DynaFix® Vision™
External Fixation System
Surgical Technique
INTRODUCTION

The New DynaFix® Vision™ External Fixation System is a pin to bar system, which will allow independent pin placement. With this system simple and effective external fixation can be applied. The DynaFix Vision System is versatile enough to be used as both temporary and definitive fixation. Temporizing measures include spanning transarticular fixation or non-spanning fixation for severe soft tissue damage or contamination. Definitive fixation uses include unilateral single bone fixation, hybrid configuration and even use in hinge designs at the elbow and knee. It can also be applied to open book pelvic injuries as a resuscitative frame or a definitive fixator.

The simplicity and ease of use make this fixator friendly in the operating room for quick applications. With the current trend for delayed open reconstruction in peri-articular fractures, the DynaFix Vision External Fixation System functions as an excellent means of “portable traction”. This allows the patients the benefit of soft tissue healing while having the option of being at home and waiting for their elective procedures. It allows the surgeon the benefits of getting the patient out of the hospital quickly and readmitting for a well-planned safe surgery or for transfer to the appropriate physician.

Spanning fixator placement can easily be converted to the hybrid configuration by simply adding a ring with tensioned wires to the articular fragment. This assembly then connects to the previously placed pins and rods. Adaptation to the DynaFix hybrid or ankle frame can also be preformed with the included components.

BASIC PRINCIPLES AND BIOMECHANICAL CONCEPTS

Half-Pin Frame Biomechanics

The ideal frame stiffness is unknown. To increase frame stability, the following principles should be followed:

1. Use the largest diameter pin possible without the pin being larger than 1/3 the diameter of the bone.
2. Maximize pin spread within each fracture fragment.
3. Place the Rod as close to the skin as possible, making sure to leave enough room for additional soft tissue swelling.
4. Placing pins out of plane will add stiffness in additional planes.
5. Place a second Rod on the frame. (double stacked)
6. Increase the number of pins in the construct.
7. Using Rods of different materials can modify the stiffness of the construct; stainless steel has the highest degree of stiffness, followed by carbon fiber, and aluminum.
8. Maximize the pin spread within a fixed 5-hole clamp or 3-hole clamp.
SLM Rapid Rod-to-Rod Clamp
Part Number 14600
The SLM Rapid Rod-to-Rod Clamp has a serrated locking mechanism, which can be tightened from either side of the clamp with a 5mm Allen Wrench. (Please note the directional arrow for locking etched on the clamp surface) The clamp was designed for rapid application and secure attachment to the DYNAFIX® Vision™ Rods. The key feature of the SLM Rapid Rod-to-Rod Clamp is the ability to secure the clamp from both sides in a single step locking procedure.

SLM Rapid 6mm Screw Clamp
Part Number 14605
The SLM Rapid 6mm Screw Clamp was designed for ease of use and rapid locking. A single step serrated lock allows for speed of application and secure purchase on rods, 6mm bone screws and 6mm transfixing screws. This clamp is locked with the 5mm Allen Wrench. The key feature of the SLM 6mm Screw Clamp is the ability to snap on to both the rod and the shank of 6mm screws and transfixing screws. This clamp also has the ability to lock to the shank of 5mm diameter screws.
SL (single locking) Rod-to-Rod
Rapid Clamp
Part Number 14005
The SL Rod-to-Rod Rapid Clamp has a single serrated locking mechanism, which is tightened with a 5mm Allen Wrench from either side of the clamp (please note the directional arrow for locking etched on clamp surface). The clamp was designed for rapid and secure attachment to DYNAFix® Vision™ Rods. The key feature of the SL Rapid Clamp is the ability to secure the clamp with a single step locking procedure.

