

Smith+Nephew

TAYLOR SPATIAL
FRAME [◇]

External Fixator

High Tibial Osteotomy
by Janet Conway, MD

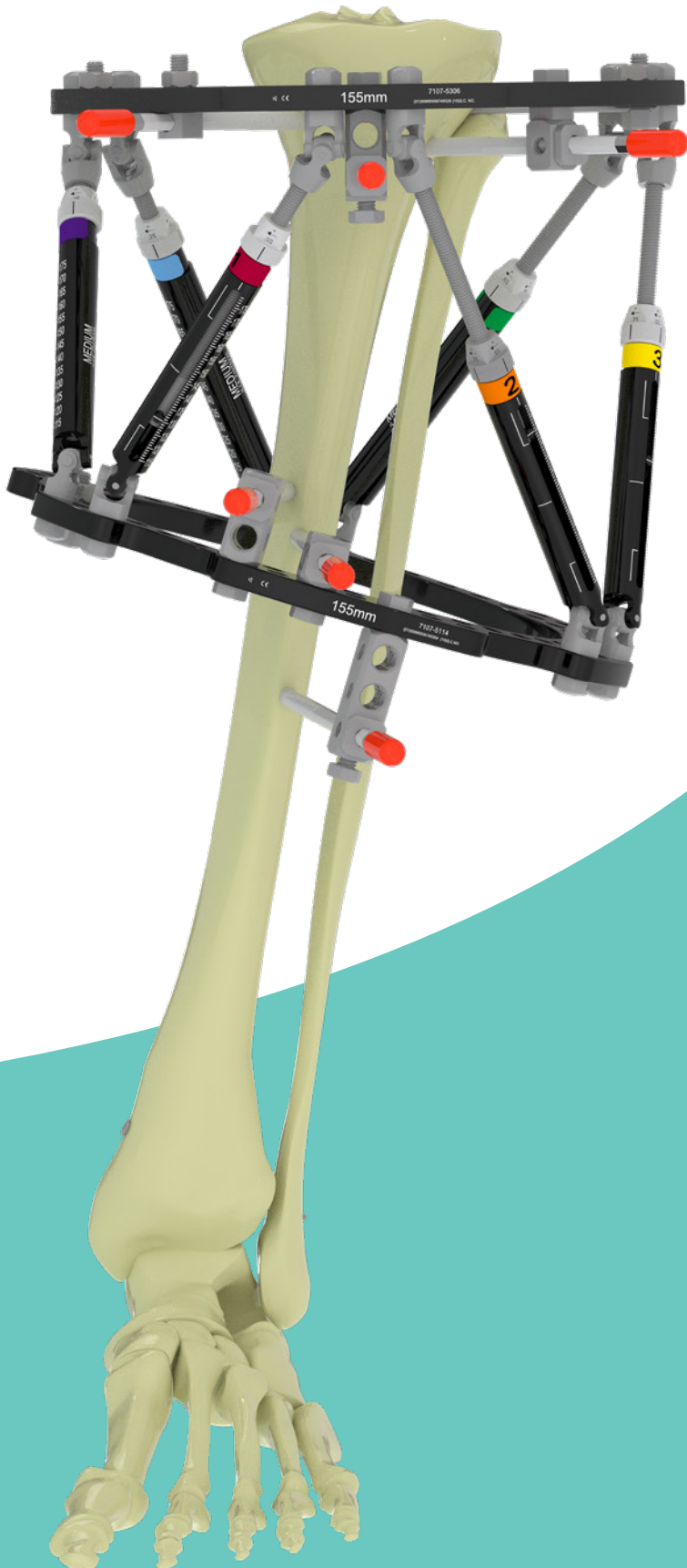


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The unicompartmental knee replacement often fails to fully correct the overall medial mechanical axis alignment and makes a subsequent total knee replacement more complicated secondary to scarring and bone loss. High tibial osteotomy offers a durable solution for these patients because it corrects the overloading of the medial joint line and preserves bone stock. It is a durable solution that allows for an uncomplicated total knee arthroplasty if and when necessary. A well done high tibial osteotomy can reliably provide good function and pain relief for many years, often circumventing the need for a total knee arthroplasty.¹

There are many options for performing a high tibial osteotomy. Internal fixation offers the option for acute correction with a medial opening wedge and plate fixation. This option is limited by the plate which cannot accommodate large amounts of translation needed to fully correct the mechanical axis. Large bone grafts needed for the acute opening wedge have a higher risk of delayed healing and are accompanied by prolonged post-operative non-weight-bearing.²⁻⁵ This type of fixation is best suited for the small correction however it does come with the risk of under-correction since the full correction is done intra-operatively and full weight-bearing cannot be achieved for several months. External fixation and gradual correction has many advantages in these cases. Near immediate full weight-bearing is possible and allows for accurate post-op adjustments to achieve the exact mechanical axis for successfully unloading the medial compartment.⁶⁻¹⁰ The medial opening wedge is regenerate bone that is stimulated to heal with full weight-bearing. The typical time for external fixation wear is 4-5 months with activity restrictions limited to impact sports only.



