

Vertical Expandable Prosthetic Titanium Rib

VEPTR™

Surgical Technique

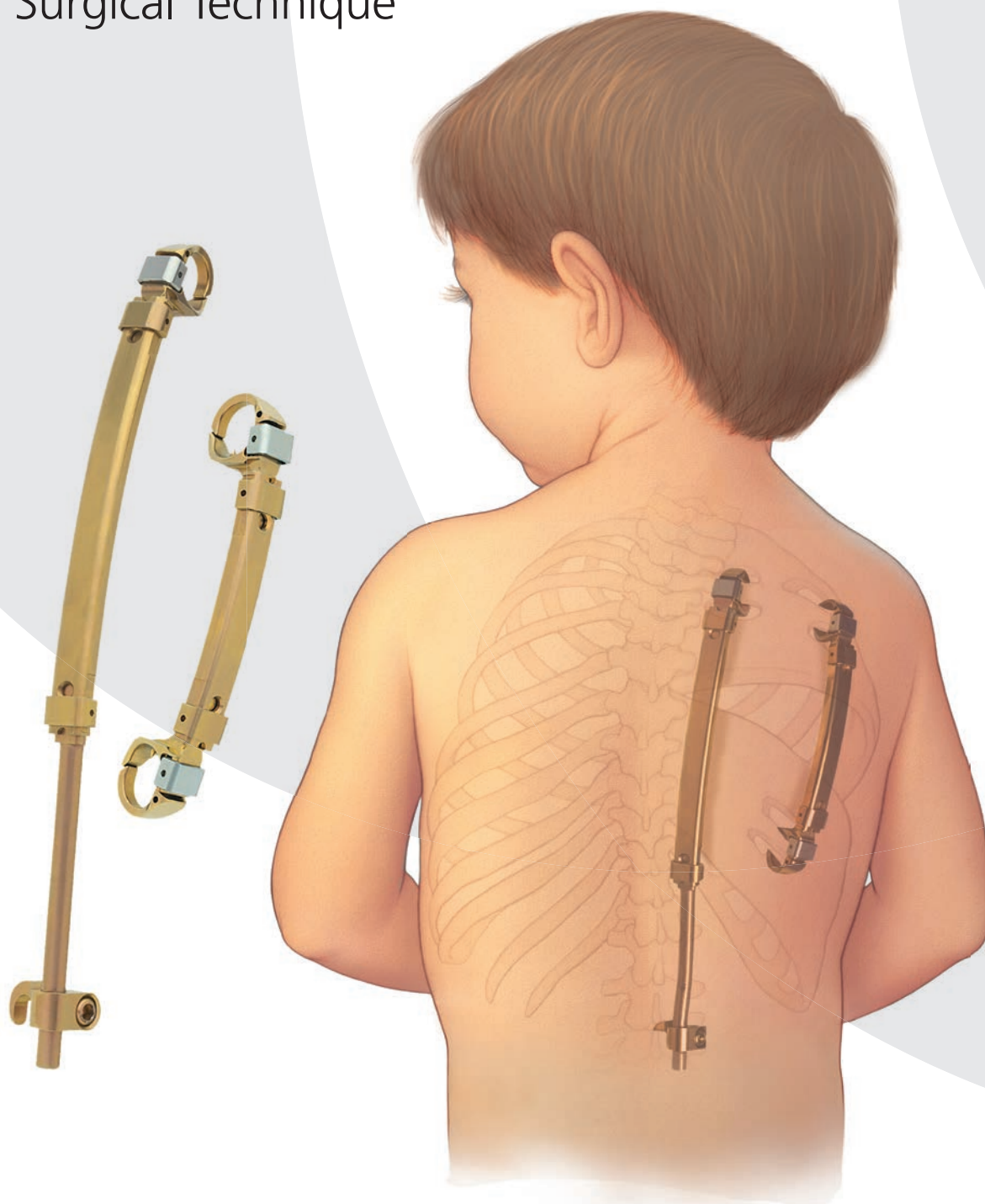




Image intensifier control

This description alone does not provide sufficient background for direct use of DePuy Synthes products. Instruction by a surgeon experienced in handling these products is highly recommended.

Processing, Reprocessing, Care and Maintenance

For general guidelines, function control and dismantling of multi-part instruments, as well as processing guidelines for implants, please contact your local sales representative or refer to:

<http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance>

For general information about reprocessing, care and maintenance of Synthes reusable devices, instrument trays and cases, as well as processing of Synthes non-sterile implants, please consult the Important Information leaflet (SE_023827) or refer to:

<http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance>

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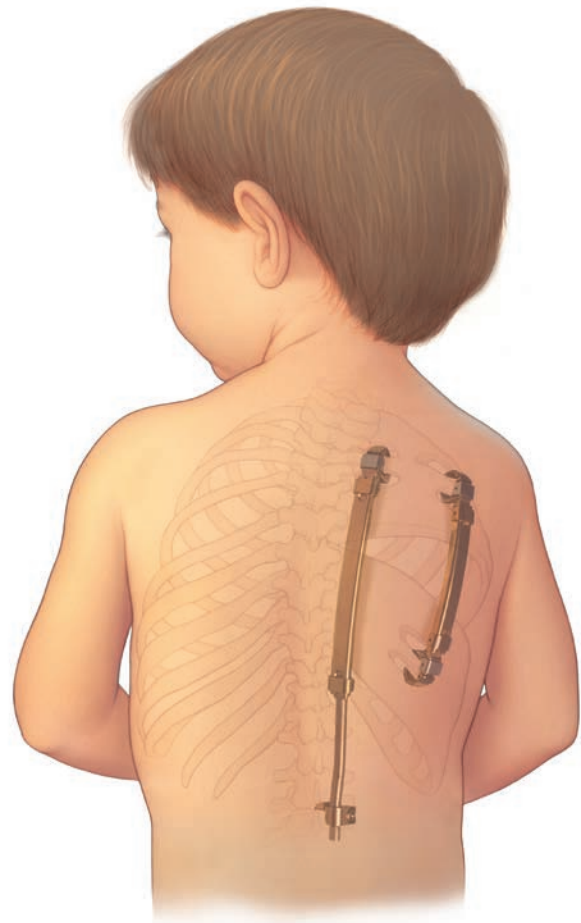
The VEPTR™ Vertical Expandable Prosthetic Titanium Rib is based on a three-dimensional thoracic approach to treat patients with complex chest wall and/or spinal deformities where the thorax is unable to support normal respiration or lung growth (Thoracic Insufficiency Syndrome). Additionally, VEPTR devices control and may correct scoliosis.

VEPTR is designed to mechanically stabilize and distract the thorax to improve respiration and lung growth in infantile and juvenile patients.

Devices are attached perpendicularly to the patient's natural ribs (superior attachment point) and more caudal ribs, a lumbar vertebra or to the ilium (inferior attachment point). Once the VEPTR device is in place, its design allows expansion, anatomic distraction, and replacement of components through less-invasive surgery.

Goals of treatment

1. Increase thoracic volume
2. Correct scoliosis
3. Improve thoracic function
4. Establish thoracic symmetry by lengthening the concave, restricted hemithorax
5. Avoid growth-inhibiting procedures
6. Maintain these improvements throughout the patient's growth
7. Maintain spinal alignment
8. Allow spinal growth



Indications and Contraindications

Indications

The VEPTR device is indicated for:

Primary Thoracic Insufficiency Syndrome (TIS) due to a three-dimensional deformity of the thorax

- Progressive thoracic congenital scoliosis with concave fused ribs
- Progressive thoracic congenital scoliosis with flail chest due to absent ribs
- Progressive thoracic congenital, neurogenic or idiopathic scoliosis without rib abnormality
- Hypoplastic thorax syndrome, including
 - Jeune's syndrome,
 - Jarcho-Levin syndrome,
 - Cerebro costal mandibular syndrome,
 - others
- Congenital chest wall defect, posterolateral
- Acquired chest wall defect, posterolateral
- Chest wall tumor resection
- Traumatic flail chest
- Surgical separation of conjoined twins

Secondary Thoracic Insufficiency Syndrome due to lumbar kyphosis (non gibbus)

Contraindications

The VEPTR device should not be used under the following conditions:

- Inadequate strength of bone (ribs/spine) for attachment of the VEPTR device
- Absence of proximal and distal ribs for attachment of the VEPTR device
- Absent diaphragmatic function
- Inadequate soft tissue for coverage of the VEPTR device
- Age beyond skeletal maturity for uses of the VEPTR device
- Age below 6 months
- Known allergy to any of the device materials
- Infection at the operative site

Warnings and Precautions

Patients implanted with the VEPTR device should not be braced. The VEPTR device is designed to allow for thoracic cavity growth and the restrictive nature of a brace would not help the condition, but defeat its purpose.

Patients may require additional wound protection to prevent inadvertent rubbing or bumping of the wound.

Patients with a diagnosis of spina bifida should have an occlusive dressing over the wound site to keep the site dry.

