

⬠ AESCULAP® Ennovate® Thoracolumbar & Sacropelvic

Complex Spine



AESCULAP® Ennovate®

Complex Spine

Part of the AESCULAP®

Ennovate® platform 

Ennovate® is the epitome of the most advanced spinal platform provided by AESCULAP®. This modular platform leverages spinal fusion on a whole new level by placing the patient in the center of the treatment and allowing the surgeon to perform uncompromising spinal corrections across all surgeries. From the cervical to the sacropelvic spine, Ennovate® enhances intraoperative flexibility, while adapting to your personal needs.

The Ennovate® Thoracolumbar & Sacropelvic modules are empowered by **Ennovate® PolyLock®** and **Ennovate® PentaCore®**, with which surgical versatility and intraoperative experiences reach new heights. Inspired by human anatomy and clinical workflows the Ennovate® Thoracolumbar & Sacropelvic modules enable for the best possible clinical outcome – with true:

solutions beyond fusion.

Note | This surgical manual is intended to assist as a guide for corrective techniques using Ennovate® in spinal deformity and scoliosis surgeries. Instrumented levels and the combination of implants with instruments should be tailored to the pathology of the patient and the desired treatment concept of the treating surgeon.



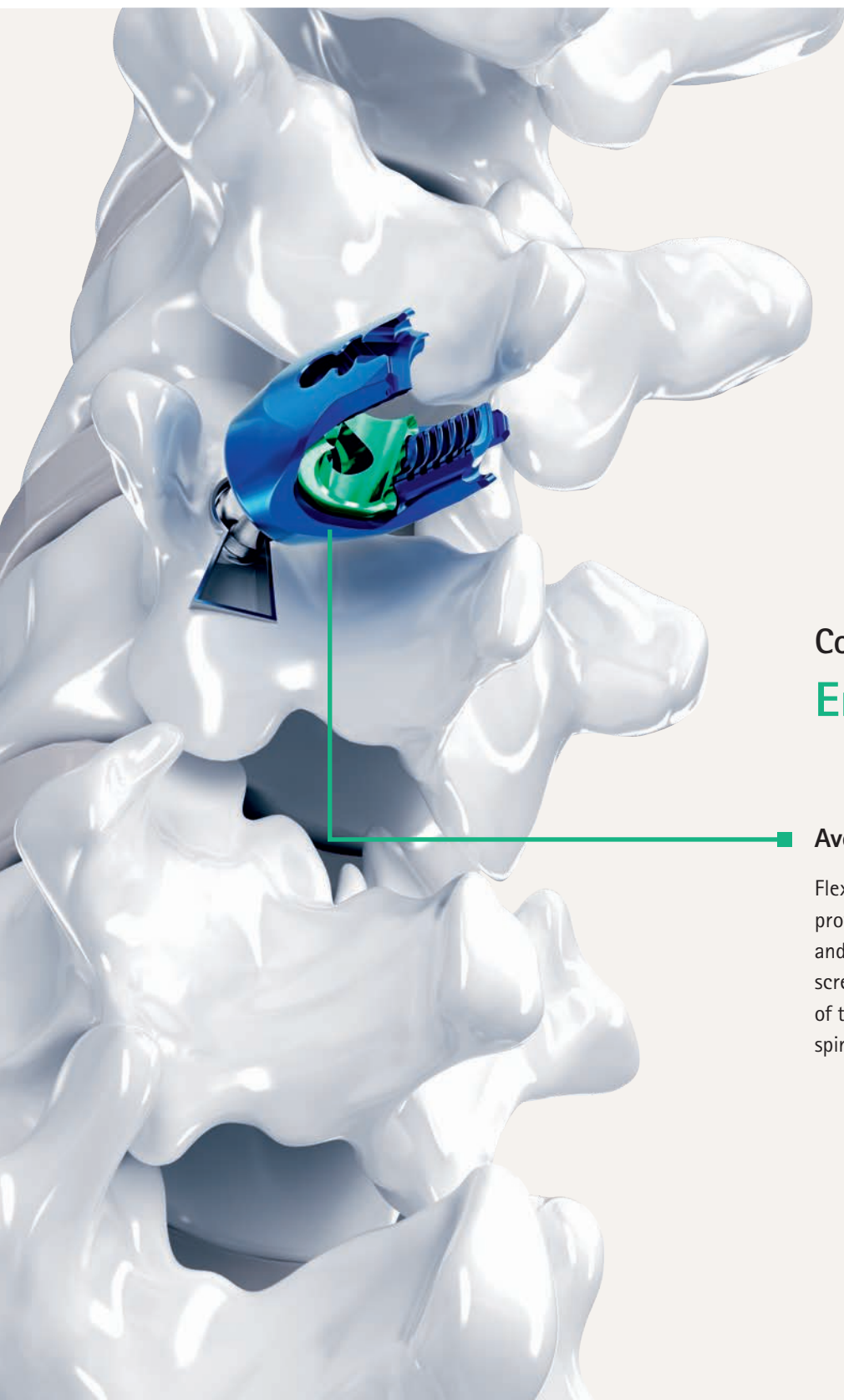
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⬠ AESCULAP® Ennovate®

Degenerative Spine – Ennovate® PolyLock® & PentaCore®



Control is key

Ennovate® PolyLock®

Avoids loss of correction

Flexibility at its best – the Ennovate® screw provides excellent intra-operative flexibility and high versatility by integrating multiple screw attributes in one design. The expansion of the implant functionality enables unexcelled spinal correction maneuvers.



Turns design into stability

Ennovate® PentaCore®

Firm, even in poor bone quality

The unique design allows for immediate grip and traction from the first turn, providing you with immediate bone purchase, tactile feedback and sense of control. The combination of a unique pentagon shaped core and an anatomical inspired thread enables for voluminous anchorage along the entire screw and unexcelled biomechanical performance.

1 | Pedicle screw placement

Pedicle Preparation

- Identify the appropriate spinal landmarks for initiating cortex perforation.
- The perforation of the cortex is created with a Pedicle Awl.



- The perforation is followed by a Pedicle Probe to open the pedicle canal.
- All Pedicle Probes provide depth markings from 30 to 110 mm, in 10 mm increments, to determine the advancement into the pedicle canal.
- The Pedicle Probes are available as straight or curved Lumbar Probes / Thoracic Probes.
- Large Probes are available for lumbar pedicle preparation, in combination with pedicle screws with a diameter starting from 5.5 mm.





- Utilize a Pedicle Sounder to verify the integrity of the pedicle and vertebral body cortex.