This High Tibial Osteotomy procedure is authored by Dr Janet Conway. Dr Conway is the Director of Bone and Joint Infection at the International Center for Limb Lengthening and an Attending Orthopaedic Surgeon at the Rubin Institute for Advanced Orthopaedics at Sinai Hospital in Baltimore MD

Nota Bene

The technique description herein is made available to the healthcare professional to illustrate the author's suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the specific patient.

The following technique guide was prepared under the guidance of and under close collaboration with the physician. It contains a summary of medical techniques and opinions based upon their training and expertise in the field, along with their knowledge of Smith+Nephew products. It is provided for educational and informational purposes only. Smith+Nephew does not provide medical advice and it is not intended to serve as such. It is the responsibility of the treating physician to determine and utilize the appropriate products and techniques according to their own clinical judgment for each of their patients. For more information on the products in this surgical technique, including indications for use, contraindications, effects, precautions and warnings, please consult the products' Instructions for Use (IFU).

Patient evaluation and selection

History: Patients will complain of medial knee pain with weightbearing activities. Prolonged walking and standing increase the symptoms.

Physical examination

Standing assessment reveals bowing of one or both legs. Medial knee pain is present upon joint line palpation. With chronic meniscal tears, joint swelling is common. Joint line laxity is present secondary to the loss of medial joint space and the lateral collateral ligament laxity that occurs from chronic stretching. Tibial rotational assessment is important. Any excessive external or internal rotation must be corrected. Joint range of motion is documented and it is important to note any lack of full extension of the knee or ankle equinus. These issues when noted can be addressed at the surgical setting with a gastrocnemius recession or planning some extension into the frame correction.

Radiographic evaluation

Standing full limb radiographs are taken. The mechanical axis of the whole limb is assessed with a line drawn from the center of the femoral head to the center of the ankle. With medial compartment osteoarthritis or varus tibiae this line falls entirely within the medial compartment when compared to normal alignment which is entirely within 1cm of the center of the knee joint. A long lateral radiograph assesses the sagittal plane alignment. The normal posterior proximal tibial angle is 80° . Anything less than this is considered pro-curvatum and can be corrected with the gradual external fixator.

Additional imaging

MRI imaging of the knee is essential for pre-operative evaluation. Any asymptomatic lateral joint line pathology is detected as well as any patella-femoral joint pathology. The medial joint line will be narrowed with cartilage loss and associated meniscal tear.



Figure 1a



Figure 1b

Surgical planning

Determining the degree of correction

Minimal, moderate and severe MCOA can be addressed using varying degrees of correction. The mechanical axis is shifted laterally according to the degree of arthritis. The maximum correction is to a point lateral to the tibial spine. Minimal or moderate correction can be to the center of the knee joint or slightly lateral to the lateral tibial spine respectively. The pre-operative standing leg radiograph is used for planning.

A line representing the new mechanical axis is drawn from the center of the femoral head to the desired correction point – for example just lateral to the lateral tibial spine.

A second line is drawn from the center of the ankle up through the mid-shaft tibia and extending proximally.

The angle this line creates is the angle of correction that will be placed into the deformity parameter of the TAYLOR SPATIAL FRAME[®] software.

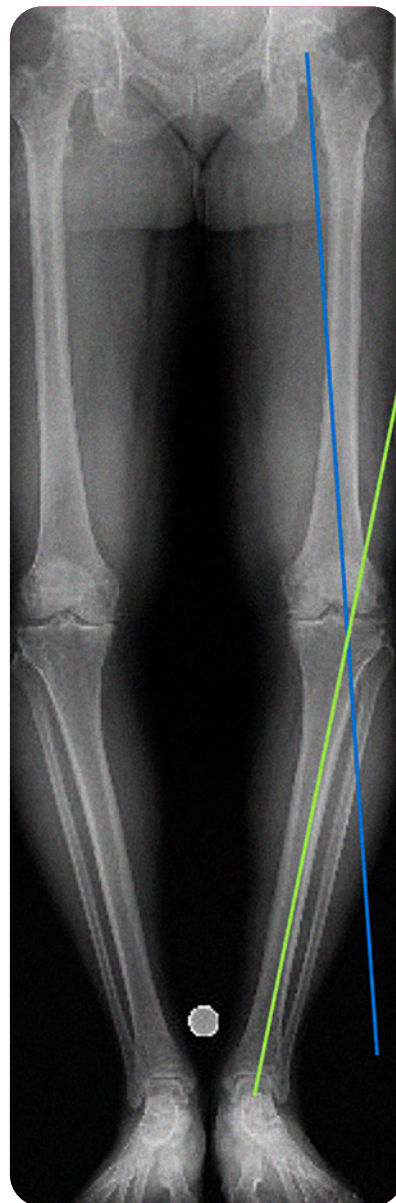


Figure 2

High Tibial Osteotomy procedure

General anesthesia is recommended.

Nerve blocks are not recommended as this may prevent detection of any rare but unwanted compartment syndrome post-operatively.

1. Knee arthroscopy addressing the intra-articular pathology such as cartilage defects and meniscal tears

The lateral joint line is examined to make sure there is no catastrophic cartilage loss that would undermine a successful osteotomy and unloading onto that compartment.