SL (single locking)
Rapid Screw Clamps
SL Rapid 6mm Screw Clamps
Part Number 14040
SL Rapid 4mm Screw Clamps
Part Number 14045
The SL Rapid Screw Clamps were designed for ease of use and rapid locking. A single step serrated lock allows for speed of application and excellent purchase on rods, bone screws and transfixing screws can be utilized with this clamp. These clamps are secured with the 5mm Allen Wrench.

SL Rod-to-Rod Clamp
SL Rapid 4mm and 6mm Screw Clamps
The 3 and 5-Hole Clamps were designed for multi-pin fixation, which increases frame stiffness. The Clamp Cover Bolts are locked down with the 5mm Allen Wrench to secure Bone Screws within the clamp. The 3/5 Post can be attached to both sides of the clamp for Rod or Bone Screw attachment. The 3/5 Post is secured to the 3 or 5-Hole Clamps with the T-handle Bone Screw Wrench.

DYNAFIX® Vision™ 3/5 Post
Part Number 14240
The 3/5 Post is utilized with the 3-Hole and 5-Hole Clamps primarily for Rod attachment, but can also be used for Bone Screw Clamp attachment. The 3/5 Post is secured to either the 3-Hole Clamp or the 5-Hole Clamp with a T-Handle Bone Screw Wrench or 9mm Wrench.
Telescoping Bone Screw Post
Part Number 14055
The Telescoping Bone Screw Post provides the ability to place Bone Screws up to 3cm off of Rods, allowing for increased versatility in bone screw placement. The Telescoping Bone Screw Post is attached to a Rod by utilizing a Rod-to-Rod Clamp.

Ring Connector Assembly (2-Bolt)
Part Number 14069
The Ring Connector Assembly is used to connect DYNAFIX® System Rings to the DYNAFIX Vision Rods to build a Hybrid Construct. The Ring Connector Assembly is secured to the Ring with two locking bolts, which are tightened with a 5mm Allen Wrench. A Rod-to-Rod Clamp is utilized with this assembly to attach to the body of the fixator.

Ring Connector Assembly (1 Bolt)
Part Number 14330
The Ring Connector Assembly is used to connect DYNAFIX System Rings to the DYNAFIX Vision Rods to build a Hybrid Construct. The Ring Connector Assembly is secured to the Ring with one locking bolt, which is tightened with a 5mm Allen Wrench. This assembly can be directly attached to a Rod.
Connecting Rods
150mm Connector Rod
Part Number 14360
100mm Connector Rod
Part Number 14355
50mm Connector Rod
Part Number 14350

The Connecting Rods were designed to increase speed of application by having one rod Coupler already attached to the small Aluminum Connector Rods. The connector rods also provide the 2 shortest rod lengths available in the system. By having a shorter overall length these connectors can serve as struts or horizontal cross members to enhance the rigidity of a construct.

Double Rod Connector
Part Number 14080
The Double Rod Connector can be utilized to double stack a Frame to increase the rigidity of the construct. The double rod connector can also be used as a compression distraction mechanism between 2 parallel rods.

DynaFix® Vision™ Rods
Part Numbers
150mm Rod Steel - 14100
200mm Rod Steel - 14105
250mm Rod Steel - 14110
300mm Rod Steel - 14115
350mm Rod Steel - 14120
400mm Rod Steel - 14125
150mm Rod Aluminum - 14130
200mm Rod Aluminum - 14135
250mm Rod Aluminum - 14140
300mm Rod Aluminum - 14145
350mm Rod Aluminum - 14150
400mm Rod Aluminum - 14155
150mm Rod Carbon - 14160
200mm Rod Carbon - 14165
250mm Rod Carbon - 14170
300mm Rod Carbon - 14175
350mm Rod Carbon - 14180
400mm Rod Carbon - 14185

The DynaFix Vision Rods are available in three different material compositions. The Materials used in the rods vary in stiffness and can be utilized to make a construct more or less rigid. The Steel Rods are the Stiffest followed respectively by the Carbon and Aluminum Rods. This allows up to 18 choices for Rod selection. All Rods are offered in a 9.5mm diameter. Carbon fiber rods have the added benefit of being radiolucent and extremely lightweight.
The Metaphyseal Bars are used primarily for peri-articular fracture fixation with Bone Screws. Please note that these bars were not designed for small tensioned wire fixation and only Screw Clamps or Rod-to-Rod Clamps should be utilized with the Metaphyseal Bars. The bars have an angled step off to allow for enhanced radiographic visualization and surgical access.