Construct Options

Rib-to-Rib

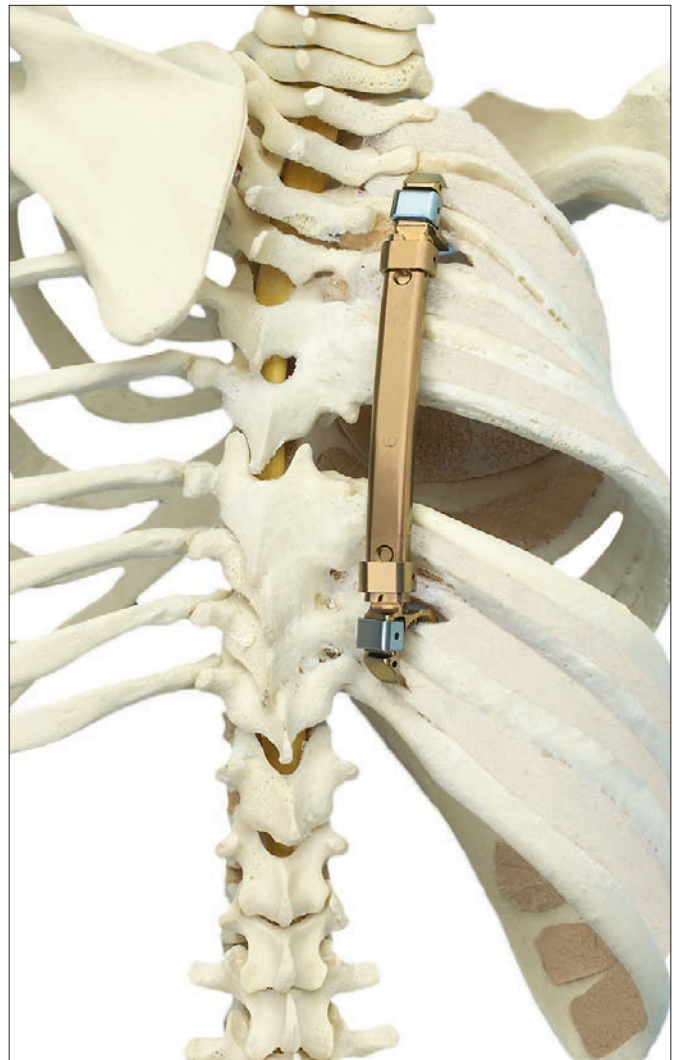
- Attaches to the superior rib and to the inferior rib
- Components available in 70 mm or 220 mm radius



220 mm radius

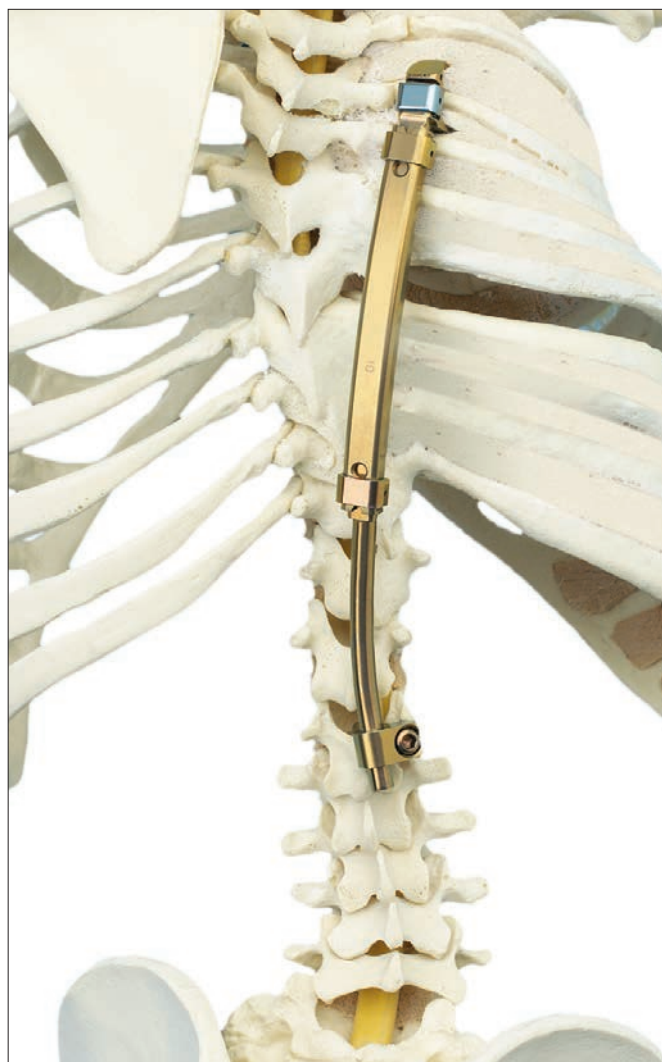


70 mm radius



Rib-to-Lumbar Lamina

- Attaches to rib and to lumbar spine
- Components available in 220 mm radius



Rib-to-Ilium

- Attaches to the rib and to the ilium
- Components available in 220 mm radius



AO Spine Principles

The four principles to be considered as the foundation for proper spine patient management underpin the design and delivery of the curriculum: stability, alignment, biology, and function.^{1,2}

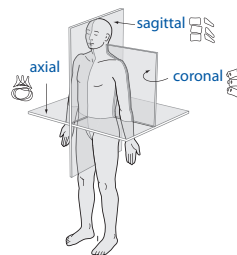
Stability

Stabilization to achieve a specific therapeutic outcome



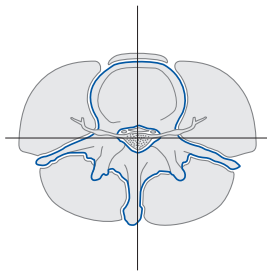
Alignment

Balancing the spine in 3 dimensions



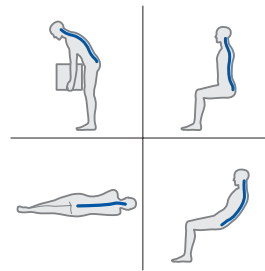
Biology

Etiology, pathogenesis, neural protection, and tissue healing



Function

Preservation and restoration of function to prevent disability



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¹ Aebi et al (1998)

² Aebi et al (2007)

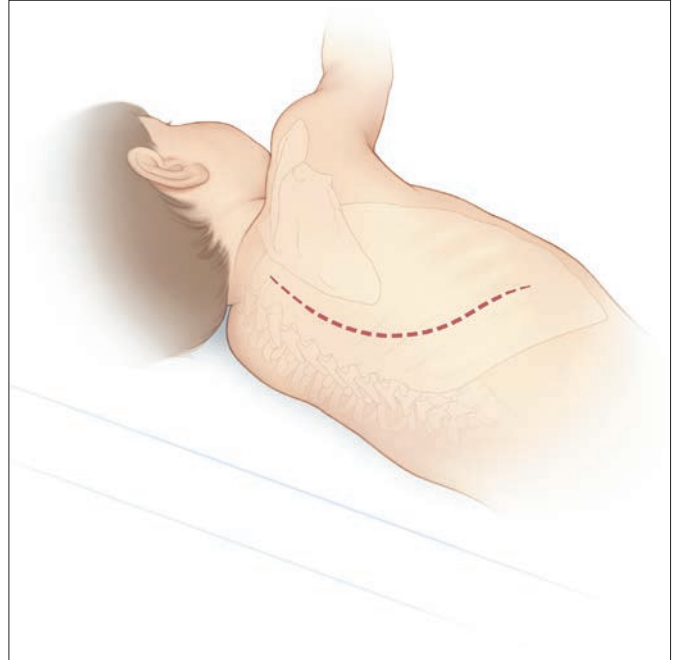
Primary Procedure

1. Position patient

Place the patient in a lateral decubitus position similar to that required for a standard thoracotomy.

To protect against brachial plexus injury, do not extend the shoulder more than 90°.

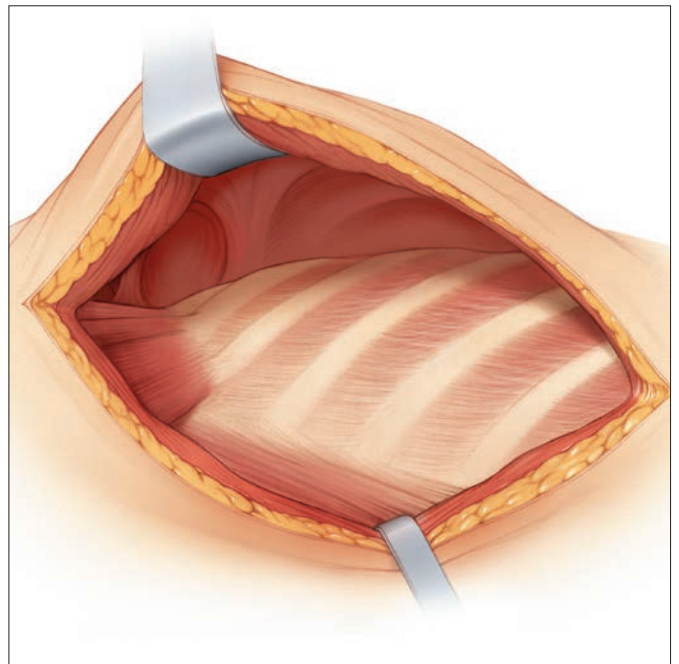
Note: Patient positioning and superior exposure remain the same regardless of the construct being implanted.



2. Perform superior exposure

Make a J-shaped thoracotomy incision without disrupting the periosteum overlying the ribs.