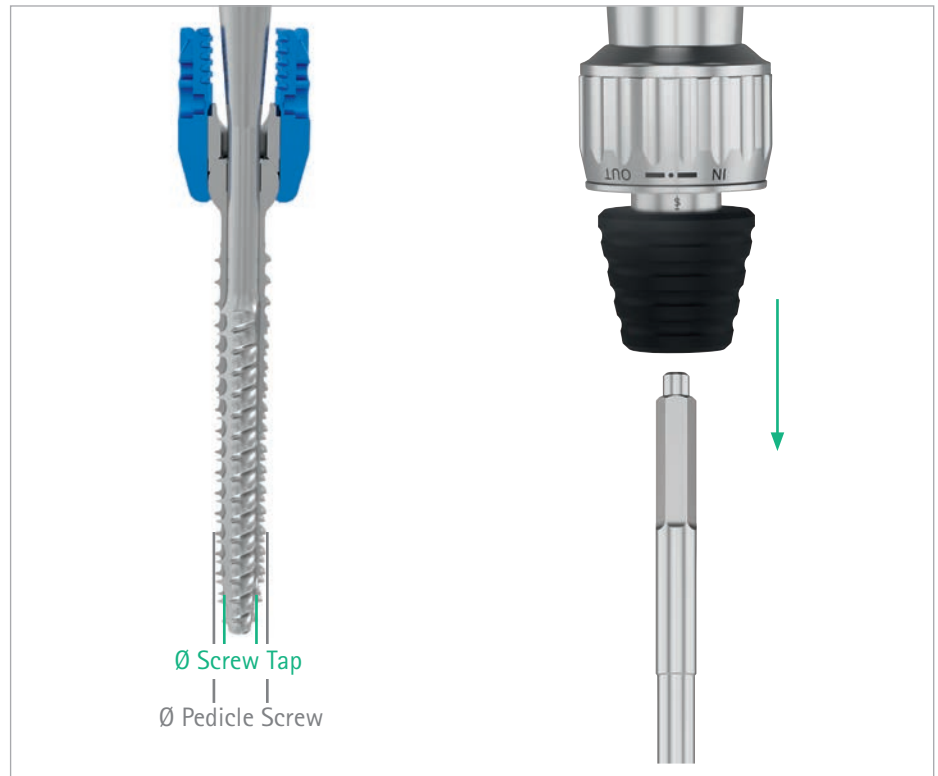


- If necessary, Pedicle Markers can be used as placeholders during pedicle preparation or for identification of proper anatomic location on the intra-operative imaging.

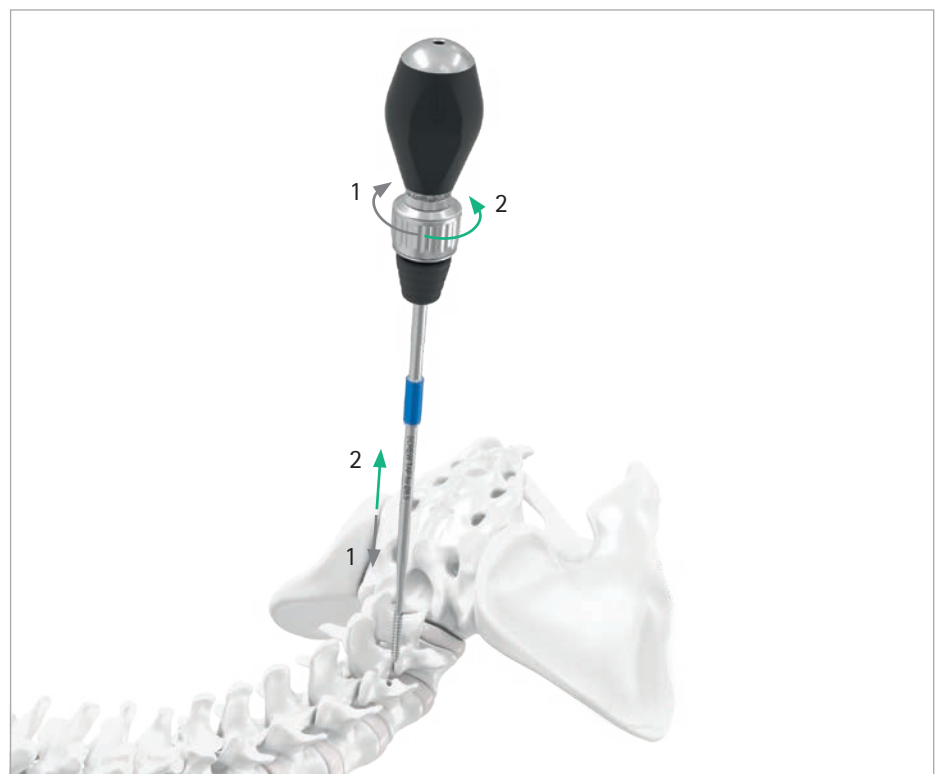
1 | Pedicle screw placement

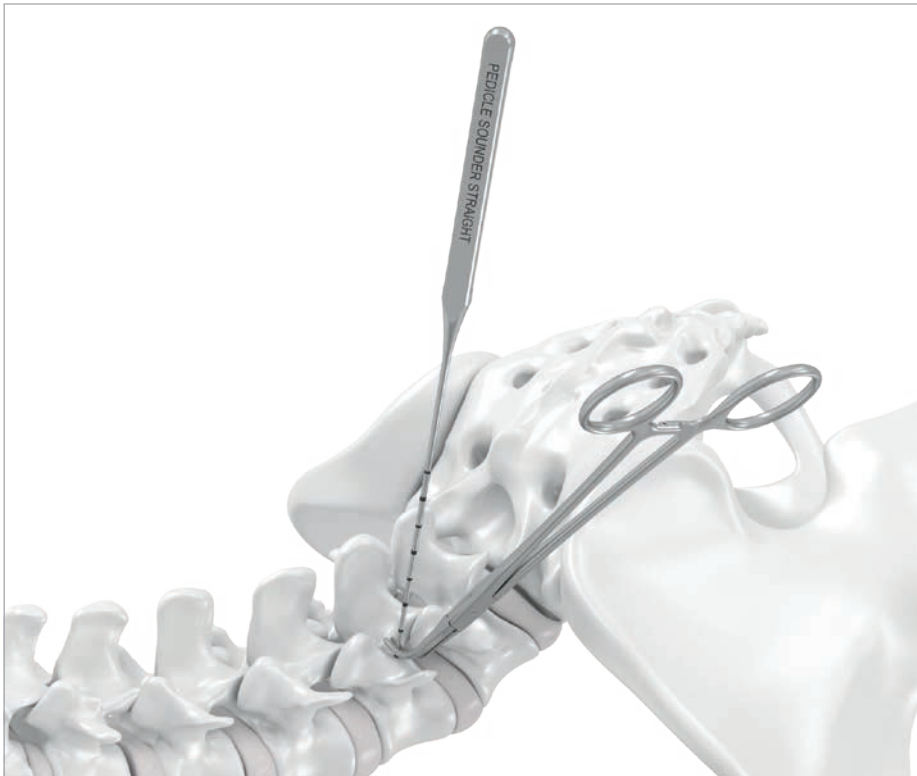
Bone Tapping

- Screw Taps are undersized by 0.25 mm of the final screw diameter.
- For screw diameters 7.5 mm and larger it is recommended to apply a sequential tapping procedure, starting with a smaller tap and increasing the diameter stepwise until the desired diameter is reached.
- Attach the desired handle to the Screw Tap by sliding the hexagonal shaped portion of the shaft into the handle coupling until the stop.
- The ratcheting handles can be moved between forward (IN), locked (-), and reverse (OUT) positions by rotating the collar of the handle.