DYNAFix® Vision™ L-Bar
Part Number 14290
The low profile lightweight aluminum material of the DYNAFix Vision L-Bar was designed to provide surgical access to the injury without compromising strength. The component was designed with room between two 45-degree bends to accommodate a Pin-to-Rod or Rod-to-Rod Clamp. This feature maximizes the potential for Pin-to-Rod and Rod-to-Rod placement on the DYNAFix Vision L-Bar.

Transfixing Screw
6mm Transfixing Screw
Part Number 14285

4mm Transfixing Screw
Part Number 14280
The 6mm and 4mm Transfixing screws were designed primarily for temporizing fixation techniques, which typically span a joint and zone of injury. The transfixing screws are secured to the frame with either style Rapid Bone Screw Clamp. Both sizes of Transfixing Screws are equipped with a drilling tip and centrally threaded body. The 6mm Transfixing Screw is unique in that it has a removable drill tip. It is important to note that the 6mm Transfixing Screw should not be reversed while the removable drill tip is attached or it may become detached while in bone or soft tissue.
**DYNAFIX® Vision™ 5/13mm L-Wrench**
Part Number 14270
The **DYNAFIX Vision** 5/13mm L-Wrench can be used to Lock both the Internal Hex Locking Bolts with the 5mm end and The External Hex Locking Bolts with the 13mm end. This wrench can also be utilized as a counter torque instrument for the Rapid Clamps by placing the 13mm end over the External Hex Bolt when loosening the Internal Hex Bolt for independent reduction maneuvers.

**DYNAFIX Vision Ratcheting T-Wrench 13mm**
Part Number 14275
The Ratcheting T-Wrench 13mm can be used to lock the External Hex Bolts on the Rapid Clamps.

**DYNAFIX Vision 9mm Wrench**
Part Number 14245
The **DYNAFIX Vision** 9mm Wrench is utilized for the **DYNAFIX Vision** 3/5 post attachment to the 3-Hole or 5-Hole fixed pin clamps.
1. Pre-operative planning is recommended prior to application of this device. Assess potential screw site location based on available bone stock and soft tissue considerations. Prep and drape in routine sterile fashion.

2. Obtaining a preliminary reduction is recommended. The first bone screw is generally inserted in the shortest or most difficult fragment. Assess available bone stock for desired bone screw position. When possible, allow 2 1/2 cm of distance between fracture site and the first bone screw.

3. A 1-cm incision is made and blunt dissection continued to bone.

4. A Trocar and appropriate length soft tissue guide are then utilized to identify the center of the bone and to establish the orientation of the screw tract to be pre-drilled. The orientation of the insertion of the bone screw should be perpendicular to the long axis of the bone to maximize biomechanical stability.
5. Once the screw site is selected use gentle pressure to maintain contact between the soft tissue guide and the cortex of the bone. Extract the Trocar. The soft tissue guide may now be tapped with a mallet if needed to engage the bone.

6. Insert appropriate drill guide into the soft tissue guide.

7. Insert matching drill bit with drill stop into the drill guide. Drill the near cortex. Drilling is halted upon contact with the far cortex. Be sure pre-drilled screw tract is perpendicular to the long axis of the bone.