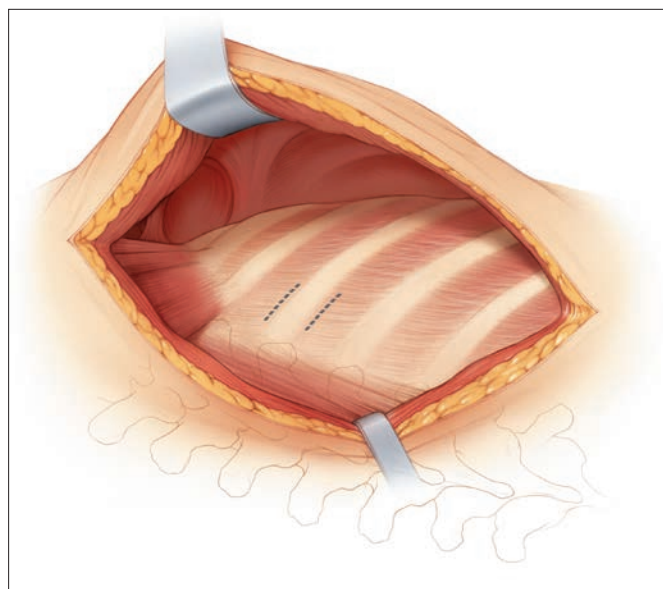
Retract the skin flaps. Continue the incision and elevate the paraspinal muscles medially only to the tips of the transverse processes. Gently elevate the scapula to expose the middle posterior scalene muscle.



3a. Identify superior rib

Identify the superior rib to be used as the superior point of attachment. Mark this point and confirm location using radiographic imaging.

Note: Because of the risk of brachial plexus impingement, do not choose the first rib as the superior point of attachment.



3b. Prepare rib for implants

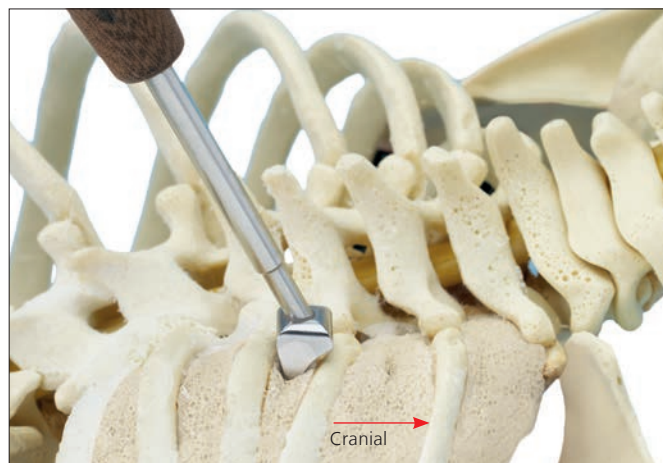
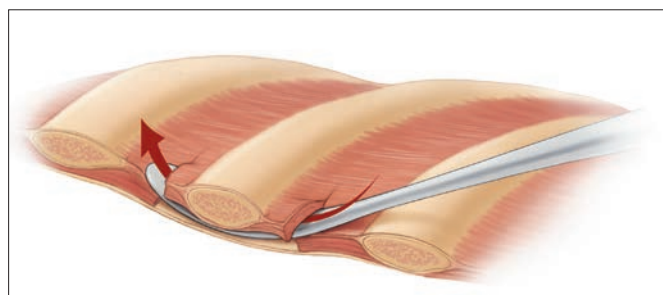
Instruments

388.467	Rib Support Feeler
398.408	Periosteal Elevator, slightly curved blade, round tip, width 5 mm
U44-48320	Periosteal Elevator, curved, 20 cm

Make a 1-cm incision into the intercostal muscles above and below the rib where the superior cradle will attach. Insert a periosteal elevator to carefully elevate the periosteum adjacent to the lung.

Take care to preserve the soft tissue surrounding the rib to protect rib vascularity and the neurovascular bundle.

Use the rib support feeler to prepare the rib for the Cranial Rib Support and the Closing Half-Ring.



3c. Select proper Cranial Rib Support angulation and radius

Assess the patient's thoracic anatomy in order to determine the required Cranial Rib Support angulation (neutral, right, or left).

Choose either a 70 mm or 220 mm radius Cranial Rib Support. A 220 mm Rib Support is used with either a lumbar extension or a 220 mm radius Caudal Rib Support. A 70 mm Rib Support is used solely with the 70 mm radius Caudal Rib Support.

The corresponding Closing Half-Ring should match the contour of the thorax when the proper angulation is chosen.



3d. Cranial Rib Support

Instrument

388.461	Holding Forceps for Closing Half-Ring or Rib Support
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Using the Holding Forceps for Rib Support, seat the underside of the Cranial Rib Support into the space between the periosteum and the rib (Figure 1). Rotate it into the correct position (Figure 2). For the medial construct, seat as medial as possible to the transverse process.

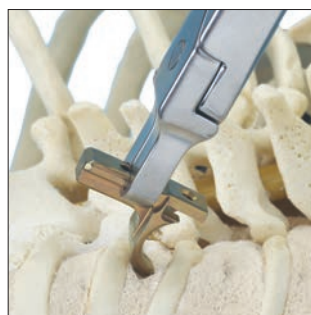


Figure 1

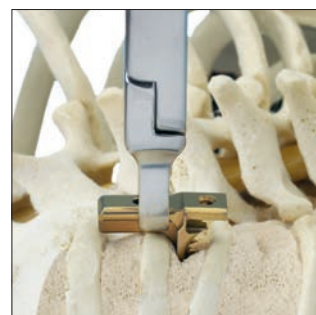


Figure 2

3e. Select proper Closing Half-Ring size

Based on the patient's anatomy, select the appropriate Closing Half-Ring (standard or large). The large Closing Half-Ring is used to encircle large areas of fused rib or two ribs.



3f. Insert Closing Half-Ring

Instrument

388.453 or 388.465	Holding Forceps for Closing Half-Ring, for VEPTR
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Using the Holding Forceps for Closing Half-Ring, insert the Closing Half-Ring into the intercostal space above the contralateral side of the rib, with the open end facing laterally to protect the great vessels (Figure 1). Rotate it distally to mate with the Cranial Rib Support (Figure 2).

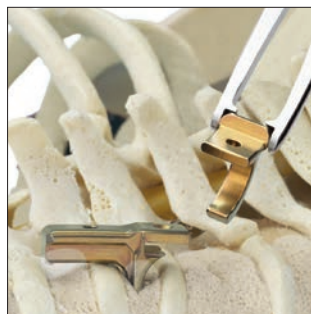


Figure 1

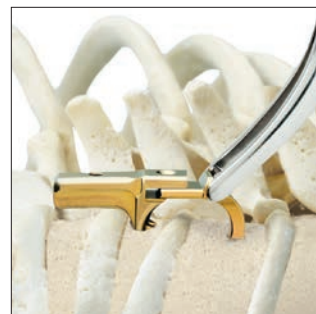


Figure 2

3g. Align Cranial Rib Support and Closing Half-Ring

Instruments

388.488	Clip for Rib Support, for No. 388.494
388.489	Clip for Closing Half-Ring, for No. 388.494
388.494	Pliers for Closing Half-Ring and Rib Support

If the Closing Half-Ring and Cranial Rib Support are not aligned, prepare the Pliers for Closing Half-Ring and Rib Support. Affix the Clip for Closing Half-Ring and the Clip for Rib Support to the Pliers for Closing Half-Ring and Rib Support. This assembly is referred to as the Pliers for Closing Half-Ring and Rib Support.

Align the Cranial Rib Support with the Closing Half-Ring using the Pliers for Closing Half-Ring and Rib Support (Figure 3).

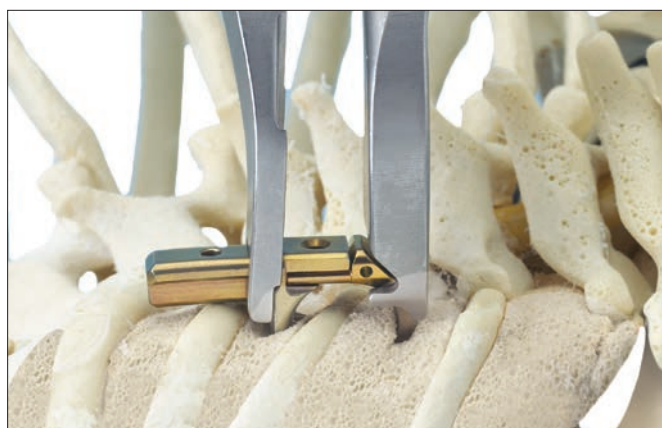
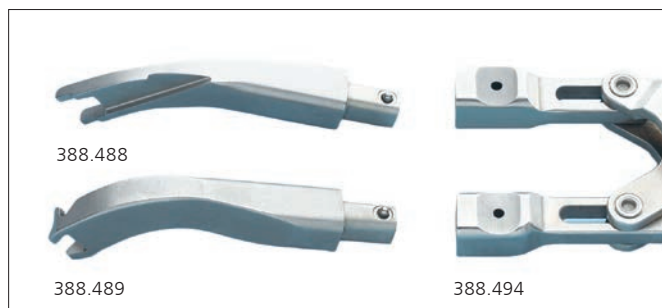


Figure 3

3h. Insert Lock for Rib Support

Instruments

388.474	Lock Crimper, for VEPTR
388.475	Lock Inserter, lateral
388.493	Inserter for Rib Support Lock

Load a blue lock into the Inserter for Rib Support Lock (Figure 1). Insert the lock into the aligned holes of the Cranial Rib Support and the Closing Half-Ring (Figure 2). Using a hammer, firmly tap the Inserter to seat the lock.

