Introduction to the Taylor Spatial Frame™ Hardware

What is the Taylor Spatial Frame?

- Next generation circular fixator capable of 6 axes of deformity correction or acute fx reduction
- Combination of hardware and software
- 2 rings joined by 6 telescoping struts
- Software is internet-based
- Acute trauma indication when Fast Fx struts are used
- Modular or pre-assembled

TSF: HARDWARE

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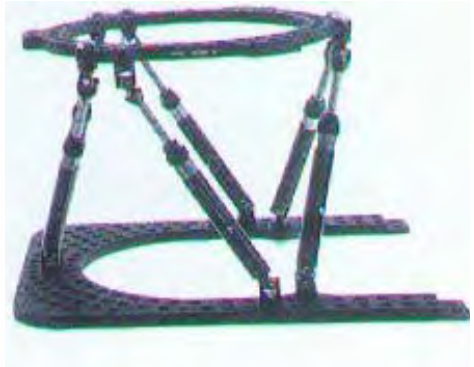
Standard Frame

Open Frame



Foot Frame

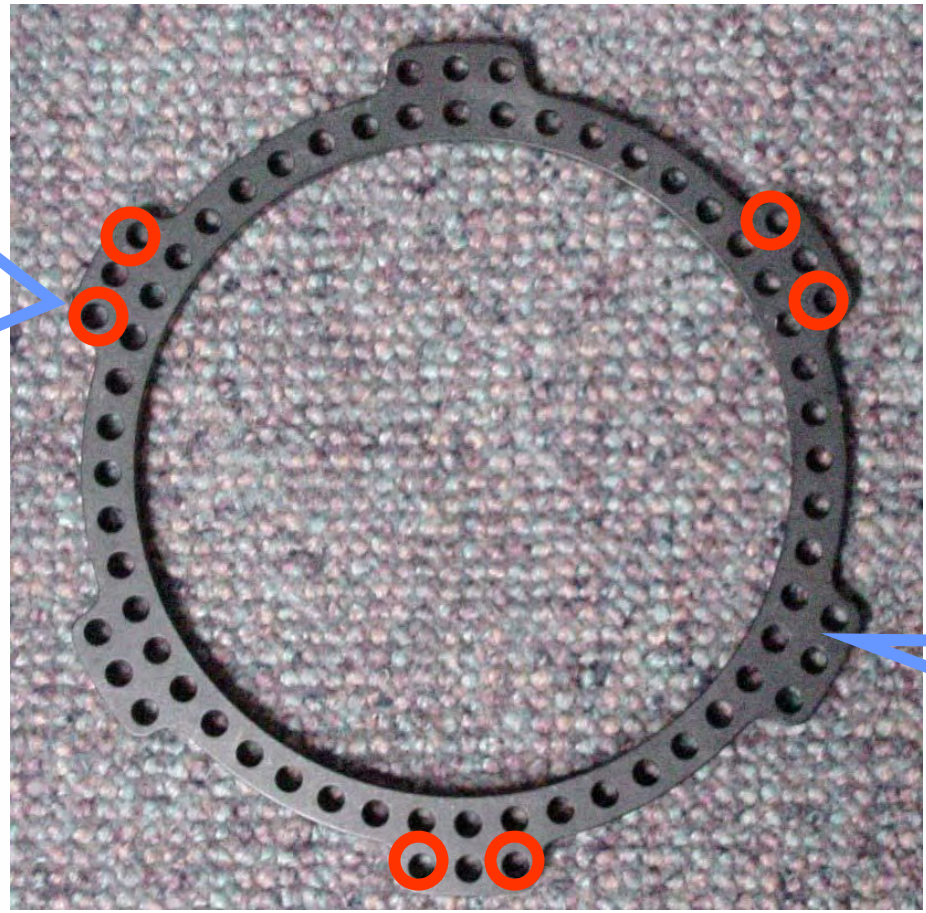
RINGS

- Allow for connection of struts
- Allow for connection of pins and wires to bone
- Also can be used to attach accessory rings for added stability
- Circular shape allows use of wires and helps spread force to prevent cantilever forces from being applied to bone segments