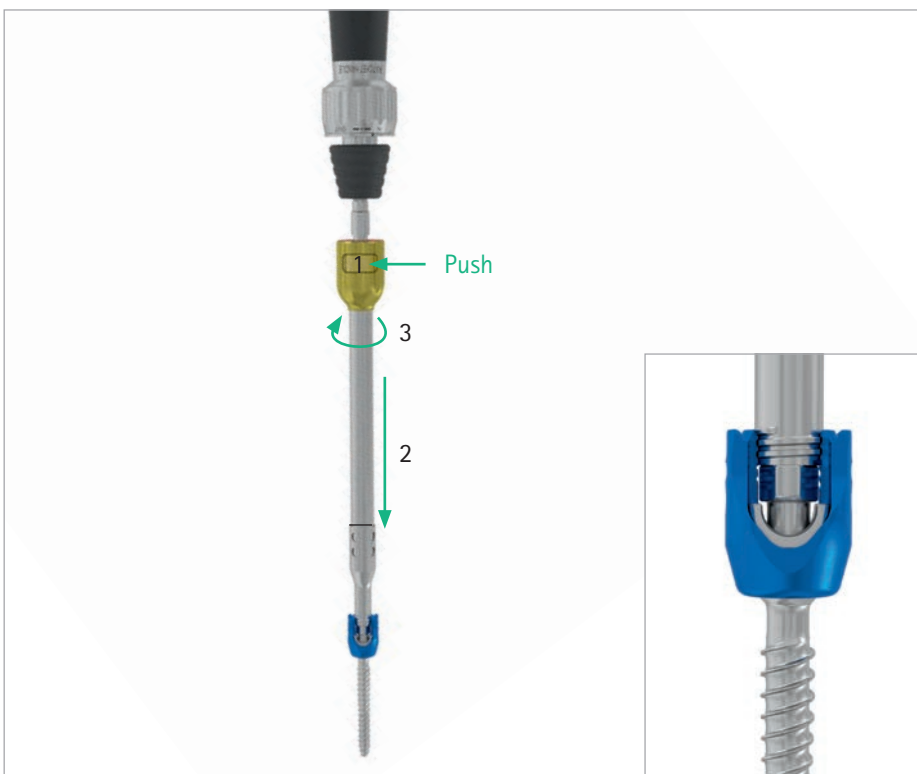


- Switch the ratchet to the forward (IN) position (1), apply the instrument to the prepared entry point and advance the tap to the desired depth by turning the handle clockwise.
- Once the pedicle has been tapped to the desired depth, switch the ratchet to the reverse (OUT) position (2) and turn the handle counter-clockwise.
- Utilize the Pedicle Sounder to verify the integrity of the pedicle and vertebral body cortex.
- Remove the Screw Tap from the handle by pulling the black collar backwards and then removing the Screw Tap.





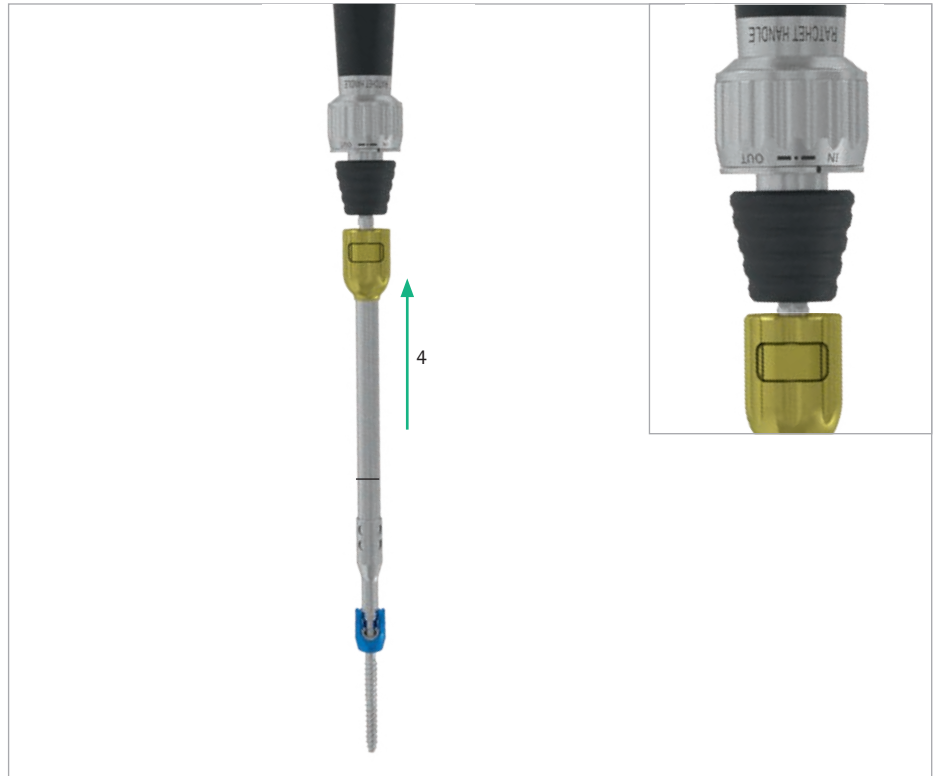
- To determine the appropriate screw length palpate the prepared pedicle canal with a Pedicle Sounder.
- Clamp a hemostat to the exposed Pedicle Sounder and measure the length using the Screw Length Scale.
- Select the appropriate screw diameter and length based on pre-operative planning and intra-operative measuring.



- Attach the desired handle to the Screw Driver by sliding the hexagonal shaped portion of the shaft into the handle coupling until the stop.
- Ensure the Screw Driver sleeve is in load position by pushing the golden button (1) and sliding the sleeve towards the tip of the Screw Driver (2).
- Place the tip of the Screw Driver assembly into the head of the screw.
- Rotate the golden knob clockwise to lock the threaded end of the Screw Driver into the screw head (3).