The lateral Lock Inserter should always be be used to ensure the lock is fully seated (Figure 3).

Alternatively, the lateral Lock Inserter can be used to seat the lock.

The implants now encircle the rib (Figure 4).

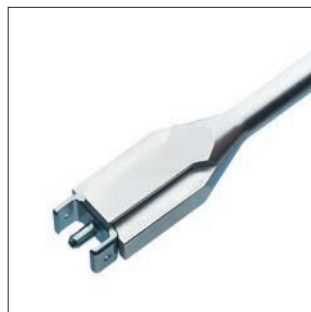


Figure 1

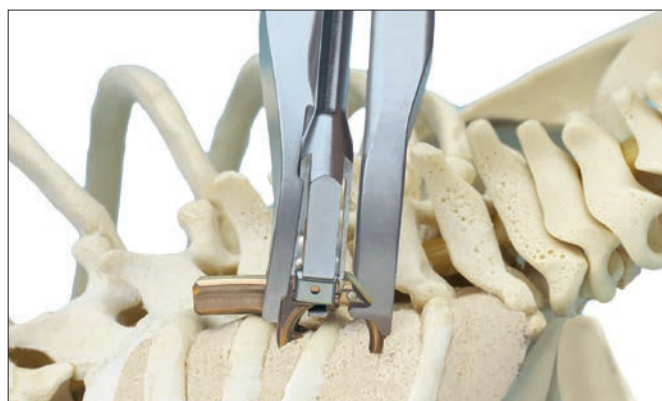


Figure 2



Figure 3



Figure 4

4. Distract chest wall

Instruments	
388.486	Foot for Rib Retractor, for No. U22-64010
399.100	Bone Spreader, speed lock, width 8 mm, length 210 mm
399.130	Bone Spreader, speed lock, width 12 mm, length 270 mm
U22-64010	Cervical Retractor, longitudinal

388.486	Foot for Rib Retractor, for No. U22-64010
399.100	Bone Spreader, speed lock, width 8 mm, length 210 mm
399.130	Bone Spreader, speed lock, width 12 mm, length 270 mm
U22-64010	Cervical Retractor, longitudinal

Assemble two Feet to the longitudinal Retractor. Distract ribs using the rib retractor assembly as needed (Figure 1). Bone spreaders in conjunction with vein retractors can also be used to gently distract the chest wall at the site of an opening wedge thoracotomy.

Additional resection of medial fused ribs may be required if distraction is difficult. Only resect visible bone adjacent to the spine. Be aware of anomalous segmental arteries due to abnormal anatomy.



Figure 1



388.486

U22-64010

5. Select appropriate Extension Bar

Instrument

388.870	Trial Rod Ø 6.0 mm, length 150 mm
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Using the Trial Rod, measure the distance between the cranial rib and either the thoracolumbar junction or the chosen caudal rib to determine the appropriate Extension Bar size.

- Measure to the thoracolumbar junction when planning a rib-to-iliac or rib-to-lumbar lamina construct.
- Measure to the caudal rib when using a rib-to-rib construct.

The measurement in centimeters will correspond to the correct Extension Bar size. For example, if the distance is determined to be 7 cm, use an Extension Bar marked with a 7. Implant sizes are identified from 4 to 13 in 1-cm increments.



**6. Lumbar extension assembly
(Use for rib-to-lumbar lamina,
rib-to-lumbar or rib-to-iliac
constructs)**

**6a. Select appropriate lumbar
extension**

Lumbar extension sizes correspond with the same size Extension Bar. For example, if the selected Extension Bar is a size 9, the correct Lumbar Extension Rod will also be a 9.



**6b. Determine contour and cut to
length, if necessary**

Instrument	
388.960	Bending Pliers with Rolls for USS Rods Ø 6.0 mm, length 300 mm
Alternative instruments	
388.910	USS Bending Iron, left
388.920	USS Bending Iron, right



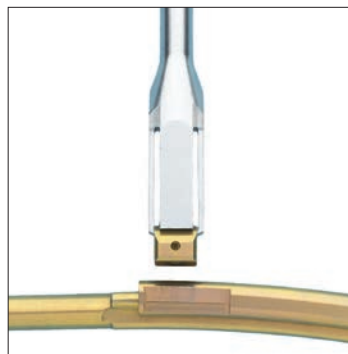
Use the Trial Rod to determine the contour of the rod portion of the lumbar extension. Do not bend the T-section of the lumbar extension which mates with the Extension Bar. Using the Bending Pliers, contour the rod portion only to match the anatomy. As an alternative, the USS Bending Irons can be used for contouring.

If necessary, cut the rod portion of the Lumbar Extension Rod to the correct length using the Rod Cutter. The length of the rod portion of the lumbar extension should be at least equal to the distance between the thoracolumbar junction and the planned caudal implant. When using a Lamina or Ala Hook, additional length of 1.5 cm should be left to allow for distraction.

6c. Insert Caudal Closure for Extension Bar

Instruments

388.456 or 388.474	Lock Crimper, for VEPTR
388.493	Insertter for Rib Support Lock



Prior to insertion, connect the Extension Bar with the lumbar extension by sliding the Lumbar Extension Rod into the Extension Bar. Align the most caudal hole in the Extension Bar with the most caudal hole in the Lumbar Extension Rod. The implants should overlap completely to maximize future expansion capacity.

Place a golden Closure for Extension Bar in this position using the Insertter for Rib Support Lock. With a hammer, firmly tap the Insertter to seat the lock. The Lock Crimper should always be used to ensure the Closure is fully seated.

6d. Insert caudal implant

1. Lamina Hook (Use for rib-to-lumbar lamina construct)

Instrument

388.495 Holding Forceps for Hooks, for VEPTR

Make a 4-cm, longitudinal, paraspinal skin incision on the concave side of the curve at the lumbar interspace that was selected preoperatively (Figure 1). Retract the paraspinal muscles unilaterally. Do not disturb the facet joints.

Use a Lamina Feeler to separate the ligamentum flavum unilaterally from the underside of the lamina to ensure good bony contact with the Lamina Hook, leaving the interspinous ligament intact. Resect enough ligamentum flavum for the hook to pass.

Choose the appropriate Lamina Hook (right or left). The hook will be placed downward-facing and the setscrew will be lateral.

Use the Holding Forceps to place the hook in the desired location on the lumbar vertebra (Figure 2).

Tip: The hook can be further secured by using a heavy, nonabsorbable suture around the spinous process.

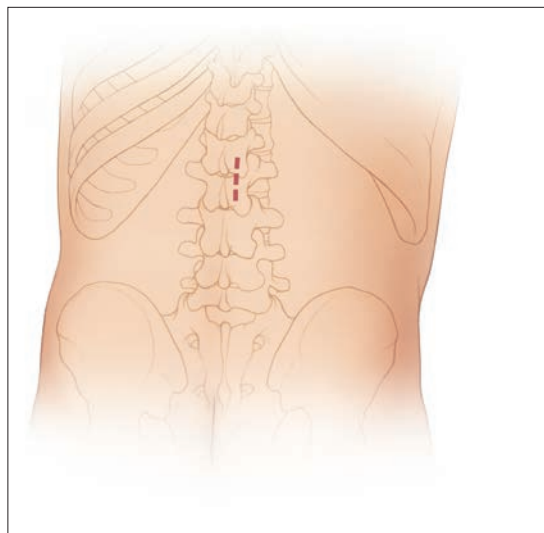


Figure 1



388.495



Figure 2

2. Ala Hook (Use for rib-to-iliac construct)

Instruments

314.070	Screwdriver, hexagonal, small, 2.5 mm, with Groove
388.441	Holding Forceps for USS Small Stature/ Paediatric Rods Ø 5.0 mm
388.911	USS Small Stature/Paediatric Bending Iron for Rods Ø 5.0 mm, left
388.922	USS Small Stature/Paediatric Bending Iron for Rods Ø 5.0 mm, right

Make a 4-cm incision just lateral to the posterior cranial iliac spine (Figure 1). Identify the posterior third and middle third of the iliac crest. Make a 1-cm transverse incision in the mid substance of the apophysis with equal layers of cartilage above and below the incision. Insert the periosteal elevator through the apophyseal incision to widen it into a tunnel and thread it along the medial cortical surface of the iliac crest. The tip of the periosteal elevator should be just lateral to the sacroiliac joint.

Choose the appropriate Ala Hook (45° or 90°, left or right). The correct Ala Hook should have the upper end lying medial to the downward pointed end.

Attach an Extension Connector to the Ala Hook using the 2.5 mm Screwdriver. Ensure the 5.0 mm opening in the Extension Connector is mated with the Ala Hook.

Use the 5.0 mm Bending Irons to contour the Ala Hook to fit the ilium. Insert the Ala Hook, pointed end downward, using the Holding Forceps for USS Paediatric Rods 5.0 mm over the top of the iliac crest and medial to the inner table of the iliac wing.