2. Insertion of a distal tibio-fibular screw

This is performed by first placing a 1.8mm Wire at the level of the distal syndesmosis from the lateral midline of the fibula to the tibia in a “tent peg” fashion. Aim distal lateral to proximal medial. (Fig. 2a) The placement of the Wire is checked with an inline gunsite view down the Wire to ensure that the screw will capture both the tibia and the fibula and will not break out the cortex of the fibula if the wire is not centered correctly. (Fig. 2b) Once this wire is centered correctly it is over-drilled with a 3.5mm Cannulated Drill medially to laterally and a 4.5mm solid screw is then placed medially to laterally. Ensure that the distal threads of the screw capture both cortices of the fibula. (Fig. 2c and 2d)



Figure 2a



Figure 2b



Figure 2c



Figure 2d

3. Perform the fibular osteotomy at the level of the mid-shaft fibula

This is a 3-4cm incision overlying the lateral fibula using the interval between the gastrosoleus muscle complex and the peroneals. Utilizing this corridor minimizes bleeding. The fibula is exposed and a 1.8mm Wire or small drill is used to mark out the oblique fibular osteotomy. The osteotomy is pre-drilled anterior proximal to distal posterior. This creates an oblique osteotomy that maximizes surface area for healing and allows the bone ends to slide past each other with the varus to valgus correction. Use fluoro to confirm that the osteotomy can 100% translate to avoid an incomplete osteotomy. Pack the wound and close at the end to allow for hemostasis and prevention of a hematoma.

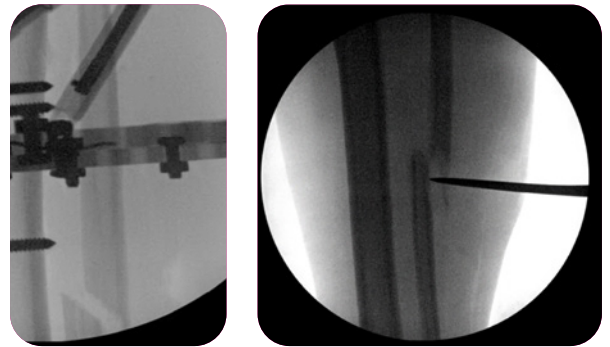


Figure 3

4. Mark the level of the osteotomy for the tibia using a wire and a marking pen

This should be approximately 4-5cm below the level of the top of the fibula.



Figure 4

5. Determine Ring size by assessing different Ring options

There should be enough room anteriorly for at least one fingerbreadth and for the medial and lateral areas of the Ring approximately two fingerbreadths on each side.



Figure 5

6. Insert a Reference Wire

Place a 1.8mm Wire just anterior to the fibula only capturing the tibia. The Wire should be placed parallel to the knee joint with the patella facing forward as well as parallel to the floor.



Figure 6

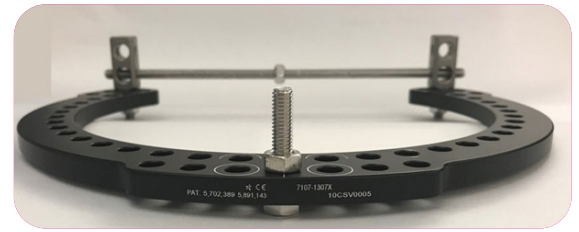
7. Mount the Proximal 2/3 Ring at the level of the head of the fibula.

The entire frame needs to be mounted with the patella facing forward. It is critical to mount the Proximal Ring orthogonal to the leg, as it becomes the Reference Ring for Mounting Parameters in the software. The Ring should be fixed proximal to the Wire. This allows for maximum pin/wire fixation proximal to the osteotomy. The center of the Ring is denoted by four equator lines. Insert a bolt at each equator line to allow easy X-ray identification. On 155mm Rings, the line falls between



Figure 7

two holes, so can be identified by placing one bolt upward, one bolt downward. With the patella forward, the Ring is secured to the Wire using one Wire Fixation Bolt, ensuring an orthogonal mount in the AP plane. Without moving the rotation of the leg, the lateral knee fluoroscopic image is checked to see if the lateral bolts are overlapping. Rotate the Ring to get the bolts at the equator to overlap to ensure that the Ring is not mounted in a rotated position. This step requires some effort and may require readjusting the rotation of the Ring a few times to get it perfect.



Useful tip on how to find center of 2/3 Ring on an AP:

Attach a 1H or 2H Rancho with Post to each Tab either side of the opening. Take a Threaded Rod with one Nut at its midpoint. Attach the Rod to the Ranchos. Use the Nut as the X-ray marker on an AP image.

8. Add additional fixation

Select a 2 Hole Rancho Cube or Pin Fixation Clamp and place it directly anteriorly on the Master Tab in the center hole. Before placing this pin, ensure that there is adequate room on the medial/lateral side of the Ring for the soft tissue.

Adjust accordingly by tapping the ring over on the wire. Now make sure that the Two Hole Rancho Cube will still capture the bone. This can be done manually or with fluoro. Use the lateral C arm shot to correctly place the pin mounting the frame orthogonally in the sagittal plane.