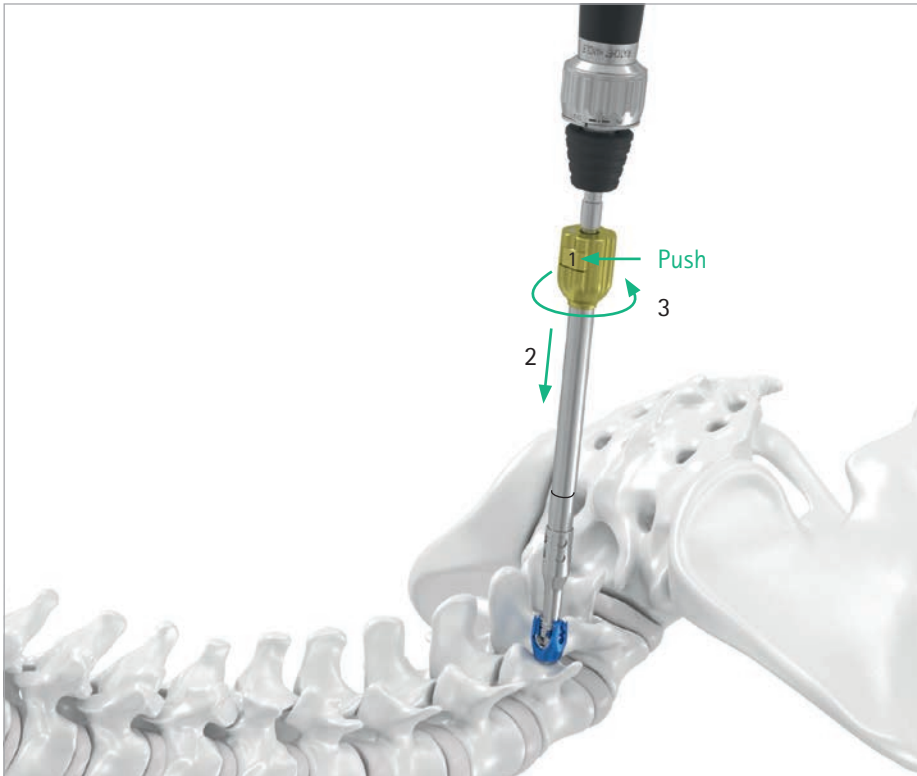
1 | Pedicle screw placement

- Proper fixation is reached when the screw is restricted polyaxially.
- Additional fixation can be achieved by holding the handle while turning the golden knob clockwise.
- Slide the sleeve backward until an acoustic signal sounds (4).



- Switch the ratchet to the forward (IN) position, apply the instrument to the prepared entry point and advance the screw to the desired depth by turning the handle clockwise.





- Once the screw is fully inserted, press the golden button (1) on the knob and slide the Screw Driver Sleeve forward (2).
- Turn the golden knob counter-clockwise to disengage the Screw Driver from the screw head (3).
- Ensure that the polyaxiality of the screw head is intact and that it shows limited interference with anatomical structures.
- The placement and size of the screws shall be confirmed with intra-operative imaging prior to rod insertion.



- If desired, align and position the screw heads using the Screw Head Manipulator.
- When using monoaxial screws, ensure proper alignment of the screw heads for all subsequent steps.
- For the alignment of monoaxial screws please use the Screw Driver.
- Screw height can be adjusted by attaching the Screw Driver to the screw, switching the ratchet to the reverse (OUT) position and turning the handle counter-clockwise.

2 | Spinal Correction

Direct Vertebral Derotation

- Place Derotation Tubes/Quick Tubes on the levels requiring derotation.
- To assist instrument attachment to the screws, slide the Derotation Tube/Quick Tube over the screw head until the interface engages to it. Visual and tactile confirmation of the connection is recommended.

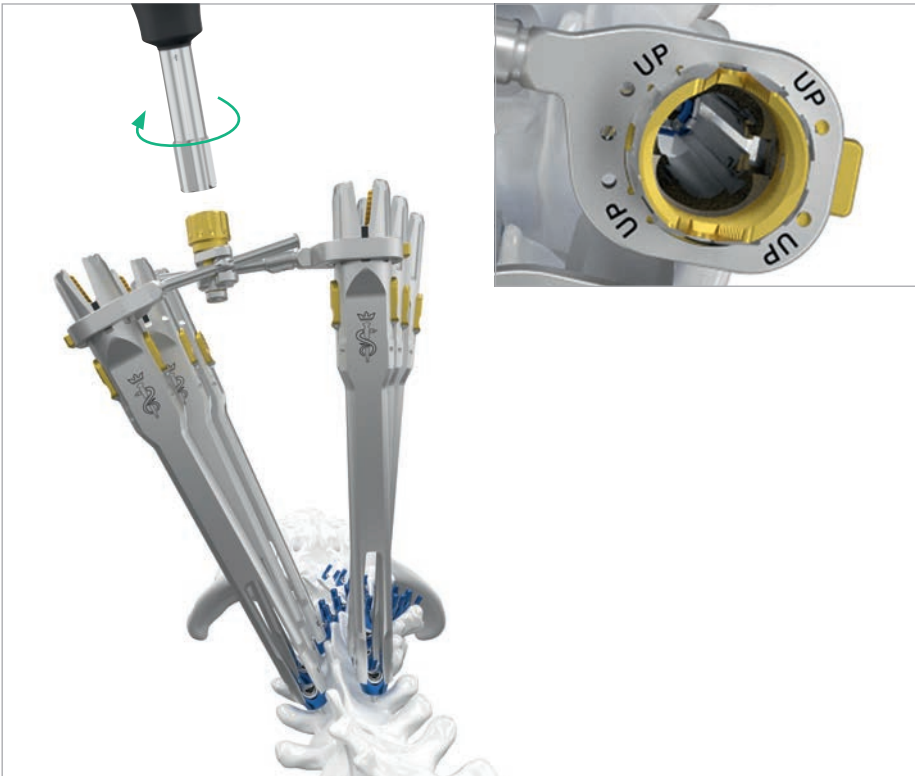
Information

Direct Vertebral Derotation can also be performed without PolyLock®. If so, the steps for PolyLock® activation can be skipped. When using Quick Tubes, please note the instructions on page 25 and 26.