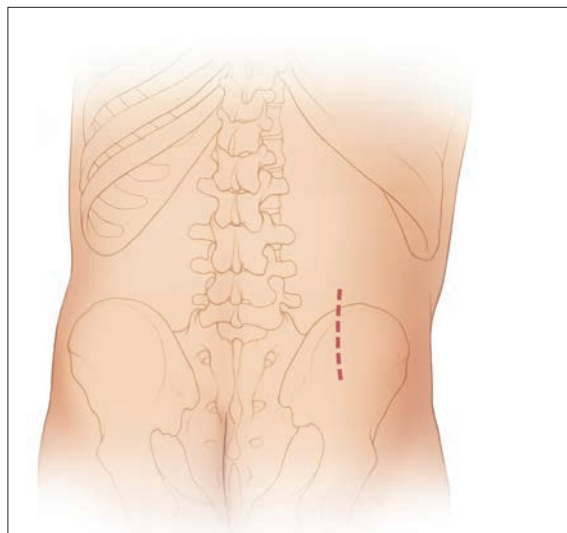
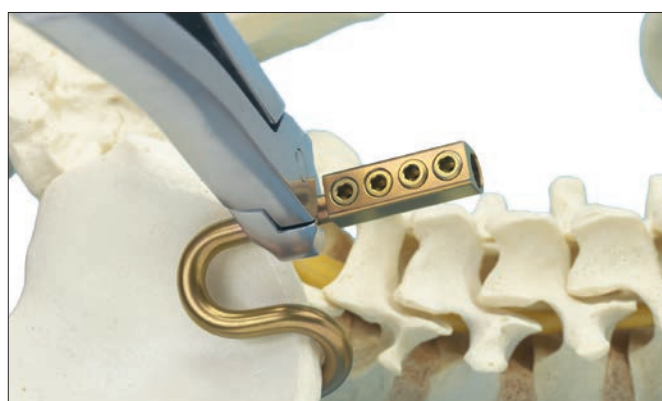
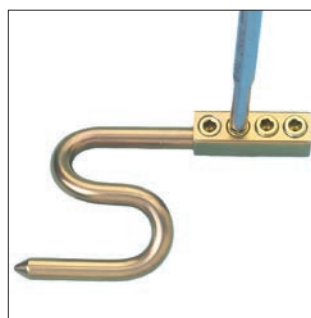


Figure 1



6e. Align lumbar extension to caudal implant

Instruments

314.070	Screwdriver, hexagonal, small, 2.5 mm, with Groove
388.441	Holding Forceps for USS Small Stature/ Paediatric Rods Ø 5.0 mm

Create a tunnel through the paraspinal muscles from the proximal incision to just above the caudal attachment point. Place the lumbar extension into the tip of a #20 chest tube and thread safely proximal-to-distal, to the caudal attachment point.

If attaching to a lamina hook (for rib-to-lumbar lamina construct), guide the distal extension into the lamina hook.

If using an Ala Hook (for rib-to-iliac construct), guide the lumbar extension into the opposing side of the Extension Connector. Tighten the setscrews in the connector using the 2.5 mm Screwdriver (Figure 1).

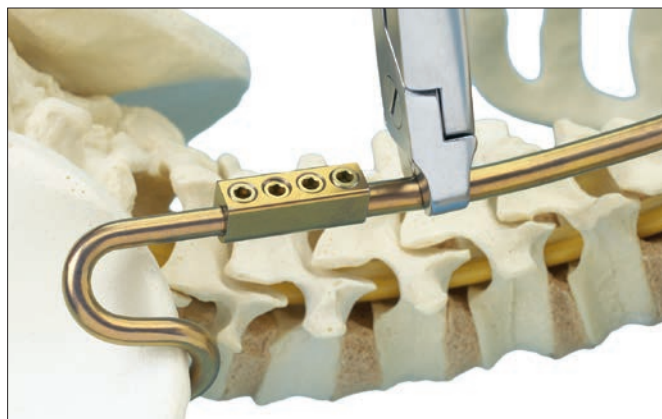
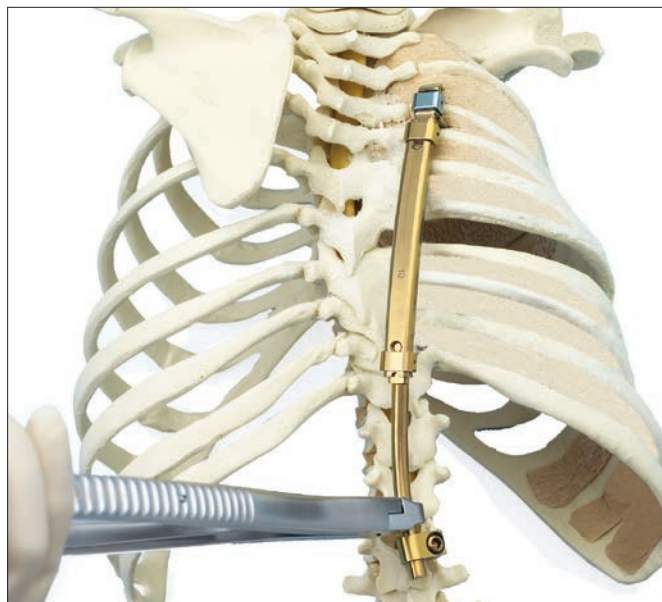


Figure 1

6f. Align Extension Bar to Cranial Rib Support

Instruments

388.461	Holding Forceps for Closing Half-Ring or Rib Support
388.468	Holding Forceps for Extension Bar

Alternative instruments

388.458	Iron for Rib Support
388.459	Iron for Extension Bar
388.466	Positioner for Rib Support

Use the Holding Forceps for Extension Bar and the Holding Forceps for Rib Support to slide the cranial end of the Extension Bar over the Cranial Rib Support (Figure 1).

Alternatively, the Iron for Extension Bar and the Iron for Rib Support can be used to align the two implants (Figure 2). The Positioner for Rib Support can also facilitate alignment.



Figure 1



Figure 2

6g. Insert Closure for Extension Bar

Instruments

388.464	Spreader for Rib Support
388.474	Lock Crimper, for VEPTR
388.475	Lock Inserter, lateral
388.493	Inserter for Rib Support Lock

Insert a golden Closure for Extension Bar using the Inserter for Rib Support Lock (Figure 1) to fix the Extension Bar to the Cranial Rib Support.

Note: If necessary, the Spreader for Rib Support can be used to align the holes.

Using a hammer, firmly tap the Inserter to seat the lock.

The Lock Crimper should always be used to ensure the lock is fully seated.

Alternatively, the lateral Lock Inserter can be used to seat the lock.

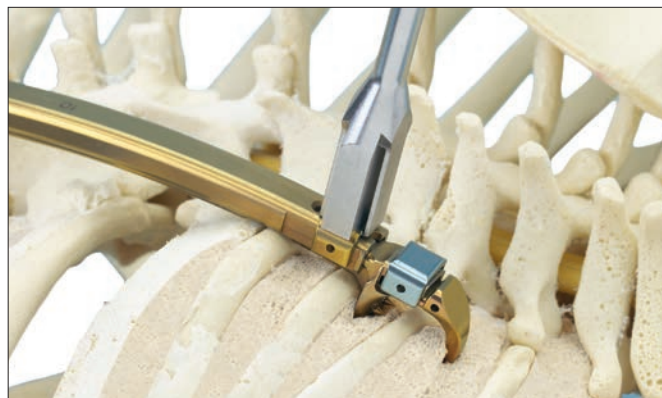


Figure 1

6h. If using a lamina hook, distract if necessary and tighten

Instruments

314.070	Screwdriver, hexagonal, small, 2.5 mm, with Groove
314.270	Screwdriver, hexagonal, large, Ø 3.5 mm, with Groove, length 245 mm
388.410	Spreader Forceps for Pedicle Screws, length 330 mm
498.910	Fixation Ring for Rods Ø 6.0 mm, Titanium Alloy (TAN)

Using the 2.5 mm small hexagonal Screwdriver, place a Fixation Ring for Rods cranial to the lamina hook onto the rod portion of the lumbar extension.

Using the Spreader Forceps, gently distract to further seat the hook (Figure 1). Use the 3.5 mm large hexagonal Screwdriver to tighten the setscrew in the hook (Figure 2).

Remove the Fixation Ring for Rods following distraction, using the 2.5 mm small hexagonal Screwdriver.

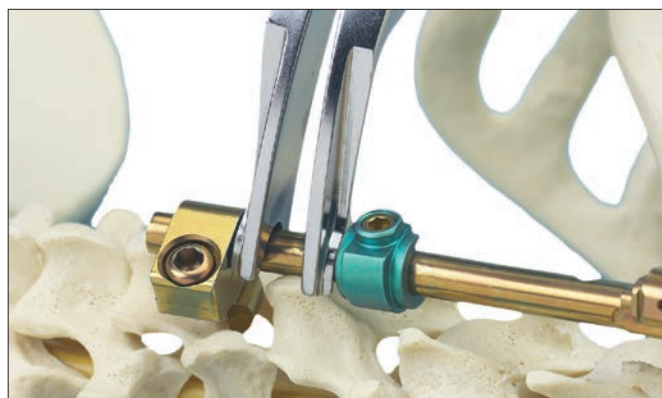


Figure 1



Figure 2

7. Caudal Rib Support (Use for rib-to-rib constructs)

7a. Choose appropriate caudal rib

The proper caudal rib for attachment of the rib-to-rib device should be transverse in orientation and of adequate width. Do not choose an oblique rib, such as rib 11 or 12.