RINGS

- Holes same distance apart regardless of ring diameter
- 7mm thickness
- Tabs for attaching struts
- Aluminum, radiopaque
- 80-300mm
- Full, 1/2, 2/3, Foot

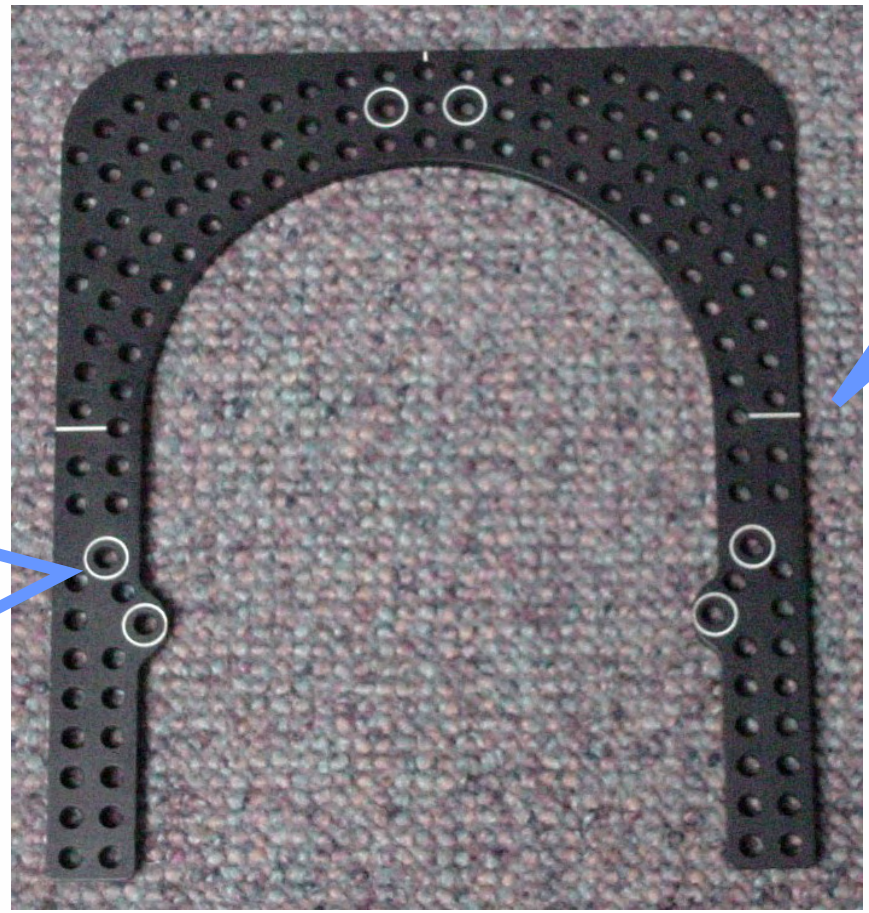
FULL RINGS



Struts attach to rings on tabs. Use outer holes

Skip a tab between

FOOT RINGS



Circles indicate positions for struts

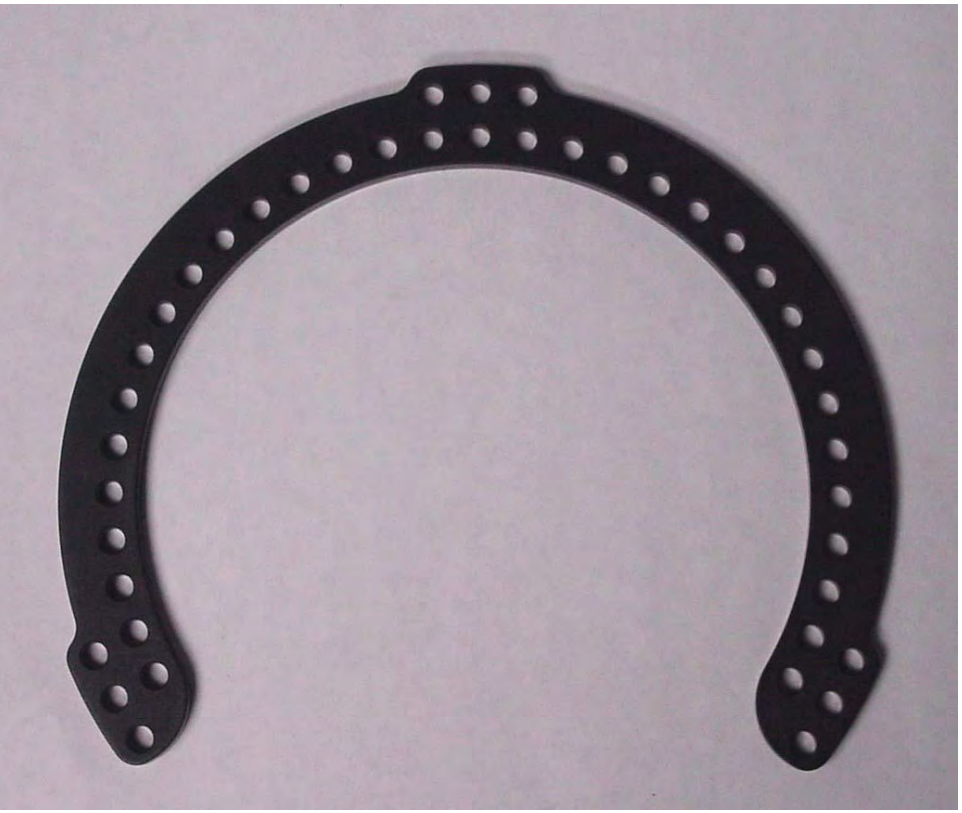
Hash marks indicate center of ring

Same markings on both sides of ring

FOOT RINGS AND U-PLATES

- Essentially the same form and function
- Foot rings are 155 and 180mm diameter
- U-plates are 80-130mm
- Foot rings have flat at end of horseshoe to accept a half ring
- U-plates have tapped holes to accept another ring mounted perpendicular
- Both types have etchings for struts and center line

2/3 RING



- Used around joint to allow ROM