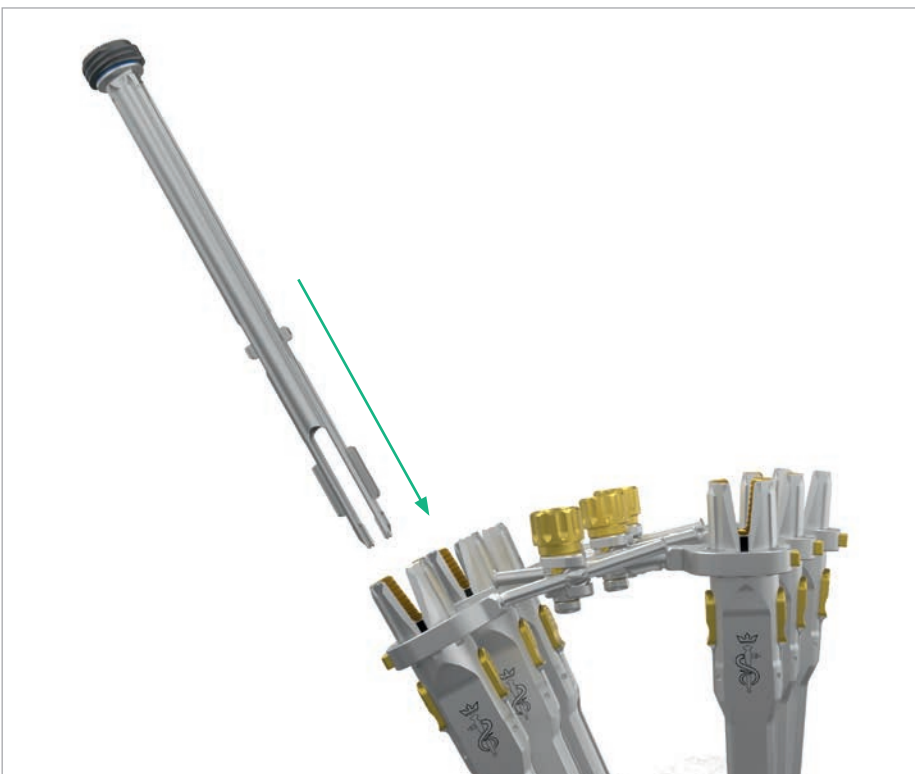


- If contra-rotational corrective forces are desired, additional Tubes may be placed on the next distal and/or proximal levels as needed.
- Connect the Tubes by using Transverse Couplers, starting from the neutral vertebra and working along the thoracic and lumbar levels that require derotation.





- Determine the appropriate length of the Transverse Couplers based on the patient anatomy.
- Prior to attachment, ensure that the Transverse Couplers are in unlocked position by turning the golden knob counter-clockwise.
- Align the snap-in couplings with the laser marking "UP" facing upwards and slide them over the Tubes until an acoustic signal sounds. The sound is an indicator that proper attachment has been achieved.
- The triangulation can be secured by turning the golden knob clockwise, using the Rod Pusher Handle.



- Activate PolyLock® on all levels requiring derotation by sliding the DT Insert Pusher into the Derotation Tube.
- If needed, the Reduction/Tightening Handle may be used to facilitate the introduction of the DT Insert Pusher.

2 | Spinal Correction

- Segmental Couplers can be used as counter holder during PolyLock® activation.
- Align the snap-in coupling with the laser marking "UP" facing upwards and slide them over the Derotation Tubes until an acoustic signal sounds. The sound is an indicator that proper attachment has been achieved.
- If needed, the Counter Torque Handle can be engaged to the Tubes instead.

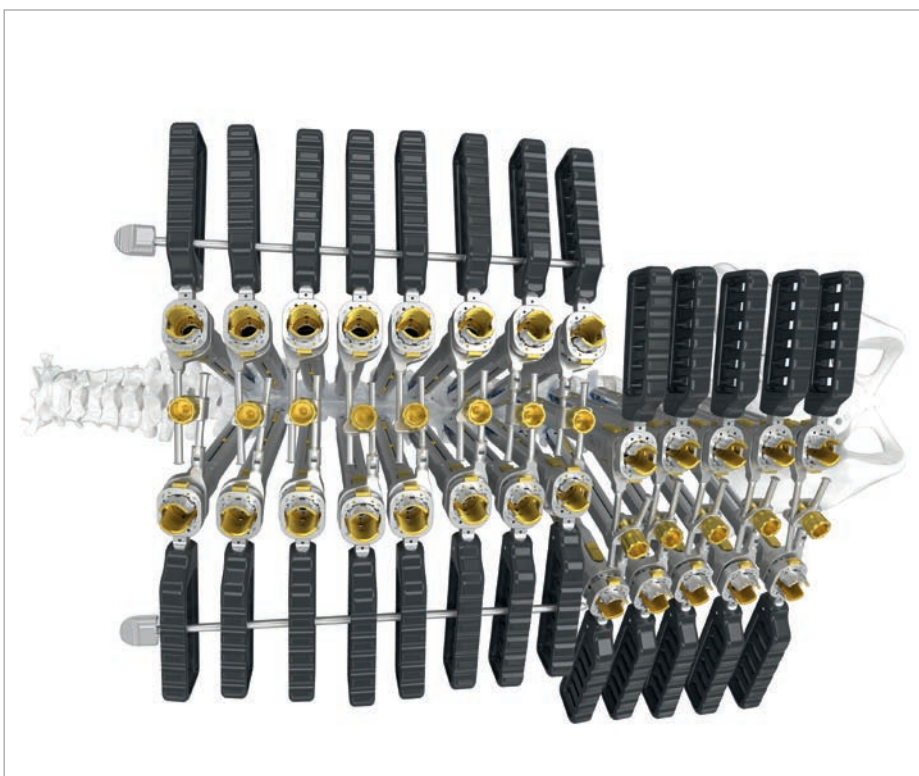


- Connect the Torque Wrench Handle 10 Nm to the PolyLock® Key by sliding the hexagonal shaped portion of the shaft into the coupling until the stop.
- Place the PolyLock® assembly into the upper portion of the Insert Pusher.
- Turn the PolyLock® assembly while firmly holding the Handle until an acoustic signal sounds. The sound is an indicator that PolyLock® has been activated.
- Once the triangulation of the instruments has been performed and PolyLock® has been activated, further Segmental Couplers may be attached on levels requiring derotation.





- Derotate the distal vertebra to a neutral position while holding the corresponding proximal neutral vertebra steady as foundation for force application.
- If additional segmental correction is needed, hold the adjacent level that requires derotation steady and derotate the level further.



- If needed, the correction can be retained by sliding Coupler Pins through the innermost slots of the Segmental Couplers.
- It is recommended to define appropriate blocks, according to the present pathology and anatomy.
- Determine the appropriate length of the Coupler Pins based on the amount of levels to be aligned.