7b. Select appropriate Caudal Rib Support

Caudal Rib Support sizes correspond to Extension Bar sizes. For example, if the selected Extension Bar is a size 7, the correct Caudal Rib Support will also be a size 7 (see “Select appropriate Extension Bar,” page 15).

Note: If a 70 mm radius Rib Support is used, a 70 mm radius Extension Bar must be used. If a 220 mm radius Extension Bar is used, a 220 mm radius Caudal Rib Support must be used.



Caudal Rib Support, size 7, 220 mm radius

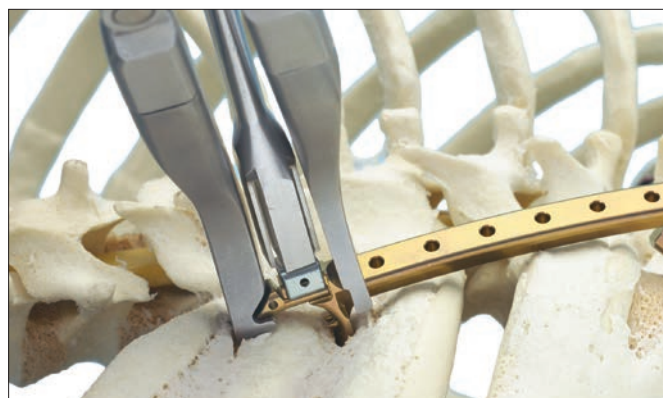


Extension Bar, size 7, 220 mm radius

7c. Insert caudal implants

Instruments

388.453 or 388.465	Holding Forceps for Closing Half-Ring, for VEPTR
388.461	Holding Forceps for Closing Half-Ring or Rib Support
388.474	Lock Crimper, for VEPTR
388.475	Lock Inserter, lateral
388.493	Inserter for Rib Support Lock



Using the Holding Forceps for Rib Support, seat the Caudal Rib Support into the space between the periosteum and the rib. Rotate it into the correct position around the rib.

Based on the patient's anatomy, select the appropriate Closing Half-Ring (standard or large).

Using the Holding Forceps for Closing Half-Ring, seat the Closing Half-Ring over the contralateral side of the rib.

Align the Caudal Rib Support and Closing Half-Ring using the Pliers for Closing Half-Ring and Rib Support.

Load a blue Lock for Rib Support into the Inserter for Rib Support Lock. Lock the assembly by inserting the Lock for Rib Support into the aligned holes of the Caudal Rib Support and the Closing Half-Ring. Using a hammer, firmly tap the Inserter to seat the lock.

The Lock Crimper should always be used to ensure the lock is fully seated.

Alternatively, the lateral Lock Inserter can be used to seat the lock.

The implants now encircle the rib.

7d. Assemble construct

Instruments

388.458	Iron for Rib Support
388.459	Iron for Extension Bar
388.464	Spreader for Rib Support
388.466	Positioner for Rib Support
388.468	Holding Forceps for Extension Bar
388.472	Distractor, curved, for Extension Bar

Use the Holding Forceps for Extension Bar to slide the selected Extension Bar over the Caudal Rib Support.

Slide the Extension Bar onto the Cranial Rib Support. The Iron for Extension Bar and the Iron for Rib Support can be used to align the two implants (Figure 1). The Positioner for Rib Support can also help with alignment.

Place a golden Closure for Extension Bar in the cranial end of the Extension Bar, using the Inserter for Rib Support Lock. Using a hammer, firmly tap the Inserter to seat the lock.

Use the Distractor for Extension Bar or the Spreader for Rib Support to distract the device (Figure 2) until the caudal hole in the Extension Bar is aligned with a hole in the Caudal Rib Support. Both the Cranial and Caudal Rib Supports should be seated against the ribs.



Figure 1



Figure 2

7e. Lock construct

Instruments

388.474	Lock Crimper, for VEPTR
388.475	Lock Inserter, lateral
388.493	Inserter for Rib Support Lock

Using the Inserter for Rib Support Lock, place a golden Closure for Extension Bar in the caudal end of the Extension Bar to lock the assembly in place. Check to ensure both locks are fully seated, using the Lock Crimper.

Alternatively, the lateral Lock Inserter can be used to seat the lock.

Note: If the patient is older than 18 months and of adequate body size, a second device (rib-to-rib construct) may be added posterolaterally in the midaxillary line to further expand the constricted hemithorax.

Special Procedures

Fused ribs and scoliosis

After the Cranial Rib Support and caudal point of attachment have been chosen, perform an opening wedge thoracostomy through the fused ribs at the apex of the thoracic deformity from the tip of the transverse process to the costochondral junction, in the general orientation of the ribs.

Separate the fusion mass. Ensure the continuity between the anterior and posterior attachments of the newly separated ribs.

Continue the procedure using the appropriate construct technique.

For a detailed description of a thoracostomy, see Robert M. Campbell Jr., MD; Melvin D. Smith, MD; Anna K. Hell-Vocke, MD. "Expansion Thoracoplasty: The Surgical Technique of Opening-Wedge Thoracostomy." *Journal of Bone and Joint Surgery—American Volume*. 86-A Supplement 1:51–64, 2004.

Hypoplastic thorax

Instrument

391.820	Wire Bending Pliers, length 155 mm, for Wires up to Ø 1.25 mm
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A hypoplastic, low-volume thorax (as seen with Jeune's syndrome) requires the use of a 70 mm radius rib-to-rib construct (70 mm radius implants include: Cranial Rib Support, Caudal Rib Support, Extension Bar). These constructs are placed bilaterally in separate procedures.

After inserting both the Cranial and Caudal Rib Supports, free the central segment of the selected hemithorax by making transverse incisions in the periosteum to enable anterior and posterior osteotomies.

Perform anterior and posterior osteotomies from ribs 3 through 8. Distract the mobilized chest segment posterolaterally.

Place retractors subperiosteally to protect the underlying lung.

Choose two to three sites in the central portion of the mobilized segment to insert the 2.0 mm titanium rod, which will hold the ribs to the construct. Bend the rod to form a gentle curve, using the Wire Bending Pliers.

Assemble the construct as stated in the rib-to-rib construct section.

After the construct has been completely assembled and locked, use the Wire Bending Pliers to again grasp the rods and contour around the implanted rib-to-rib construct, leaving space available to remove the locks and expand the construct.



Expansion Procedure

Note: When performing an expansion procedure on patients implanted with a VEPTR device, the decision to distract the implanted VEPTR device should consider the risk/benefit of lengthening the device further versus alternative options including replacement of cranial and/or caudal construct components to longer ones. Remaining vigilant and closely monitoring patients for any device breakage with careful interpretation of this area on post-op imaging is recommended.

1. Position patient

Place the patient in a lateral decubitus or prone position.

2. Exposure

Identify the approximate location of the caudal Closure for Extension Bar through palpation and/or radiographic marker. Make a transverse or longitudinal incision over the caudal Closure for Extension Bar.

3. Remove lock

Instruments

388.452	Lock Removal Pliers, for VEPTR
388.462	Lock Removal Device, for VEPTR

Remove the golden Closure for Extension Bar using the Lock Removal Pliers or the Lock Removal Device.

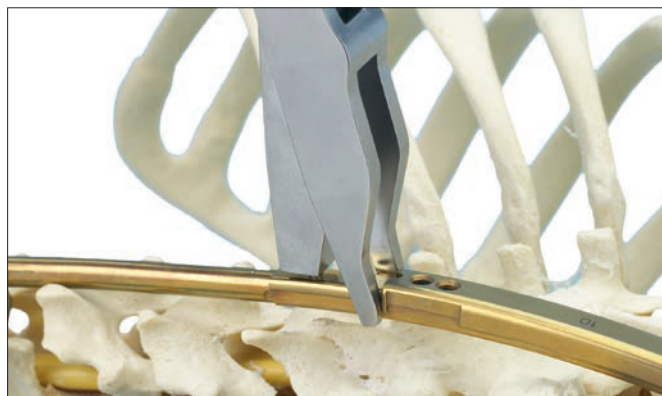


4. Distraction

Instruments

388.457	Distraction Pin for VEPTR, for temporary use
388.471	Rib Distraction Pliers
388.472	Distractor, curved, for Extension Bar
498.910	Fixation Ring for Rods Ø 6.0 mm, Titanium Alloy (TAN)

Use the Rib Distraction Pliers or the Distractor for Extension Bar in conjunction with a Fixation Ring for Rods to gently distract the implanted device until the device is adequately lengthened. Use the Temporary Distraction Pins as placeholders to assist distraction.



5. Final locking

Instruments

388.474	Lock Crimper, for VEPTR
388.475	Lock Inserter, lateral
388.493	Inserter for Rib Support Lock

Insert a new golden Closure for Extension Bar using the Inserter for Rib Support Lock to fix the Extension Bar in its distracted position. With a hammer, tap the Inserter to seat the Closure. Check to ensure the closure is fully seated using the Lock Crimper.

Alternatively, the lateral Lock Inserter can be used to seat the lock.

