393.464)
Connects wire or Schanz screw to ring

Ring-to-Rod Clamp (393.436)
Connects rod to ring
Product Information

4 Instruments

Ratchet Wrench (321.160)

Bending-Cutting Pliers (391.962)

Wire Tensioner (393.742)
Provides calibrated tensioning of wires

Back-up Wire Tensioner (393.743)
Provides uncalibrated tensioning of wires

Split Protection Sleeves
Protect soft tissues during wire or Schanz screw insertion.

- For wire/pins up to 5.0mm diameter (393.746)
- For wires up to 2.5mm diameter (393.745)
Product Information

176.200 Hybrid Ring Fixator

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<td>676.202</td>
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<td>Tray for instruments, top</td>
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### Product Information

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**Literature**