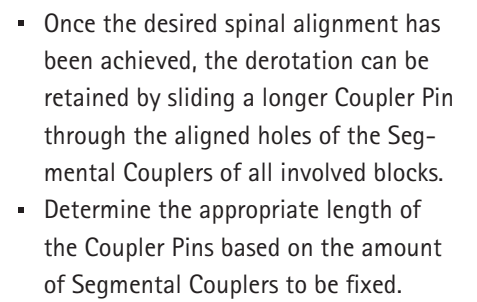
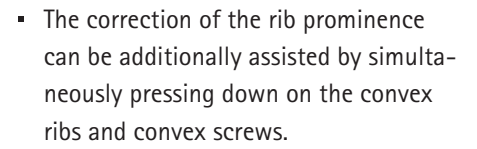
2 | Spinal Correction

En-bloc Derotation

In case of an en-bloc derotation, the levels requiring derotation may be divided into smaller blocks in order to achieve the most effective correction possible. In the event of a double major curve, two blocks may lead to desired correction. For single thoracic and triple major curves, three derotation blocks may be considered.

- If needed, attach further Transverse Couplers to the remaining Tubes in order to achieve instrument connection (triangulation) of all levels requiring derotation.
- For triangulation, align the snap-in coupling with the laser marking "UP" facing upwards and slide them over the Tubes until an acoustic signal sounds. The sound is an indicator that proper attachment has been achieved.
- If needed, attach further Segmental Couplers to the remaining Tubes.
- Prior to correction, ensure that all levels within the blocks are retained by Coupler Pins.
- Correct the spine by slowly derotating the blocks in opposing directions until the desired axial plane correction is achieved.





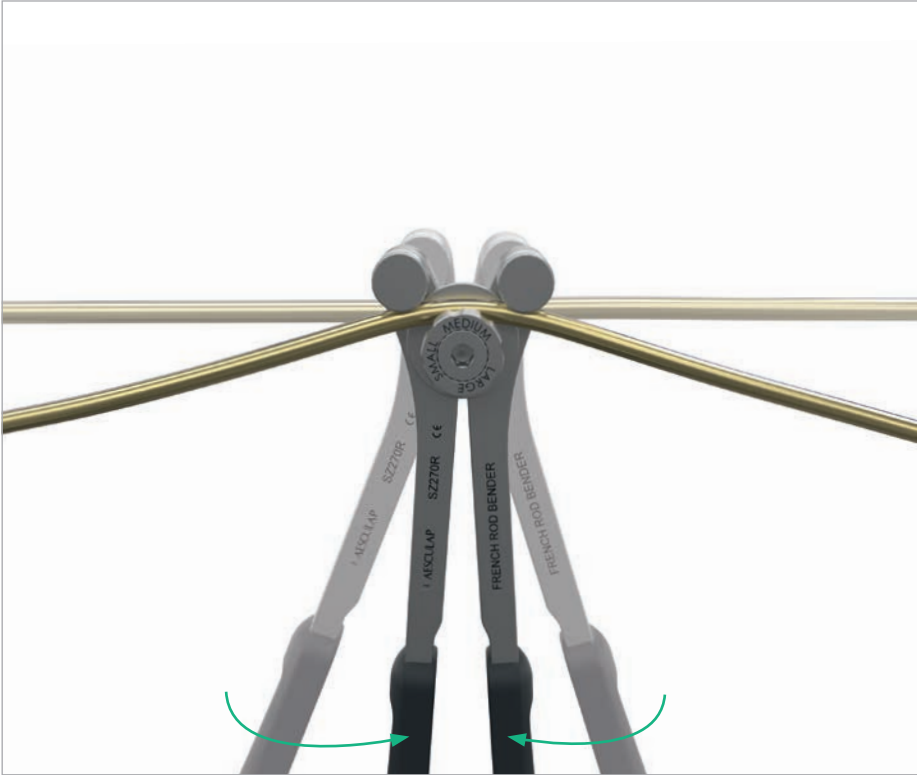
Rod Contouring

- For rod contouring, the flexible Rod Template may be used to determine rod length and the sagittal profile.
- For sagittal and coronal profile contouring, the Rod Template may be placed in the opening of the Tubes.

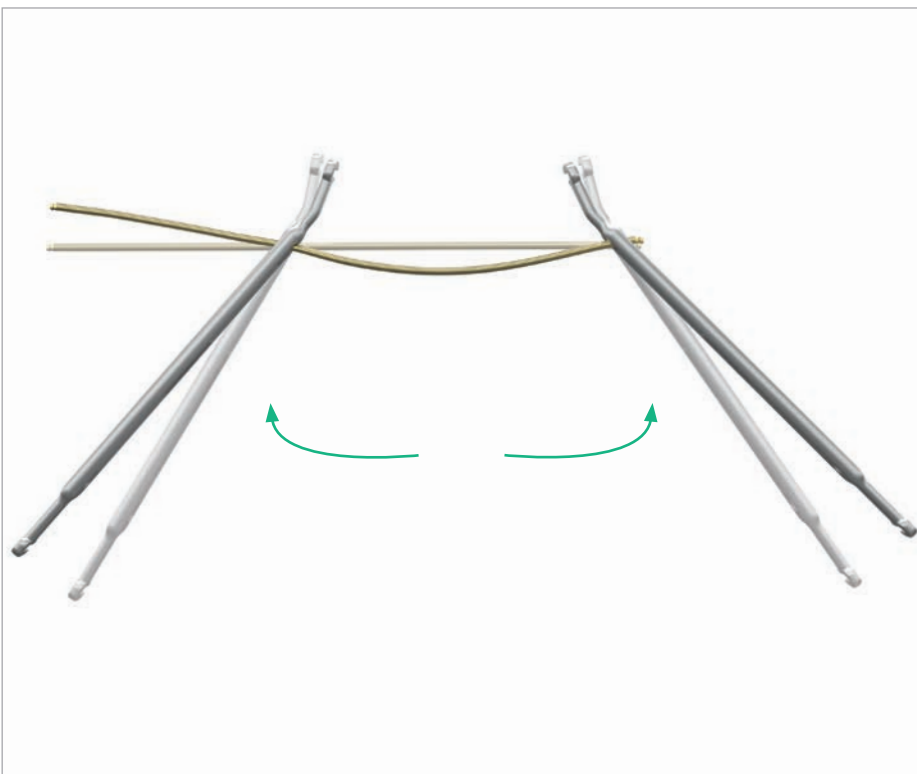


- If needed, the Rod Cutter may be used to assist rod cutting to the required length.





- Rods may be contoured using the Rod Bender, which offers various bending radii.
- To contour the rod, set the bending radius by pulling the knob and turning it to the desired radius.
- Place the rod between the bending knob and both holding knobs. All rods show a line marking as a reference to assist bending in sagittal plane.
- For rod contouring, squeeze both handles and repeat the contouring process along the rod, until the desired rod contour is achieved.