- 80-230mm

Can I build a frame with two 2/3 rings?

Yes

- The openings cannot be lined up with each other because struts won't attach
- Rotate rings 60 degrees from each other
- This will put a tab from one ring in the middle of the opening of the other ring
- Why? Because one ring could be at the proximal humeral joint and the other could be distally at the mid-shaft humerus (ROM)

USING ILIZAROV◇ RINGS w/TSF

You can do this, but there will be some problems:

- This avenue of approach is not recommended

USING TSF RINGS w / ILIZAROV

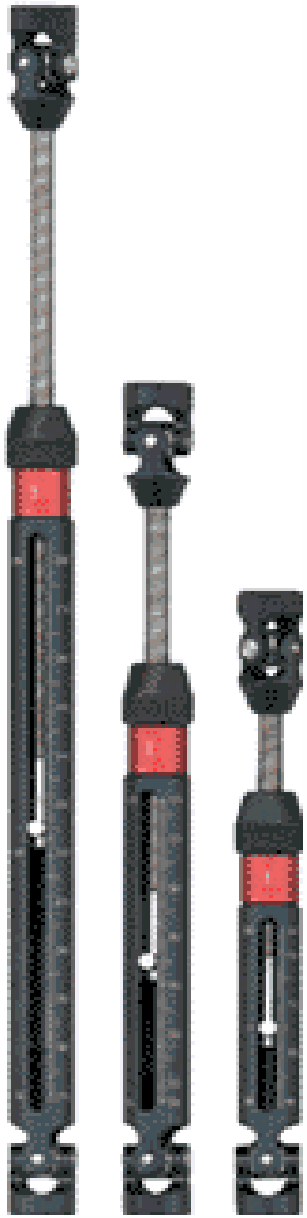
Done all the time

- TSF full rings stiffer than Ilizarov half rings
- TSF Foot Rings and U-Plates stiffer than Ilizarov foot rings
- Very common to do a bone transport with TSF rings and Ilizarov clickers, but change to struts for docking