Replacement of Components

Replacement of components

Instrument

388.452	Lock Removal Pliers, for VEPTR
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For replacement of the Extension Bar, Caudal Rib Support or Lumbar Extension Rod, make three transverse incisions, one at the midportion of the implanted construct and others along the distal and proximal portions. A portion of the previous thoracostomy incision may be used.

Unlock the device by removing the golden Closure(s) for Extension Bars using the Lock Removal Pliers.

Remove the required components and insert the new components through the fibrous canal surrounding the old devices.

Install new Closure(s) for Extension Bars.

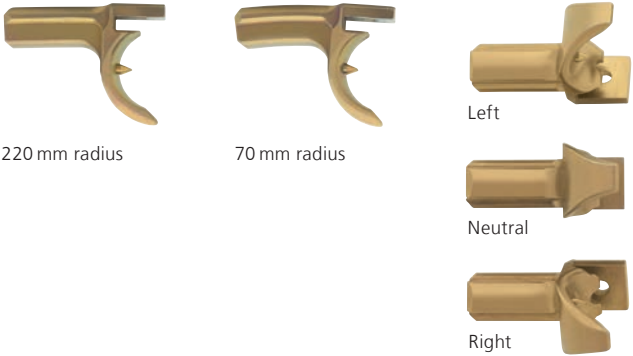
Refer to detailed instructions within this surgical technique to install specific components.

Implants

Cranial Rib Support, Titanium Alloy (TAN), gold

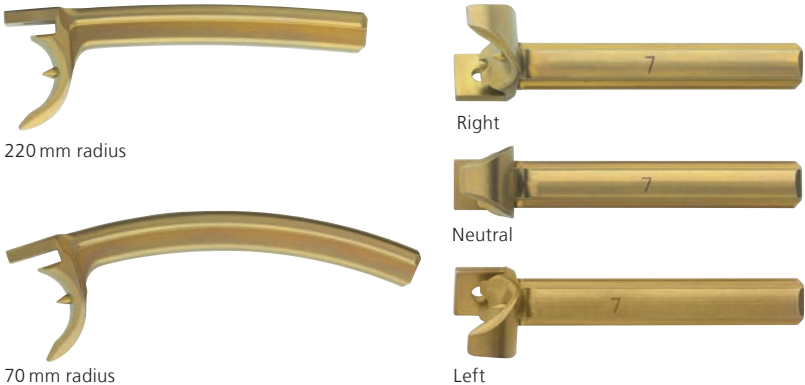
Attaches to the Closing Half-Ring and Extension Bar to support the cranial rib.

Item No.	Description
497.057	Neutral
497.058	Right angled
497.059	Left angled
497.061	Neutral, radius 70 mm
497.062	Right, radius 70 mm
497.063	Left, radius 70 mm



Caudal Rib Support, Titanium Alloy (TAN), gold

Attaches to the Closing Half-Ring and Extension Bar to support the caudal rib.



Neutral, radius 220 mm

Item No.	Description
497.065	Size 4
497.066	Size 5
497.067	Size 6
497.068	Size 7
497.069	Size 8
497.225	Size 9
497.226	Size 10
497.227	Size 11
497.228	Size 12
497.229	Size 13

Neutral, radius 70 mm

Item No.	Description
497.085	Size 4
497.086	Size 5
497.087	Size 6
497.088	Size 7
497.089	Size 8
497.241	Size 9
497.242	Size 10
497.243	Size 11

Right angled, radius 220 mm

Item No.	Description
497.071	Size 4
497.072	Size 5
497.073	Size 6
497.074	Size 7
497.075	Size 8
497.230	Size 9
497.231	Size 10
497.232	Size 11
497.233	Size 12
497.234	Size 13

Left angled, radius 220 mm

Item No.	Description
497.076	Size 4
497.077	Size 5
497.078	Size 6
497.079	Size 7
497.080	Size 8
497.235	Size 9
497.236	Size 10
497.237	Size 11
497.238	Size 12
497.239	Size 13

Right angled, radius 70 mm

Item No.	Description
497.091	Size 4
497.092	Size 5
497.093	Size 6
497.094	Size 7
497.095	Size 8
497.244	Size 9
497.245	Size 10
497.246	Size 11

Left angled, radius 70 mm

Item No.	Description
497.096	Size 4
497.097	Size 5
497.098	Size 6
497.099	Size 7
497.100	Size 8
497.247	Size 9
497.248	Size 10
497.249	Size 11

Closing Half-Ring

- Attaches to the Cranial or Caudal Rib Support to encircle the cranial or caudal rib(s)
- Two sizes, standard and extended

Item No.	Description
497.126	Closing Half-Ring for Rib Support, Titanium Alloy (TAN), gold
497.129	Closing Half-Ring for Rib Support, large, Titanium Alloy (TAN)



Standard



Large

Locks

- Lock for Rib Support (blue) connects the Closing Half-Ring to the Cranial Rib Support or the Caudal Rib Support
- Closure for Extension Bar (gold) connects the Extension Bar to the Cranial Rib Support, Caudal Rib Support or Lumbar Extension Rod

Item No.	Description
497.128	Lock for Rib Support, Titanium Alloy (TAN), blue
497.125	Closure for Extension Bar, Titanium Alloy (TAN), gold



Lock for Rib Support (blue)



Closure for Extension Bar (gold)

Extension Bar, Titanium Alloy (TAN), gold

Attaches the Cranial Rib Support to the Caudal Rib Support or Lumbar Extension Rod.



radius 220 mm



radius 70 mm

Extension Bar, radius 220 mm

Item No.	Description
497.103	Size 4
497.104	Size 5
497.105	Size 6
497.106	Size 7
497.107	Size 8
497.108	Size 9
497.109	Size 10
497.110	Size 11
497.111	Size 12
497.112	Size 13

Extension Bar, radius 70 mm

Item No.	Description
497.115	Size 4
497.116	Size 5
497.117	Size 6
497.118	Size 7
497.119	Size 8
497.120	Size 9
497.121	Size 10
497.122	Size 11



Extension Bar, radius 220 mm

Lumbar Extension Rod, radius 220 mm, Titanium Alloy (TAN), gold

Attaches the Extension Bar to the Lamina Hook or the Extension Connector.

Item No.	Description
497.131	Size 6
497.132	Size 7
497.133	Size 8
497.134	Size 9
497.251	Size 10
497.252	Size 11
497.253	Size 12
497.254	Size 13

Lamina Hook

- Right or left angled
- Low profile minimizes soft tissue interference
- Opening captures 6.0 mm rod and permits longitudinal adjustments along the rod before tightening
- 3.5 mm setscrew secures the placement

Item No.	Description
497.261	Lamina Hook with low profile, left, Titanium Alloy (TAN)
497.262	Lamina Hook with low profile, right, Titanium Alloy (TAN)



Top view



Side view

Ala Hook 90°, Pure Titanium

- Used with the Lumbar Extension Rod and Extension Connector to attach to the ilium
- Left or right contours

Item No.	Description
04.601.000	Ala Hook 90°, right
04.601.001	Ala Hook 90°, left



Top view 90°

Extension Connector

Connects the Ala Hook (5.0 mm rod) to the Lumbar Extension Rod (6.0 mm rod).

Item No.	Description
497.256	Extension Connector 5.0/6.0



Rod Ø 2.0 mm

Holds osteotomized ribs against the construct.

Item No.	Description
497.127	Rod Ø 2.0 mm, Pure Titanium



Instruments

314.070 Screwdriver, hexagonal, small, 2.5 mm, with Groove



314.270 Screwdriver, hexagonal, large, Ø 3.5 mm, with Groove, length 245 mm



388.920 USS Bending Iron, right



388.910 USS Bending Iron, left



388.410 Spreader Forceps for Pedicle Screws, length 330 mm



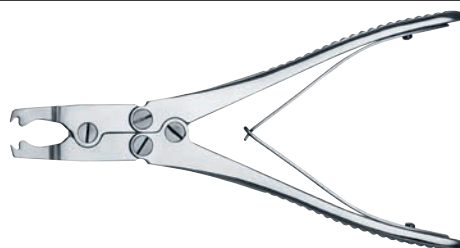
388.422 Compression Forceps, length 335 mm, for Pedicle Screws



388.441 Holding Forceps for USS Small Stature/ Paediatric Rods Ø 5.0 mm



388.452 Lock Removal Pliers, for VEPTR



388.457 Distraction Pin for VEPTR,
for temporary use



388.458 Iron for Rib Support



388.459 Iron for Extension Bar



388.461 Holding Forceps for Closing Half-Ring
or Rib Support



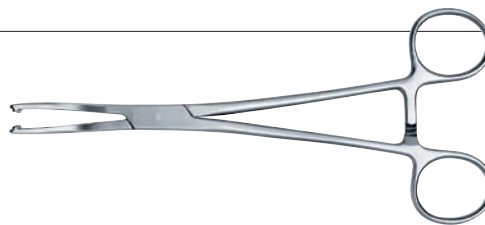
388.462 Lock Removal Device, for VEPTR



388.464 Spreader for Rib Support



388.465 Holding Forceps for Closing Half-Ring,
for VEPTR



388.466 Positioner for Rib Support



388.467 Rib Support Feeler



388.468 Holding Forceps for Extension Bar

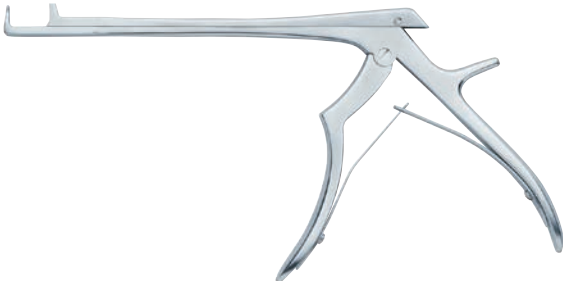
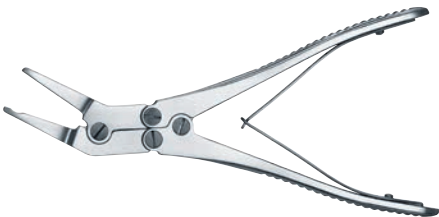