**Table:**

<table>
<thead>
<tr>
<th>Drill Guide</th>
<th>Drill Bit</th>
<th>Screw</th>
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<tr>
<td><strong>6mm Screw Shank Diameter</strong></td>
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<td>4.8mm</td>
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<td>6/5mm Cortical</td>
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<td>2.9mm</td>
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<th>Drill Guide</th>
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<tr>
<td><strong>4mm Screw Shank Diameter</strong></td>
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<td>2.7mm</td>
<td>2.7mm</td>
<td>3.3/3.0mm Cortical</td>
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<td>2.0mm</td>
<td>2.0mm</td>
<td>3.0/2.5mm Cortical</td>
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*(Bone screw diameter should not exceed 1/3 diameter of bone)*

**NOTE:** Care must be taken to avoid over-penetration. Due to the tapered design bone screws must not be backed out or they will lose purchase.
8. Upon contact with the far cortex the drill stop is re-positioned and secured approximately 5mm from the base of the drill guide. The drill stop will prevent over penetration of the drill bit into underlying soft tissue structures. The far cortex is then drilled.

9. After bi-cortical penetration of the drill, the drill and drill guide are withdrawn. Maintain contact and position of the soft tissue guide.

10. The appropriate length screw is then inserted through the soft tissue guide. The bone screw T-Wrench is used to advance the screw into the bone. To obtain optimal purchase, all bone screws must be bi-cortical with no less than 2mm protruding from the far cortex and about 5mm remaining outside the near cortex. Image intensification is utilized to confirm depth of penetration.
• Unstable Pelvic Fractures
• Open Book Pelvic Fractures
• Highly Contaminated wounds
• Cannot physiologically tolerate an extended surgical procedure
• Supplementing Posterior Fixation

Two pins are applied to either iliac crest and connected with an anterior frame. The ASIS is identified and the insertion points are 2cm posterior for the first pin. The second pin is inserted approximately 2-3cm posterior to the first along the crest. A small incision is centered over the iliac crest/tubercle and sharply dissected down to bone. The medial and lateral borders of the crest are identified. The 4.8mm drill and drill guide are then used to drill the cortex in the middle to a depth of approximately 1cm. The 6mm pin is then inserted through the soft tissue sleeve. Care must be taken to ensure that the pin does not penetrate the inner or outer Table of the crest.

The second pin is inserted in a similar fashion. Screw clamps are used to connect the two half-pins on either side. The frame is trapezoidal in shape and fixed such that the patient can sit up in bed. Surgeons are encouraged to achieve reduction by applying a compressive force across the pelvic ring by pushing against the greater trochanter. It is not recommended to push against the screw clamps. This will increase forces on the pin to bone interface. This can also increase or exacerbate posterior instability. Pushing from the greater trochanter will provide an even compressive force across the pelvic ring. Once adequate compression has been achieved, all locking components should be definitively tightened. Traction is applied as may be necessary.
Pediatric femur fractures
Vascular injury with prolonged ischemia time
Severe soft tissue compromise
Cannot physiologically tolerate an extended surgical procedure

Midshaft Femur Fractures

Half-pins are usually inserted from the lateral side of the femur. Ideally pins should be placed obliquely along the lateral intramuscular septum so that the pin transfixes the least amount of muscle. For extremely unstable fractures a delta frame can be constructed with additional pins placed from anterior to posterior or frames can be double stacked to increase stiffness and rigidity. A minimum of two pins are placed distal and proximal to the fracture. Using traction and manipulation, the fracture is reduced and the clamps tightened. The pins are connected to a rod with 6mm screw clamps and definitively tightened.