STRUTS

- The motor that drives correction
- 6 struts – 6 planes of deformity correction
- Replaces translation/rotation mechanism, threaded rods, clickers, hinges and
- Gotta have 6 of them or the frame is completely unstable

STANDARD STRUTS



- Telescoping, graduated
- Passive universal joints
- Shoulder bolts included, ID bands are not
- Sizes overlap to facilitate strut changes
- Aluminum body and steel rods
- Interchangeable
- Primarily for deformity correction
- 4 sizes

FAST Fx STRUTS

- Trauma and deformity applications
- Adjustment knob disengages for rapid acute adjustments
- Gradually adjustable for fine tuning
- Jam nut prevents strut migration
- Special ID band keeps adjustment mechanism locked
- About 2.5cm longer than standard struts

FAST F_x STRUTS

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Jam Nut

Locking Ring

Adjustment Knob

Location for ID Band

Adjustment Indicator

FAST F_x STRUTS

When adjustment knob is unlocked, strut can slide freely for rapid acute adjustments

When adjustment knob is locked strut can adjust gradually for fine tuning

FAST Fx ID BAND

- Identifies strut for both surgeon and patient
- Coincides with number and color coding on software
- Prevents locking ring from disengaging
- Difficult to remove by design

STANDARD vs. FAST F_x

- Gradually adjustable
- ID band only identifies strut
- Mostly for deformity correction

- Gradual OR acute adjustment
- ID band identifies strut AND prevents disengagement
- Jam nut prevents migration
- Struts are longer
- For BOTH deformity correction and acute trauma

FAST FX vs. STANDARD

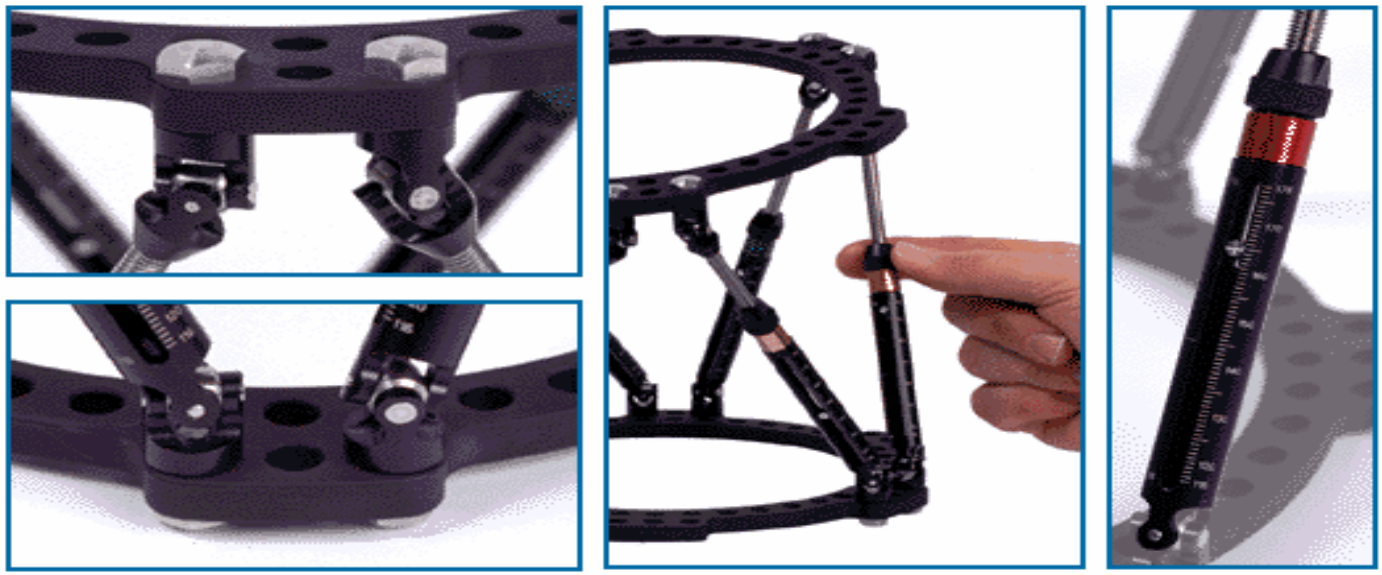
If you could choose only one strut . . .