Proper sagittal alignment is when the Ring is tilted 10 degrees to the joint line. Once the frame is aligned correctly drill and place the Pin. Adjustments can be made to the sagittal alignment with the 4.8mm Drill in place by adjusting your hand before the second cortex is drilled. Self-drilling Pins are not recommended and hydroxyapatite-coated Pins are preferred, to prevent pin loosening and infection. Place the Pin and use the C-arm to check that it has bi-cortical purchase. Once it is placed fix it to the Cube with two Set Screws or 8mm Bolts. Now the proximal Ring is mounted. Remaining fixation will be placed after the second Ring is mounted.

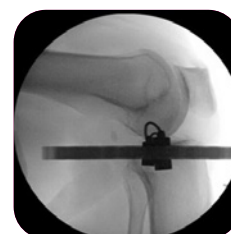


Figure 8

9. Mount the second Ring (Figure 9 and 10)

This can be placed anywhere along the distal portion of the limb. Using a Medium Standard or FAST FX[®] Strut with the length at the mid-point, is a good general guide to where the second Full Ring will be mounted. This setting allows for adjustments to be easily made after the frame is mounted without having to do a Strut change early in the correction phase. Mark the AP and Lateral center of the second Ring using bolts. Ensure there is proper clearance of the Ring around the soft tissues. Mount the Ring with a transverse Wire placed parallel to the floor and perpendicular to the tibial bone on the AP projection. Be careful to keep the patella forward during mounting of the distal Ring as well if you are not planning rotational correction. If you are planning rotational correction, consider mounting the distal Ring orthogonal to the foot with the foot forward instead of the patella. Fix the Ring to the leg in a similar fashion as the proximal Ring to ensure that the frontal and coronal plane alignment are correct. This will require that the mounting Bolts line up on the AP and LAT projections before fixing the Wire. Tension the Wire to 130kgs.



Figure 9

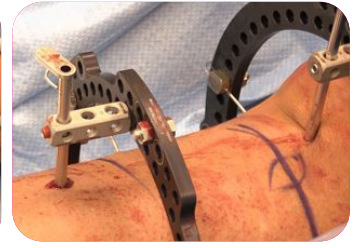


Figure 10

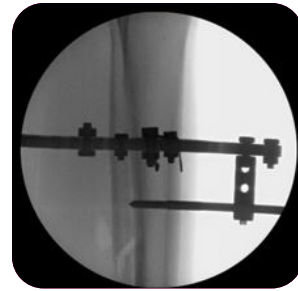


Figure 11

10. Center the Ring on the leg with respect to the soft tissues

Once the Ring is accommodating medially and laterally, use a Three Hole Cube to fix the Ring in the sagittal plane. Place this Cube distal to the Ring and check the lateral X-ray to ensure that the Pin is placed perpendicular to the tibial shaft. Place the Pin and secure in the Cube.

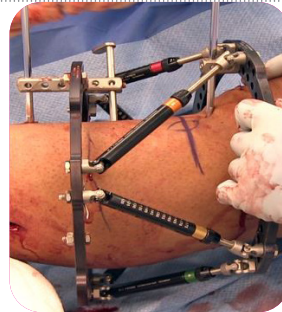


Figure 12

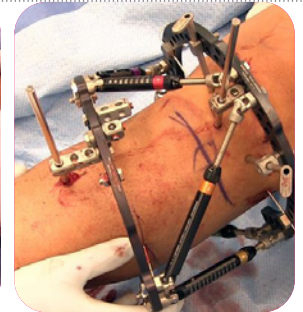


Figure 13

11. Place six Medium Struts in their positions

Standard or FAST FX Struts can be used. The author's preference is for Standard Struts.

Note the initial Strut settings and size for the frame planning schedule. After the osteotomy you will verify that these numbers are the same.



Figure 14

12. Add additional fixation

This includes two more Half Pins proximally and two more Half Pins distally. The proximal ring can accommodate a One Hole Cube with a washer and a Pin Fixation Bolt. The distal Ring can accommodate two more Pins inside the Ring.



Figure 15

13. Perform the osteotomy 4cm distal to the proximal Ring using multiple drill holes and an osteotome.

Ensure the osteotomy is complete by detaching the Struts from one of the Rings and counter-rotating the Rings. If the Rings do not rotate freely, the osteotomy is not complete. If using FAST FX[®] Struts, simply unlock the FAST FX mechanism without detaching the Struts. Once complete, re-attach the Struts back up and check to make sure the osteotomy is not displaced on the fluoro and the Strut numbers are all the same.



Figure 16



Figure 17

14. Take the reference images for Mounting Parameters

These are orthogonal AP and Lateral images of the proximal Ring with the patella forward. This reference shot determines your AP frame offset, LAT frame offset and distance from the osteotomy which will be used as your deformity planning location.

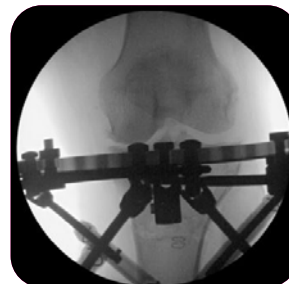


Figure 18



Figure 19

15. All wounds are closed

Antiseptic-soaked ILIZAROV[™] Sponges are placed around the Pins and 4x4's are stuffed into the frame to help control swelling with a stockinette around the frame to hold them in place.

Frame planning

Go to www.spatialframe.com to plan the correction and generate a correction schedule.