Independent Pin Placement Femoral Fixation

Alternatively the pins can be placed freehand in each fracture fragment, connected within each fragment using a short rod and two 6mm screw clamps. A Rod-to-Rod Clamp is then used to connect the two bars together. The fracture is reduced using manual traction and the clamps are tightened. The frame is typically double stacked to increase frame stiffness.
Femoral Fixation Fixed Clamps

Using two 5-hole clamps a minimum of two pins are placed proximal and distal to the fracture site. The first pin in each fragment is placed freehand and the second is placed using the pin clamp as a guide to insure parallel pin placement within the clamp. The pins should be placed through the first and last holes of the pin clamp to maximize the spread of the pins in each fracture fragment. The pin clamps are connected using an anterior and a posterior bar attached to the 3/5 Posts with Rod-to-Rod Clamps. Manual traction is then used to reduce the fracture and all clamps are tightened definitively.
TIBIA FRACTURES, MIDSHAFT FRACTURES

- Vascular injury with prolonged ischemia time
- Severe soft tissue compromise
- Cannot physiologically tolerate an extended surgical procedure
- Highly contaminated wound

INDEPENDENT PIN PLACEMENT - SINGLE STACKED TIBIAL FIXATION

Tibial pins are usually placed either in an antero-medial direction starting on the anteromedial face of the tibia or in an anteroposterior direction starting just medial to the tibial crest. A minimum of two pins are placed freehand in each fracture fragment and connected to a Rod using 6mm Screw Clamps. The two Rods are then connected using a Rod-to-Rod Clamp. A reduction is performed using manual traction and all clamps are definitively tightened.

Midshaft Tibia reduction frame – anterior and medial view
INDEPENDENT PIN PLACEMENT - DOUBLE STACKED TIBIAL FIXATION

Tibial pins are usually placed either in an anteromedial direction starting on the anteromedial face of the tibia or in an anterioposterior direction starting just medial to the tibial crest. A minimum of two pins are placed freehand in each fracture fragment and connected to a Rod using 6mm Screw Clamps. The two Rods are then connected using a Rod-to-Rod Clamp. A reduction is performed using manual traction and all clamps are definitively tightened. To increase the stiffness of the frame a second Rod can be placed.
INDEPENDENT PIN PLACEMENT - BOX FRAME TIBIAL FIXATION

The DYNAFix® Vision™ External Fixation System has Telescoping Bone Screw Posts that can be placed on the rod allowing pins to be placed at different angles into fracture fragments. This allows great versatility for pin placement and is useful for proximal and distal fractures as well as those with multiple fracture lines. A 6mm Screw Clamp can be used in the less comminuted fragment and then pins can be placed off the bar connected to the pin clamp into the smaller and/or more comminuted fragment using the Telescoping Bone Screw Post. They can also be used to place pins into a segmental fracture fragment. A reduction is performed using manual traction and all clamps are definitively tightened.

PROXIMAL AND DISTAL THIRD FRACTURES TIBIAL FIXATION

- Vascular injury with prolonged ischemia time
- Severe soft tissue compromise
- Cannot physiologically tolerate an extended surgical procedure
- Highly contaminated wound
- Comminuted fractures that may interfere with internal fixation insertion techniques

To gain fixation in a small proximal or distal fragment, pins can be placed out of plane and convergent. A hybrid ring with variable bone screw carriages or a Metaphyseal Bar with independent pins can be used for fixation in the small fragment distally or proximally. Fixation in the large fragment can be obtained using parallel pins placed in a 5-hole clamp or pins can be placed independently and connected with a rod and 6mm screw clamps. A minimum of two pins are placed distal and proximal to the fracture.

Metaphyseal Tibia/Segmental – anterior proximal, anterior distal and angled proximal view

SURGICAL TECHNIQUE
Open Fractures
Severe soft tissue compromise
Cannot physiologically tolerate an extended surgical procedure
Highly contaminated wound

The proximal pins are placed from lateral to medial, and the distal pins either from lateral to medial or posterior to anterior. The pins must be placed using open incisions, with the bone visualized, and using guides to protect the neurovascular structures. A simple single stacked frame is usually sufficient for the humerus. Pins could also be placed using the 3 or 5-Hole Clamps, and if needed, the frame can be double stacked. A reduction is performed using manual traction and all clamps are definitively tightened.
• Complex open distal femur fractures not amenable to acute fixation
• Unstable knee dislocations
• Complex tibial plateau fractures with soft tissue compromise
• Floating knee fractures