- Go with Fast Fx
- It does everything Standard does, plus more
- Allows for more flexible application of frame

XSHORT and XXSHORT STANDARD STRUT

- XShort adjustable from 75-96mm
- Overlaps standard Short Strut by 6mm
- New XXshort strut adjustable from 59-76mm
- Shortest strut so it allows for less distance between rings
- Both are useful for pediatrics or severe angulation

6 STRUT CONFIGURATION



Excellent torsion & compression strength

6 struts – 6 planes of deformity correction

Struts can be changed to different sizes as needed

Can be moved out of way for pin insertion, strut changes, or flap work

ID BAND KIT

- Identifies struts for surgeon during frame application
- Identifies strut for patient during frame adjustment
- Separate kits for Fast Fx and standard
- Fast Fx also prevents disengagement of locking ring between adjustments
- New Fast Fx ID Bands are made of plastic. Standard made of aluminum

ID BANDS

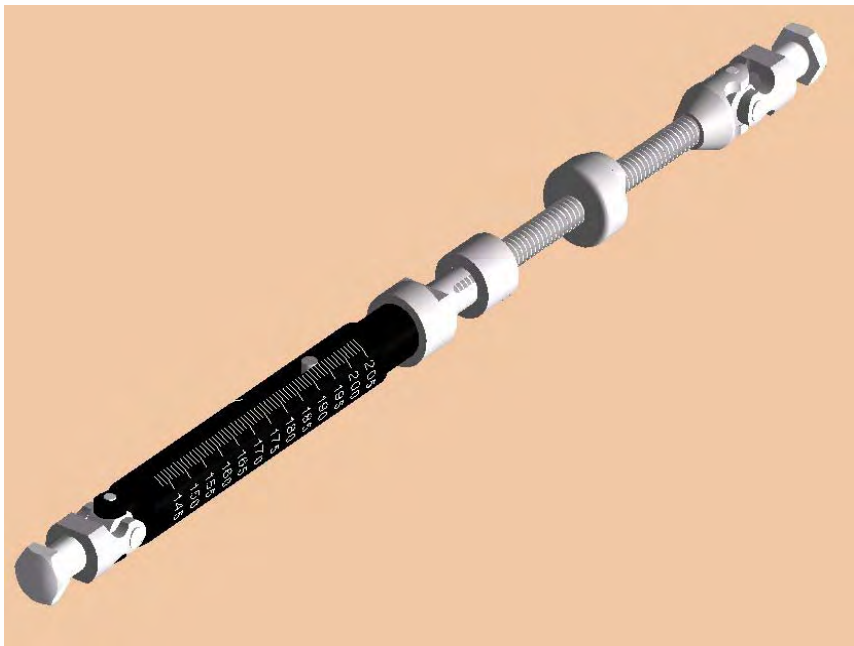
Fast F_x ID Band goes on adjustment mechanism to identify strut AND prevent loosening

Standard ID Band goes on strut body only to identify it

METAL INJECTION MOLDING (MIM) STRUTS

- Cost savings initiative: convert to metal injection molding from machining
- Reduces manufacturing lead times
- Makes strut more robust
- Lower manufacturing cost, but components will be silver colored and slightly heavier
- Beginning December, struts will have mixed silver and black components
- ID bands will be molded plastic
- Transition complete by mid 2Q 2Q04