Inputs Needed:

- Name for the case
- Anatomical parameters: side and anatomical region
- Type of correction: Total residual
- Type of Strut: Standard or FAST FX[®]
- Reference Ring: Proximal

The screenshot displays the 'Case Info' step of the Spatial Frame software interface. At the top, there is a navigation bar with buttons for 'Save', 'Save As', 'Close', and 'Create New Case'. Below this is a progress indicator with seven steps: 1. Case Info (active), 2. Deformity, 3. Frame, 4. Mount, 5. Strut Settings, 6. Duration / SAR, and 7. Prescription.

The main content area is divided into three sections:

- First, Enter Case Info:** This section contains several input fields: 'Case Name' (with a required field indicator), 'Date' (with a calendar icon), 'Case ID', and 'Case Notes' (containing the text 'left varus proximal tibia').
- Next, Select Correction Area:** This section features two anatomical diagrams. The left diagram shows a full human skeleton with blue brackets on the lower legs. The right diagram shows a detailed view of the tibia and fibula, with a blue box highlighting the proximal metaphysis region. Below these diagrams is the text 'Left Tibia / Fibula, Proximal Metaphysis'.
- Help:** A vertical sidebar on the right side of the interface.

At the bottom of the interface, there is a section for 'Then, Choose Operating Mode:' with two radio button options: 'Total Residual' (selected) and 'Chronic'.

Figure 20

Deformity parameters

- AP Angulation: Typically 10-16° of varus based upon pre-operative calculations
- AP Translation: Corresponding Point is typically 5mm-10mm medial
- Rotation: Based upon pre-operative clinical assessment
- Lateral Angulation: typically Apex Anterior 10° frames always go into pro-curvatum; planning the pro-curvatum ahead in the initial frame schedule prevents multiple residual corrections.
- Lateral Translation: None

Save Save As Close

1. Case Info 2. Deformity 3. Frame 4. Mount 5. Strut Settings 6.

► **First, Select Reference Fragment:**

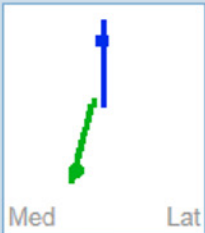
Proximal Distal

► **Next, Enter Deformity Measurements:**


AP View

Angulation: (degrees)
 Valgus Varus

Translation: (mm)
 Medial Lateral



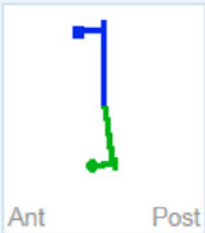
Anatomy: Left View: **Bone** Dowel



Lateral View

Angulation: (degrees)
 Apex Posterior Apex Anterior

Translation: (mm)
 Posterior Anterior



Axial View

Angulation: (degrees)
 Internal External

Translation: (mm)
 Short Long




Figure 21

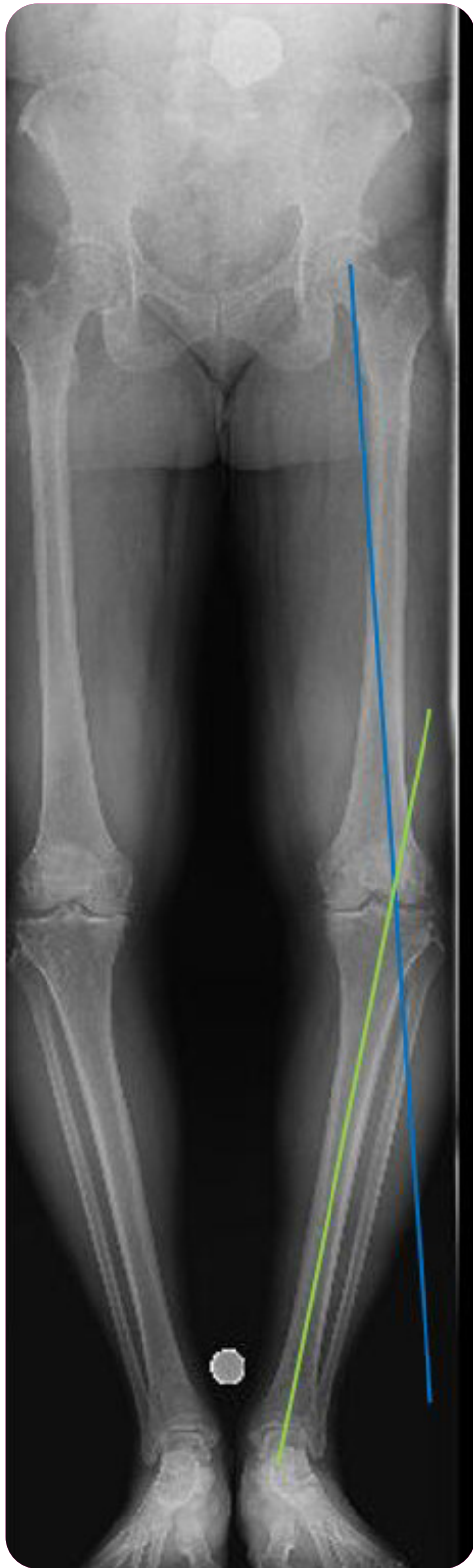


Figure 22a



Figure 22b



Figure 22c

- **Mechanical Axis:**
Center of the femoral head through knee for minimum correction or lateral to lateral tibial spine for maximum correction
- **Deformity Axis:** Line through center of ankle and center of mid-shaft tibia
- **Joint Line**
- - - **Osteotomy:** Parallel to the joint line, 4-5cm below top of fibula
- ⋯ Draw a line from the edge of the osteotomy that is 90° to the Mechanical Axis
- This is the **Origin**
- ⋯ Draw a line from the edge of the Osteotomy that is 90° to the Deformity Axis
- This is the **Corresponding Point**