The femoral pin insertion sites are identified as proximal to all fractures and all future Internal fixation. Pins are inserted on the anterior surface of the femur. Use the 5-Hole Clamp and aim to insert two pins through the 1st & 5th screw positions. Utilizing a small skin incision dissect down to bone through the quadriceps muscle using blunt dissection. Following pin insertion protocol proceed to insert the first screw. In order to maintain a parallel relationship to the first pin insert the second pin using the 5-Hole Clamp as a guide. The Tibial Pin insertion sites are identified as distal to all fractures and all future Internal fixation. Pins are inserted on the anteromedial surface of the tibia. Use 5-Hole Clamp and aim to insert two pins through the 1st & 5th screw positions. Utilizing a small skin incision dissect down to bone using blunt dissection. Following pin insertion protocol proceed to insert the first screw. In order to maintain a parallel relationship to the first pin insert the second pin using the 5-Hole Clamp as a guide. One 5-Hole Clamp is used for each set of pins. Alternatively, you can use independent 6mm Screw Clamps for each pin. The femoral and tibial pins are connected to each other with Rods and Rod-to-Rod Clamps anterior to the knee joint. Using traction and manipulation, the fracture is reduced and the clamps tightened definitively taking care to keep the knee flexed approximately 15 degrees to relax the posterior neurovascular structures.
• Distal tibia fractures
• Plafond fractures with or without fibula fixation
• Unstable ankle fractures or dislocations
• Severe soft tissue compromise

Tibial pin sites should be planned in accordance with secondary or definitive protocols in mind. Pins are inserted on the anteromedial surface of the tibia. Use the 5-Hole Clamp and aim to insert two pins through the 1st & 5th screw positions. Utilizing a small skin incision dissect down to bone using blunt dissection. Following pin insertion protocol proceed to insert the first screw. In order to maintain a parallel relationship to the first pin insert the second pin using the 5-Hole Clamp as a guide. The 6mm calcaneal pin is inserted from medial to lateral. A small incision is made posterior and distal to the neurovascular bundle, and blunt dissection is made down to the bone. Following pin insertion protocol the calcaneal pin is inserted into the bone parallel to the ankle joint. A 4mm pin is now inserted from the medial side into the medial and middle cuneiform. A small incision is made over the midpoint of the medial cuneiform and blunt dissection is carried down to the bone.

Following pin insertion protocol insert the 4mm pin staying parallel to the ankle joint. The pin should be placed through the medial cuneiform and into the middle cuneiform. Connect the pins in a triangular formation using the 6mm Screw Clamp, 4mm Screw Clamp, and Rods. Apply traction to the leg along its long axis, using the calcaneal pin. Once adequate reduction is achieved, tighten the clamps over the tibia and calcaneus. The foot is then dorsiflexed to the neutral position and clamps connecting the cuneiform pins are tightened. All clamps should be checked for definitive locking.

Spanning Ankle Triangular frame – anterior, anteromedial and medial view
**ANKLE SPANNING TRANSFIXING SCREW FRAME**

- Distal tibia fractures
- Pilon fractures with or without fibula fixation
- Unstable ankle fractures or dislocations
- Severe soft tissue compromise