- Rods may be contoured using the Sagittal Rod Benders, which allow high radius bending.
- The Sagittal Rod Bender has straight and angled holes for enhanced rod accommodation.
- To contour the rod, slide the rod into the desired hole of each Sagittal Rod Bender.
- Grip the most distal portions of the Sagittal Rod Benders for enhanced mechanical advantage during contouring.
- By levering the Sagittal Rod Benders the rod is bent according to the desired contour.

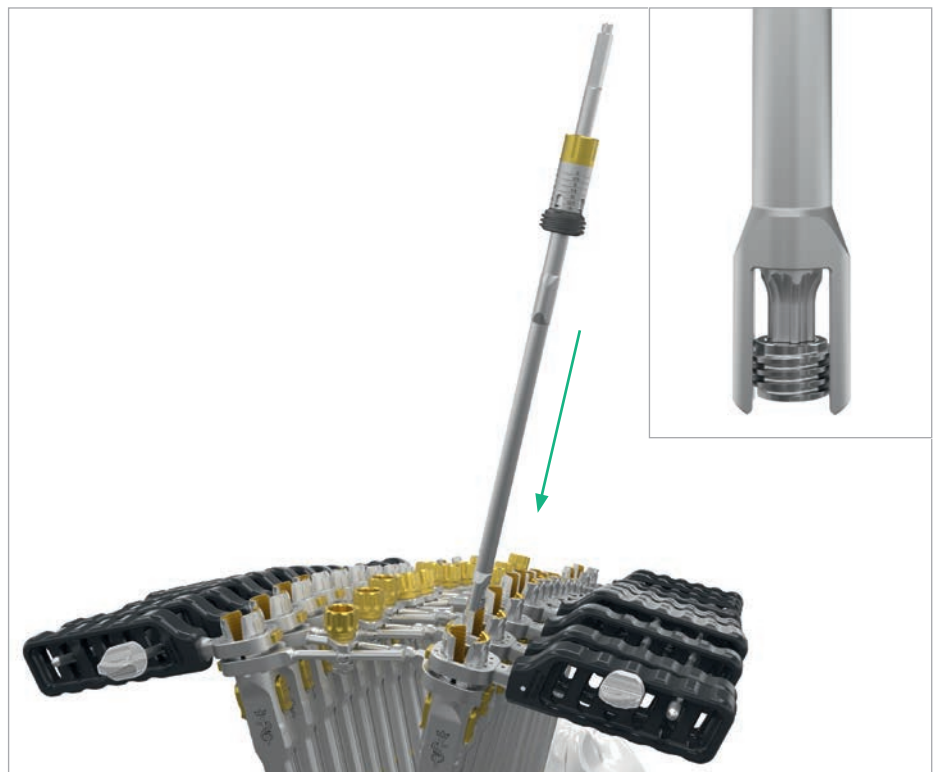
2 | Spinal Correction

Rod Placement

- Align the contoured rod along the patient's physiological sagittal profile and slide it through the longitudinal slots of all Tubes.
- If needed, Rod Rotation Wrenches can be engaged to the hexagon shaped ends of the rod to facilitate rod alignment.

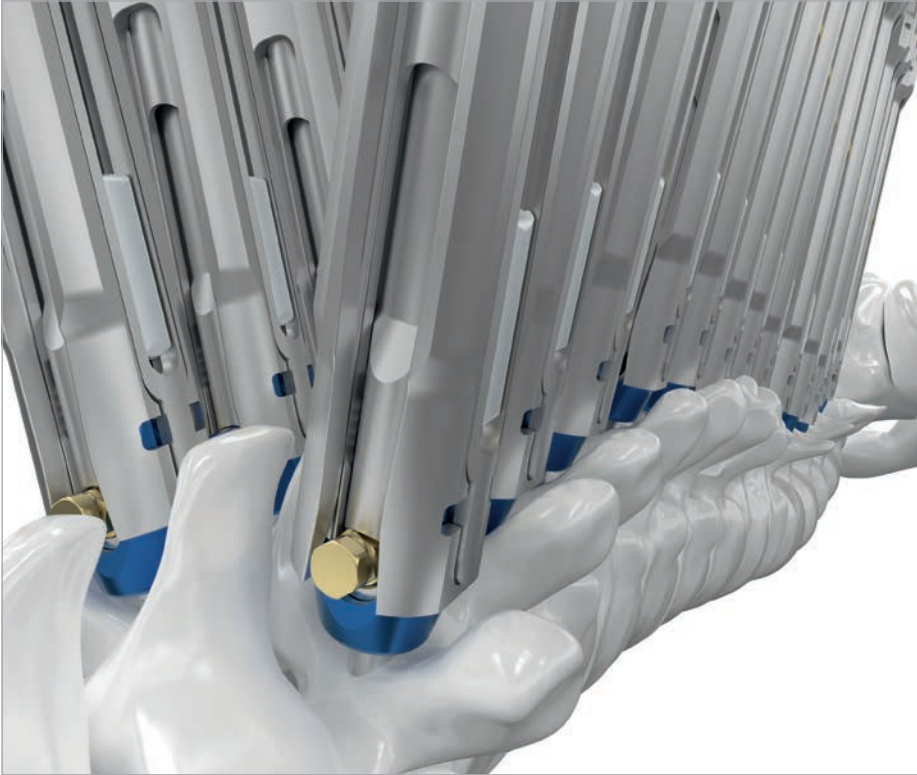


- Once the rod has passed through all Tubes, slide the Set Screw Driver through the DT Rod Pusher.
- Ensure that the Set Screw is loaded to the Set Screw Driver prior to rod pushing procedure.
- For Set Screw placement, load a Set Screw on the Set Screw Driver and ensure proper fixation of the implant based on its alignment with the laser marking on the instrument.