Save Save As Close

1. Case Info > 2. Deformity > 3. Frame > 4. Mount > 5. Strut Settings > 6. Di

► **First, Select Rings:**

Proximal Ring: 2/3 Ring 180 mm, 7107-1307 Outer Mount Between Struts 4 & 5

Distal Ring: Full Ring 180 mm, 7107-0115

► **Next, Select Struts:**

	Standard Struts					Fast FX Struts			
	XXS 59-76 mm 7107-0200 Select All	XS 75-96 mm 7107-0205 Select All	Short 90-125 mm 7107-0210 Select All	Medium 116-178 mm 7107-0220 Select All	Long 169-283 mm 7107-0230 Select All	XS 91-121 mm 7107-0705 Select All	Short 116-152 mm 7107-0710 Select All	Medium 143-205 mm 7107-0720 Select All	Long 195-311 mm 7107-0730 Select All
Strut 1	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strut 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strut 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strut 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strut 5	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strut 6	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 23

Mounting parameters

- AP Frame Offset: typically 0-10mm lateral
- Lat Frame offset:
 - 180mm ring, typically 30-35mm posterior
 - 155mm ring, typically 15-20mm posterior
- Axial offset: distance from Origin to Center of Ring, 4cm based on level of Osteotomy

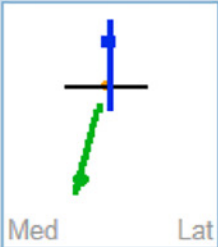
1. Case Info 2. Deformity 3. Frame 4. Mount 5. Strut Settings 6. Du

▶ **Enter Reference Ring Settings:**

AP View

Frame Offset:
 (mm)

Medial to Origin
 Lateral to Origin

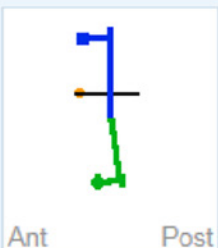


Med Lat

Lateral View

Frame Offset:
 (mm)

Anterior to Origin
 Posterior to Origin



Ant Post

Axial View

Frame Offset:
 (mm)

Proximal to Origin
 Distal to Origin


Rotary Frame Angle:
 (degrees)

Internally Rotated
 Externally Rotated



Lat Medial

Anatomy: Left View: Bone Dowel



Med Lat

[Go Back to Step 3](#) [Continue to Step 5](#)

Figure 24

Check initial frame graphics to ensure that the pictures match the clinical scenario. Remember that the frame will appear to be in more varus on the diagrams because you are over-correcting the leg and building in extra varus into the frame.

1. Case Info > 2. Deformity > 3. Frame > 4. Mount > 5. Strut Settings > 6. Du

► **First, Enter Initial Strut Settings:**

	Strut 1 ■	Strut 2 ■	Strut 3 ■	Strut 4 ■	Strut 5 ■	Strut 6 ■
Initial Strut Lengths:	<input type="text" value="112"/> (mm)	<input type="text" value="153"/> (mm)	<input type="text" value="128"/> (mm)	<input type="text" value="127"/> (mm)	<input type="text" value="115"/> (mm)	<input type="text" value="102"/> (mm)

Calculate Final Settings

► **Next, View Final Settings & Frame Previews:**

	Strut 1 ■	Strut 2 ■	Strut 3 ■	Strut 4 ■	Strut 5 ■	Strut 6 ■
Initial Strut Settings:	112	153	128	127	115	102
Final Strut Settings:	104	152	120	117	155	129

Frame Previews View: Bone Dowel

Initial Frame



Final Frame

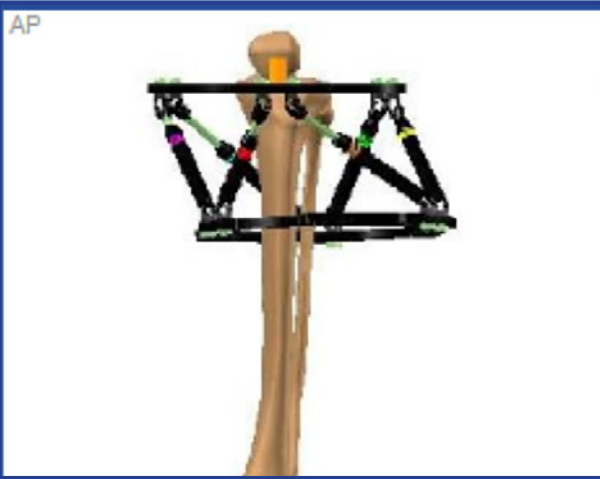
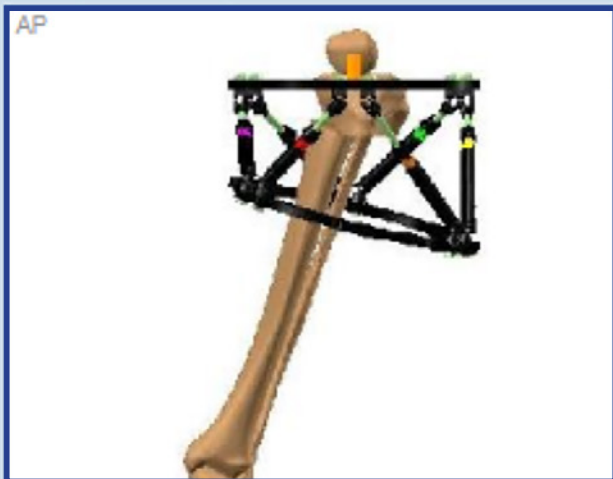