Tibial Pin sites should be planned in accordance with secondary or definitive protocols in mind. Pins are inserted on the anteromedial or anterior surface of the tibia. Pins can be placed independently using 6mm Bone screw clamps or through a fixed 5-Hole clamp. Utilizing a small skin incision dissect down to the bone using blunt dissection. Following pin insertion protocol place the tibial bone screw cluster. The 6mm transfixing screw is inserted from medial to lateral. A small incision is made posterior and distal to the neurovascular bundle, and blunt dissection is made down to the bone. Following pin insertion protocol the calcaneal transfixing screw is inserted into the bone parallel to the ankle joint. Transfixing screws are available in 4mm and 6mm sizes. Bone screw clamps are now attached to either side of the transfixing screw and appropriate size rods are attached. The proximal end of both the medial and lateral rod, are now attached to the most proximal pin in the tibia with bone screw clamps. The distal pin in the tibia is attached to the construct with a bone screw clamp and the appropriate size rod. The rod attached to the distal pin in the tibia is now connected to the medial and lateral rods with rod to rod clamps. Apply traction to the leg along its long axis, using the calcaneal transfixing screw. Once adequate reduction is achieved, tighten all clamps. All clamps should be checked for definitive locking.
Tibial external fixation can be used for temporary or definitive fixation. External fixation is utilized for patients who cannot physiologically tolerate internal fixation, have a vascular injury with prolonged ischemia time, or have a severe soft tissue injury. In addition highly comminuted proximal or distal third fracture patterns may interfere with internal fixation insertion techniques, necessitating an alternative operative modality. Intra and peri-articular fractures where the fracture pattern and available bone stock preclude the introduction of larger diameter bone screws.

The first step in placing a hybrid external fixator in the distal tibia is to obtain an anatomic reduction of the joint surface. This can be accomplished percutaneously if the joint surface is non-displaced the external fixator can be placed early. If formal open reduction needs to be performed, then delayed reconstruction is recommended after allowing adequate time for soft tissue healing.

First choose an adequate size ring to allow 2 finger breadths distance around the ankle. Elevate the ankle on 4-5 cloth towels to allow clearance to place the tensioned wires. The first tensioned olive wire is placed from posterolateral through the fibula exiting anteromedial. The wire should exit medial to the tendon of tibialis anterior to avoid neurovascular injury. The second wire is then placed posteromedial to anterolateral. Posteromedial placement should be just anterior to posterior medial edge of the tibia and exit should be between the peroneal tendons and toe extensors. This wire placement will allow for maximum spread utilizing the “safe zones” as described by Behrens and Searls to avoid neurovascular damage.

The wires are then connected to the ring by use of the variable wire carriages and tensioned to the appropriate level.

Two 6mm cortical pins are placed in the proximal diaphysis by drilling with the 4.8mm drill bit. This system allows for the versatility of either using a 5-Hole Clamp or for independent pin placement. Once the half pins are inserted the distal and proximal segments are attached by using the 9.5mm carbon fiber rods.

When using the 5-Hole Clamp a 3/5 Post is placed on either side of cluster. This allows a Rod-to-Rod Clamp to attach the rod to the peri-articular segment and the ring. Connection to the ring is accomplished via the Ring Connector Assembly that connects with either one or two screws to the ring. Alternatively the rod can be connected to the ring via the post extension of the wire carriage and the use of a Rod-to-Rod Clamp.

An alternative method of connecting the half pins to the rods is by direct connection with the use of Screw Clamps. A triangular (delta) type configuration is easily made.

Once all connections have been established the fracture is reduced and aligned by the use of ligamentotaxis. The frame is tightened and fluoroscopy imaging is done to confirm length, alignment and rotation. Small adjustments can be easily achieved by
loosening the appropriate clamp to allow correction in the plane which adjustment is needed. Once alignment has been obtained additional rods can be added to increase frame stiffness and rigidity. For example if the fracture is tending to collapse into a varus a medial strut will maintain medial length and keep a neutral position.

The final step involves placement of a point of fixation in the peri-articular segment. This can be either a half pin or tensioned wire. Final full length x-rays centered at the ankle should be obtained prior to waking the patient from anesthesia to assure adequate alignment and reduction has been obtained.
Tibial external fixation can be used for temporary or definitive fixation. External fixation is utilized for patients who cannot physiologically tolerate internal fixation, have a vascular injury with prolonged ischemia time, or have a severe soft tissue injury. In addition highly comminuted proximal or distal third fracture patterns may interfere with internal fixation insertion techniques, necessitating an alternative operative modality. Intra and peri-articular fractures where the fracture pattern and available bone stock preclude the introduction of larger diameter bone screws.