AFFECTED COMPONENTS



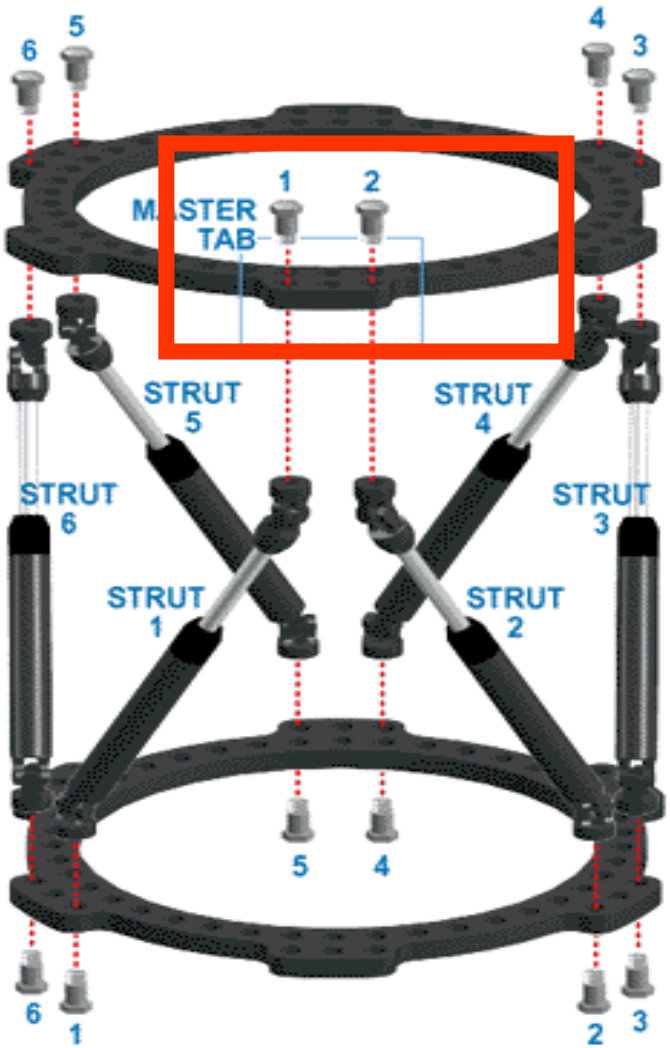
SHOULDER BOLT

- Included with struts AND sold separately
- Do not need to order shoulder bolts when building a frame unless you just want to have extras
- Standard 10mm head
- Shoulder allows bolt to be tightened but still allows strut to rotate
- Cannot be replaced by a regular connection bolt
- Special spiral lock threads prevent loosening
- DO NOT OVERTIGHTEN!

TORQUE WRENCH

10mm socket prevents over-tightening of shoulder bolts.
Torque release: 50 in. lbf.

FRAME CONSTRUCTION



- Master Tab proximal and anterior
- ALWAYS on proximal ring
- Independent of reference ring
- 1 and 2 strut always must meet at master tab
- Struts always must be positioned in order and counter clockwise rotation as patient looks down limb
- Struts always must be mounted on tabs

THERE ARE EXCEPTIONS TO EVERY RULE!

- Sometimes the master tab is not mounted anterior:
  - Error in mounting
  - Rotated to allow range of motion

- Not a problem
  - Enter the amount of rotation as Rotary Frame Offset under Mounting parameters

MASTER TAB MISTAKE

- What if the resident mounted the frame upside down? (master tab distal)
- Again, not a problem:
  - Before the attending finds out, remove the ID bands
  - Replace them so that the master tab is superior and as anterior as you can get it
  - Run a Total Residual from there

MASTER TAB

- Determined by tab where 1 and 2 struts join proximal ring
- ALWAYS on proximal ring not necessarily reference ring
- If using a distal reference, master tab is still on proximal ring. NEVER INVERT FRAME!
- Already determined on Pre-Assembled Frames
- Selected on custom frames by where you place color bands (start at any tab, but follow rules of strut sequence)

STRUT ORIENTATION

- It does not matter which way struts point (adjustment knob up or down)
- It only matters that crotch of 1 and 2 struts joins master tab
- Patients usually find it easier to read calibrations if struts are pointed down