Figure 25

Mounting parameters *continued*

Structure at Risk – define where the rate of correction should be limited to your chosen rate

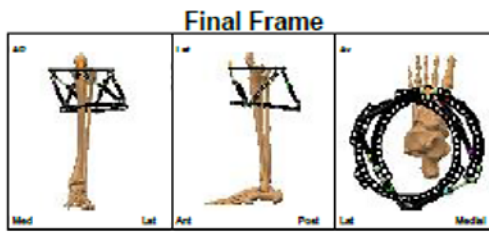
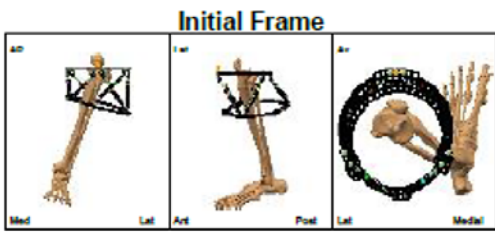
Suggest using medial cortex – typically 10-20mm medial to origin

Rate of correction at the SAR: 1mm/day

The screenshot shows a software interface with a top navigation bar containing 'Save', 'Save As', 'Close', and 'Create New Case'. Below this is a progress bar with steps: 1. Case Info, 2. Deformity, 3. Frame, 4. Mount, 5. Strut Settings, 6. Duration / SAR, and 7. Prescription. The main area is titled 'First, Define Structure At Risk (SAR):'. It features three view panels: AP View (Offset: 20.0 mm, Lateral To Origin selected), Lateral View (Offset: 0.0 mm, Anterior To Origin selected), and Axial View (Offset: 0.0 mm, Distal To Origin selected). A central 3D model of a bone shows a 'Dowel' and 'Bone' with a 'Med' label. A 'Help' box on the right contains a 'Please Note' and text explaining SAR and correction time. Below the views is a section titled 'Next, Enter Correction Time:' with a 'Calculate Minimum Correction Time' box (Maximum Safe Distraction Rate: 1.0 mm/day, resulting in 23 Days) and a 'Desired Correction Time' box (23 Days, Override Correction Time? checkbox). A note explains that users can enter a custom correction time but it is recommended to define a SAR and calculate a minimum correction time.

Figure 26

Latency period is usually 5 days, and average correction time is 10-14 days.



Prescription

Once satisfied, print the schedule and determine if there are Strut changes. Plan your post-operative visits for these dates. You can adjust the frame schedule by adjusting the rate if you need to orchestrate the strut change date to your advantage

Prescription

Date	WkDay	Day	Strut 1	Strut 2	Strut 3	Strut 4	Strut 5	Strut 6
03/12/19	Tue	0	112	153	128	127	115	102
03/13/19	Wed	1	112	153	128	127	117 ^a	103
03/14/19	Thu	2	111	153	127	126	118 ^a	104
03/15/19	Fri	3	111	153	127	126	120 ^a	106
03/16/19	Sat	4	111	153	127	125	122 ^a	107
03/17/19	Sun	5	110	153	126	125	124 ^a	108
03/18/19	Mon	6	110	153	126	124	125 ^a	109
03/19/19	Tue	7	110	153	126	124	127	110
03/20/19	Wed	8	109	153	125	124	129	111
03/21/19	Thu	9	109	153	125	123	131	113
03/22/19	Fri	10	109	153	125	123	132	114
03/23/19	Sat	11	108	153	124	122	134	115
03/24/19	Sun	12	108	152	124	122	136	116 ^b
03/25/19	Mon	13	107	152	123	121	138	117 ^b
03/26/19	Tue	14	107	152	123	121	139	118 ^b
03/27/19	Wed	15	107	152	123	120	141	120 ^b
03/28/19	Thu	16	106	152	122	120	143	121 ^b
03/29/19	Fri	17	106	152	122	120	145	122 ^b
03/30/19	Sat	18	106	152	122	119	146	123 ^b
03/31/19	Sun	19	105	152	121	119	148	124 ^b

Prescription

Date	WkDay	Day	Strut 1	Strut 2	Strut 3	Strut 4	Strut 5	Strut 6
04/01/19	Mon	20	105	152	121	118	150	125 ^b
04/02/19	Tue	21	105	152	121	118	152	127
04/03/19	Wed	22	104	152	120	117	153	128
04/04/19	Thu	23	104	152	120	117	155	129

Strut Change-Outs

Change-Out	Strut	Overlap Interval		Strut Change	
		First Day	Last Day	From	To
a	5 (Blue)	1 (03/13/19)	6 (03/18/19)	7107-0210 Short Standard	7107-0220 Medium Standard
b	6 (Violet)	12 (03/24/19)	20 (04/01/19)	7107-0210 Short Standard	7107-0220 Medium Standard

Post-operative care*

The patient can perform range of motion of the knee and ankle and weight bear as tolerated on the limb. An orthoplast splint is fashioned by the in-house Occupational Therapist for the patient to wear on a two-hour on / two-hour off schedule while awake and at night to prevent an equinus contracture.