For tibial plateau fractures the same basic steps as for the Pilon should be followed. Fixation in the peri-articular (proximal tibia) segment by placement of tensioned olive wires. Half-pin placement in the distal to the fracture site. Followed by connecting the frame and reducing the fracture. Adding supporting struts to prevent collapse and loss of reduction and final placement of a third fixation point in the metaphysis.

Again, anatomic reduction of the articular surface is mandatory. If no incisions are necessary immediate hybrid fixation can be performed. If an open reduction is required, trans-articular fixation should be performed first, with definitive reconstruction delayed until the soft tissue envelope has a chance to heal, typically 7 to 14 days.

Safe wire placement is as follows. The first wire is placed posterolateral, just in front of the fibula exiting anteromedial. As opposed to the ankle the fibula head should not be included in the fixation. The second wire should be placed from posteromedial, anterior to the medial head of the gastrocnemius, exiting anterolateral. Wire divergence should maximized, as described by Tornetta and Geller, to increase the strength of the construct. The third wire will be placed anterior to point of intersection of the first two wires, which will also increase the strength of the construct. Whenever possible, wires should be kept a minimum of 15mm from the joint surface to avoid penetrating the knee joint capsule. This will decrease the associated risk of septic arthritis.

The remaining portion of this procedure is identical to that for Pilon fractures. The appropriate diameter ring should be used. Keep in mind, that if hybrid fixation is done acutely the proximal soft tissue envelope may significantly swell, thereby making the 2/3rds ring chosen to small. In the acute setting err on too large of a ring.

**HYBRID RING FIXATION TIBIAL PLATEAU**

Proximal Tibia Hybrid – anterior and anteromedial view.
SUGGESTED SCREW SITE CARE

Dry sterile gauze is wrapped around the shanks of the bone screws to prevent pistoning of the soft tissues on the bone screws. A solution of 2% hydrogen peroxide and sterile water should be used on the pin sites until the wounds have healed and sutures are removed. The patients are then instructed to shower on a daily basis using soap and water and reapply gauze dressings as a means for routine bone screw hygiene. Screw sites should be monitored during subsequent clinical visits. All fixator locking components should be evaluated for tightness during subsequent clinical visits.

STERILIZATION

The EBI X FIX® System is provided nonsterile and must be sterilized prior to use. Repeated sterilization of carbon fiber components is not recommended. All packaging materials must be removed prior to sterilization. All fixator components should be sterilized in a loosened state such that components may move freely. The following steam sterilization parameters are recommended.

- **Cycle:** Vacuum Steam
- **Temperature:** 270° F/132° C
- **Time:** 8 minutes
- **Note:** Allow for cooling

Individuals or hospitals not using the recommended method, temperature, and time are advised to validate alternative methods or cycles using an approved method or standard.

INDICATIONS

The DYNAFix® Vision™ External Fixation System is a modular external fixator intended for use in the treatment of bone conditions including leg lengthening, osteotomies, arthrodesis, fracture fixation, and other bone conditions amenable to treatment by use of the external fixation modality.

**Caution:** Federal Law (USA) restricts this device to sale by or on the order of a physician.

**Warning:** This device is not approved for screw attachment or fixation to the posterior elements (pedicles) of the cervical, thoracic, or lumbar spine.

See package insert for full prescribing information.

To reorder call:
(800) 526-2579
Fax (800) 524-0457

EBI, as the manufacturer of this device, and their surgical consultants, do not recommend this or any other surgical technique for use on a specific patient. The surgeon who performs any implant procedure is responsible for determining and utilizing the appropriate techniques for implanting the device in each individual patient. EBI and their surgical consultants are not responsible for selection of the appropriate surgical technique to be utilized for an individual patient.
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