388.471 Rib Distraction Pliers



388.472 Distractor, curved, for Extension Bar



388.474	Lock Crimper, for VEPTR	
388.475	Lock Inserter, lateral	
388.486	Foot for Rib Distractor, for No. U22-64010	
388.488	Clip for Rib Support, for No. 388.494	
388.489	Clip for Closing Half-Ring, for No. 388.494	
388.493	Inserter for Rib Support Lock	
388.494	Pliers for Closing Half-Ring and Rib Support	

388.495 Holding Forceps for Hooks, for VEPTR



388.870 Trial Rod Ø 6.0 mm, length 150 mm



388.911 USS Small Stature/Paediatic Bending Iron for Rods Ø 5.0 mm, left



388.922 USS Small Stature/Paediatic Bending Iron for Rods Ø 5.0 mm, right



388.940 Rod Pusher for USS Rods Ø 6.0 mm



388.960 Bending Pliers with Rolls for USS Rods Ø 6.0 mm, length 300 mm



399.100 Bone Spreader, speed lock, width 8 mm, length 210 mm



391.820 Wire Bending Pliers, length 155 mm,
for Wires up to Ø 1.25 mm



398.408 Periosteal Elevator, slightly curved blade,
round tip, width 5 mm



399.130 Bone Spreader, speed lock,
width 12 mm, length 270 mm



498.910 Fixation Ring for Rods Ø 6.0 mm,
Titanium Alloy (TAN)



U22-64010 Cervical Retractor, longitudinal



U44-48320 Periosteal Elevator, curved, 20 cm



VEPTR System

Instrument and Implant Set

Vario Cases

186.795	VEPTR Instrument Set in Vario Case
186.790	VEPTR Expansion Set in Vario Case
01.601.800	VEPTR Implant Set (220 mm), in Vario Case
01.602.800	VEPTR Implant Set (70 mm), in Vario Case

Instruments

314.070	Screwdriver, hexagonal, small, 2.5 mm, with Groove	388.486	Foot for Rib Distractor, for No. U22-64010
314.270	Screwdriver, hexagonal, large, Ø 3.5 mm, with Groove, length 245 mm	388.488	Clip for Rib Support, for No. 388.494
388.410	Spreader Forceps for Pedicle Screws, length 330 mm	388.489	Clip for Closing Half-Ring, for No. 388.494
388.422	Compression Forceps, length 335 mm, for Pedicle Screws	388.493	Insertor for Rib Support Lock
388.441	Holding Forceps for USS Small Stature/ Paediatric Rods Ø 5.0 mm	388.494	Pliers for Closing Half-Ring and Rib Support
388.452	Lock Removal Pliers, for VEPTR	388.495	Holding Forceps for Hooks, for VEPTR
388.457	Distraction Pin for VEPTR, for temporary use	388.870	Trial Rod Ø 6.0 mm, length 150 mm
388.458	Iron for Rib Support	388.910	USS Bending Iron, left
388.459	Iron for Extension Bar	388.911	USS Small Stature/Paediatric Bending Iron for Rods Ø 5.0 mm, left
388.461	Holding Forceps for Closing Half-Ring or Rib Support	388.920	USS Bending Iron, right
388.462	Lock Removal Device, for VEPTR	388.922	USS Small Stature/Paediatric Bending Iron for Rods Ø 5.0 mm, right
388.464	Spreader for Rib Support	388.940	Rod Pusher for USS Rods Ø 6.0 mm
388.465	Holding Forceps for Closing Half-Ring, for VEPTR	388.960	Bending Pliers with Rolls for USS Rods Ø 6.0 mm, length 300 mm
388.466	Positioner for Rib Support	391.820	Wire Bending Pliers, length 155 mm, for Wires up to Ø 1.25 mm
388.467	Rib Support Feeler	398.408	Periosteal Elevator, slightly curved blade, round tip, width 5 mm
388.468	Holding Forceps for Extension Bar	399.100	Bone Spreader, speed lock, width 8 mm, length 210 mm
388.471	Rib Distraction Pliers	399.130	Bone Spreader, speed lock, width 12 mm, length 270 mm
388.472	Distractor, curved, for Extension Bar	U22-64010	Cervical Retractor, longitudinal
388.474	Lock Crimper, for VEPTR	U44-48320	Periosteal Elevator, curved, 20 cm
388.475	Lock Insertor, lateral		

Note: For additional information, please refer to the package insert.
For detailed cleaning and sterilization instructions, please refer to:
www.depuyssynthes.com/reprocessing

Implants

497.057	Cranial Rib Support, Titanium Alloy (TAN), gold
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497.061	Cranial Rib Support, radius 70 mm, Titanium Alloy (TAN), gold
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Caudal Rib Support, radius 220 mm, Titanium Alloy (TAN), gold

TAN	Size	TAN	Size
497.065	4	497.225	9
497.066	5	497.226	10
497.067	6	497.227	11
497.068	7	497.228	12
497.069	8	497.229	13

Caudal Rib Support, radius 220 mm, Titanium Alloy (TAN), gold

TAN	Direction	Length mm	TAN	Direction	Length mm
497.076	left angled	4	497.071	right angled	4
497.077	left angled	5	497.072	right angled	5
497.078	left angled	6	497.073	right angled	6
497.079	left angled	7	497.074	right angled	7
497.080	left angled	8	497.075	right angled	8
497.235	left angled	9	497.230	right angled	9
497.236	left angled	10	497.231	right angled	10
497.237	left angled	11	497.232	right angled	11
497.238	left angled	12	497.233	right angled	12
497.239	left angled	13	497.234	right angled	13

**Caudal Rib Support, radius 70 mm,
Titanium Alloy (TAN), gold**

TAN	Size	TAN	Size
497.085	4	497.089	8
497.086	5	497.241	9
497.087	6	497.242	10
497.088	7	497.243	11

**Caudal Rib Support, radius 70 mm,
Titanium Alloy (TAN), gold**

TAN	Direction	Size
497.096	left angled	4
497.097	left angled	5
497.098	left angled	6
497.099	left angled	7
497.100	left angled	8
497.247	left angled	9
497.248	left angled	10
497.249	left angled	11
497.091	right angled	4
497.092	right angled	5
497.093	right angled	6
497.094	right angled	7
497.095	right angled	8
497.244	right angled	9
497.245	right angled	10
497.246	right angled	11

**Extension Bar, radius 220 mm,
Titanium Alloy (TAN), gold**

TAN	Size	TAN	Size
497.103	4	497.108	9
497.104	5	497.109	10
497.105	6	497.110	11
497.106	7	497.111	12
497.107	8	497.112	13

**Extension Bar, radius 70 mm,
Titanium Alloy (TAN), gold**

TAN	Size	TAN	Size
497.115	4	497.119	8
497.116	5	497.120	9
497.117	6	497.121	10
497.118	7	497.122	11

497.125	Closure for Extension Bar, Titanium Alloy (TAN), gold
497.126	Closing Half-Ring for Rib Support, Titanium Alloy (TAN), gold
497.127	Rod Ø 2.0 mm, Pure Titanium
497.128	Lock for Rib Support, Titanium Alloy (TAN), blue
497.129	Closing Half-Ring for Rib Support, large, Titanium Alloy (TAN)

**Lumbar Extension Rod, radius 220 mm,
Titanium Alloy (TAN), gold**

TAN	Size
497.131	6
497.132	7
497.133	8
497.134	9
497.251	10
497.252	11
497.253	12
497.254	13

Ala Hook 90°, Pure Titanium

TiCP	Direction
04.601.000	right
04.601.001	left

**Lamina Hook with low profile,
Titanium Alloy (TAN)**

TAN	Direction
497.261	left
497.262	right

**Parallel Connector for USS Small Stature/Paediatric
Rods, Titanium Alloy (TAN)**

TAN	Ø mm	Colour
498.162	5.0/6.0	light blue
498.162S	5.0/6.0	light blue, sterile

Extension Connector, Titanium Alloy (TAN)

TAN	Ø mm	Colour
498.167	5.0/6.0	dark blue
498.167S	5.0/6.0	dark blue, sterile

Fixation Ring for Rods, Titanium Alloy (TAN)

TAN	Ø mm
498.910	6
498.910S	6 (sterile)

Bibliography

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1. Aebi M, Thalgott JS, Webb JK (1998): AO ASIF Principles in Spine Surgery. Berlin: Springer.
 2. Aebi M, Arlet V, Webb JK (2007) AOSPINE Manual (2 vols), Stuttgart, New York: Thieme.