REFERENCE RING

- Considered to be non-moving ring
- Can be proximal or distal ring
- Distal referencing generally used for distal femur, distal tibia, and foot
- Always orthogonal (perpendicular) to reference bone fragment
- Despite proximal or distal referencing, master tab is always superior

DISTAL REFERENCING

- When using a distal reference, 4 things must change:
  - Change reference ring to “Distal”
  - AP translation: What was lateral becomes medial and vice versa
  - Lateral Translation: What was anterior becomes posterior and vice versa
  - Reference ring probably will be DISTAL to origin (mounting parameter)

ADJUSTING STRUTS

- STANDARD STRUTS
- Black adjustment knob has an arrow and a plus sign to indicate direction
- Turn knob in appropriate direction
- Turn in direction of arrow to lengthen
- Turn away from arrow to compress
- Turn knob a full turn until you feel a click
- One full turn is 1mm of correction

ADJUSTING STRUTS

- Fast Fx Struts GRADUAL MODE:
- Loosen black jam nut
- Silver adjustment knob has an arrow and a plus sign to indicate direction
- Turn knob in appropriate direction
- Turn in direction of arrow to lengthen
- Turn away from arrow to compress
- Turn knob a full turn until you feel a click
- Re-secure jam nut

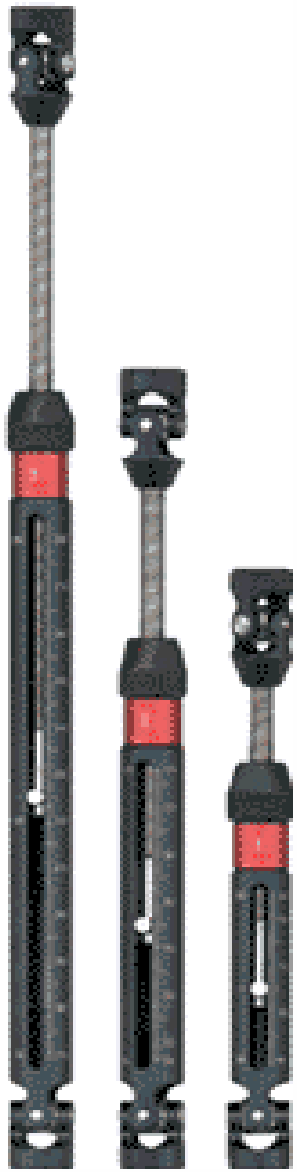
ADJUSTING STRUTS

- Fast Fx Struts ACUTE MODE:
- Loosen black jam nut
- Fully disengage knurled locking ring on adjustment mechanism by pulling down on locking ring
- Push or pull strut to desired length
- Engage locking ring by pushing it up until it is seated against end of adjustment collet
- Re-secure jam nut

STRUT CHANGES

- In cases of severe deformity, you likely will need to begin with one set of strut sizes and end with another
- 6-strut configuration is very stable, but removal of even one strut makes frame completely unstable
- To change a strut, introduce 7th point of fixation anywhere between rings before removing strut
- Usually done with twisted plates and threaded rods
- Replace strut and remove 7th point of fixation

STRUT CHANGES



- Struts overlap in length to make changes easier
- Only applies to struts of same family
- A short standard overlaps with a medium standard but not with a medium Fast F_x, etc.

What's Needed for a Case

4 rings: 2 ea. 155 and 180 (most common)

10 struts

- 2 Long
- 6 Medium
- 2 Short

ID Band Kit

Ilizarov set

Or 71070600 TSF Standard set

Or 71070500 TSF Fast Fx set

HA pin instruments and implants

TSF SETS

- Designed for tibial applications
- Contains 6 of each size strut (either Fast Fx or standard)
- Contains 155 and 180mm full, 2/3 and/or half rings
- Contains Ranchos, nuts, bolts, wires, and instruments
- 2 cases, 3 trays
- Everybody loves them because they’re simple

Questions???