The average hospital stay is two days. Post-operative pain medication may be necessary.

Pin care is with Hexagonal sponges and saline. Showers with antibacterial soap are allowed after the stitches or staples are removed and the pin care is performed following showers.

Physical therapy is three times per week and is for range of motion of the knee and gait training.

Deep vein thrombosis prophylaxis is recommended for 4-6 weeks.

Post-operative visits are scheduled two weeks post-operatively and then weekly until the correction is perfect on the standing leg and long lateral radiograph. Once final correction is achieved, the Struts are secured which cloth tape around the dial. Radiographs are performed monthly following the achievement of the correction until the bone is consolidated. Prior to frame removal, the frame can be dynamized in a variety of ways that reduce the stability of the construct, thereby reducing the tension in the device and allowing the bone to experience more load for one month prior to removal.

The average frame time is 4-5 months. To ensure proper healing all patients are given 5000IU vitamin D daily and their vitamin D level is checked in the hospital. If low, the 5000IU daily is supplemented with 50,000IU weekly for 8 weeks and the level is re-checked.

Once the bone has healed the frame is removed under anesthesia as an outpatient. Weight-bearing following frame removal is 50% for two weeks followed by 100% for two weeks. This is allowed with the use of crutches for one month. This is to prevent any fractures through the pin sites while they remodel.

After one month, physical therapy is continued until the patient is strong enough to resume all of their desired activities.

*Postoperative care is individualized and is determined by the physician based on the patient's symptoms, injury pattern, unique patient anatomy, patient medical history, and individual treatment requirements. Not all patients will have the same surgical procedure or timelines for rehabilitation.

The views and opinions expressed for postoperative care are solely those of the surgeon(s) and do not reflect the views of Smith+Nephew.

See Dr. Conway perform the High Tibial Osteotomy procedure using TSF[®] on VuMedi:
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Nota Bene

The technique description herein is made available to the healthcare professional to illustrate the author's suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the specific patient.



Pre-op Mechanical Axis outside the knee



Post correction Mechanical Axis Restored



Post frame removal Mechanical Axis Restored



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20678 V4 07/21

References

1. Capella M, Gennari E, Dolfin M, Saccia F. Indications and results of high tibial osteotomy; *Ann Joint* (2017) 2:33. **2.** Noyes FR, Mayfield W, Berber-Westin SD, Albright JC, Heckmann TP; Opening Wedge High Tibial Osteotomy; *The Amer J of Sports Medicine* (2006) Vol 34, No 8. **3.** Villattea G, Erivana R, Fournier PL, Pereirac B, Galvina M, Descamps S, Boisgarda S. Opening-wedge high tibial osteotomy with a secure bone allograft (Osteopure™) and locked plate fixation: Retrospective clinical and radiological evaluation of 69 knees after 7.5 years follow-up; *Orthopaedics & Traumatology: Surgery & Research* 101 (2015) 953-957. **4.** Van Houten AH, Heesterbeek PJC, van Heerwaarden RJ, van Tienen TG, Wymenga AB. Medial Open Wedge High Tibial Osteotomy: Can Delayed or Nonunion Be Predicted? *Clin Orthop Relat Res* (2014) 472:1217-1223. **5.** Warden SJ, Morris HG, Crossley KM, Brukner PD, Bennell KL. Delayed- and non-union following opening wedge high tibial osteotomy: surgeons' results from 182 completed cases. *Knee Surg Sports Traumatol Arthrosc* (2005) 13:34-37. **6.** Rampurada A, Madan S, Tadross T. Treatment of complex tibial plateau and distal tibial fractures with Taylor Spatial Frame: experience in a district general hospital. *Eur J Orthop Surg Traumatol*. 2008;18:521-524. **7.** Ashfaq K, Fragomen AT, Nguyen TJ, Rozbruch SR. Correction of Proximal Tibia Varus with External Fixation. *J Knee Surg*. 2012;25:375-384. **8.** Elbatrawy Y, Fayed M. Deformity Correction With an External Fixator : Ease of Use and Accuracy? *Orthopedics*. 2009;32(2):82. **9.** Sala F, Thabet AM, Castelli F, et al. Bone Transport for Postinfectious Segmental Tibial Bone Defects With a Combined Ilizarov/Taylor Spatial Frame Technique. *J Orthop Trauma*. 2011;25:162-168. **10.** Sharr PJ, Mangupli MM, Winson IG, Buckley RE. Current management options for displaced intra-articular calcaneal fractures: Non-operative, ORIF, minimally invasive reduction and fixation or primary ORIF and subtalar arthrodesis. A contemporary review. *Foot Ankle Surg*. 2016;22(1):1-8.