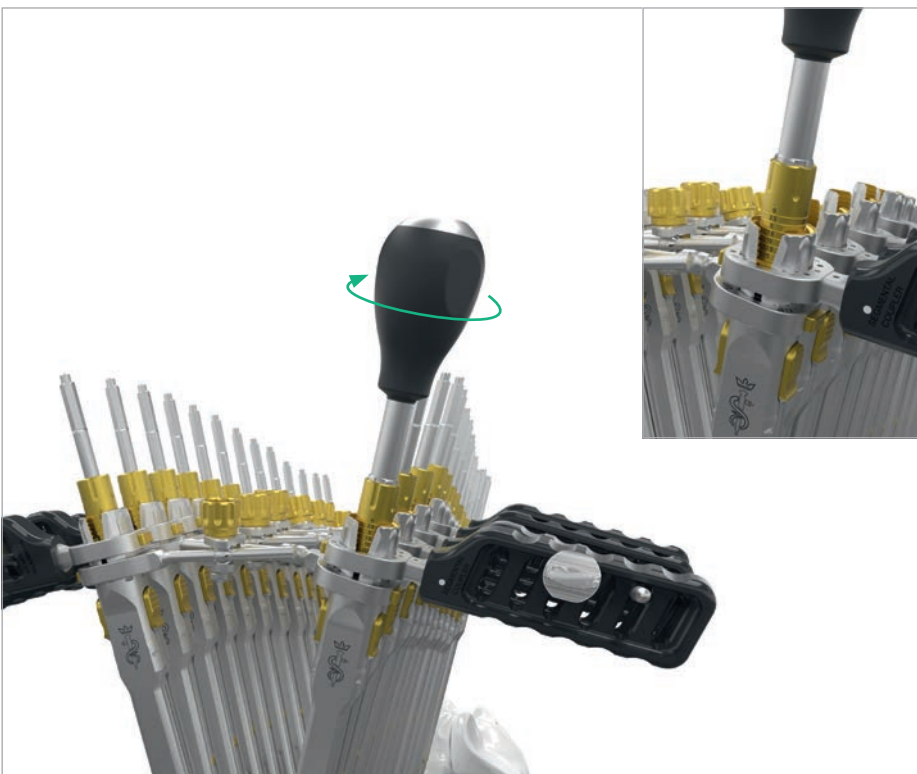


Information

If spinal correction is performed without PolyLock®, the DT Combo Pusher may be used for rod pushing.



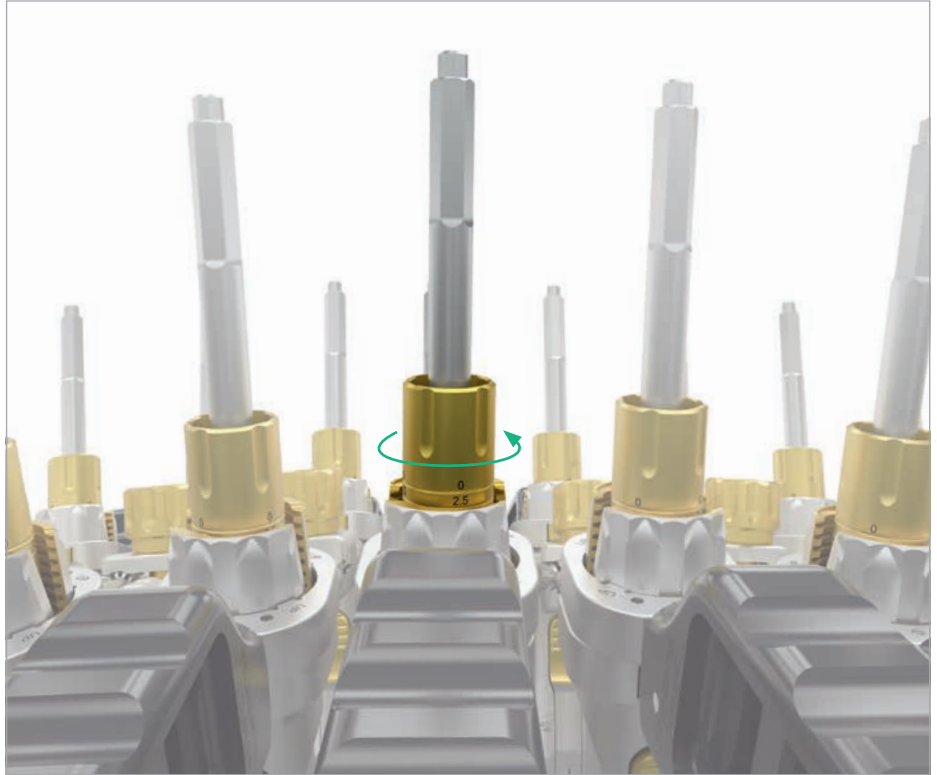
- Slide the DT Rod Pusher assembly (with Set Screw Driver and loaded Set Screw) into the Derotation Tube and turn the golden part clockwise until the DT Rod Pusher contacts the rod.
- The marked scale on top of the DT Rod Pusher indicates the amount of persuasion left until the rod is fully seated in the screw head.



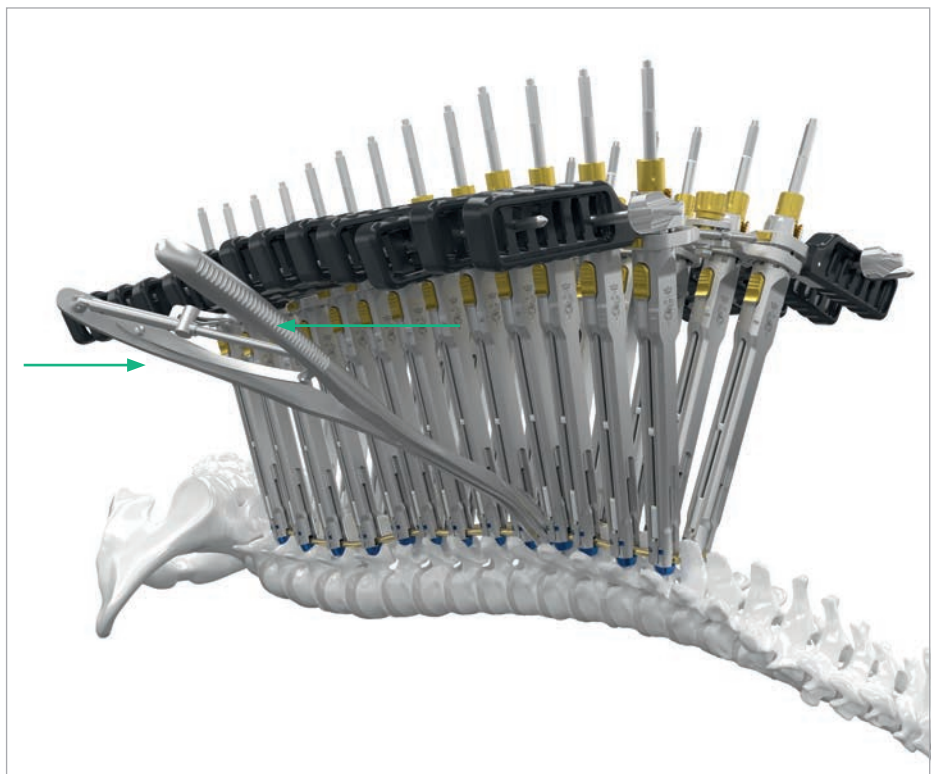
- If needed, the Reduction/Tightening Handle may be used to facilitate rod pushing.

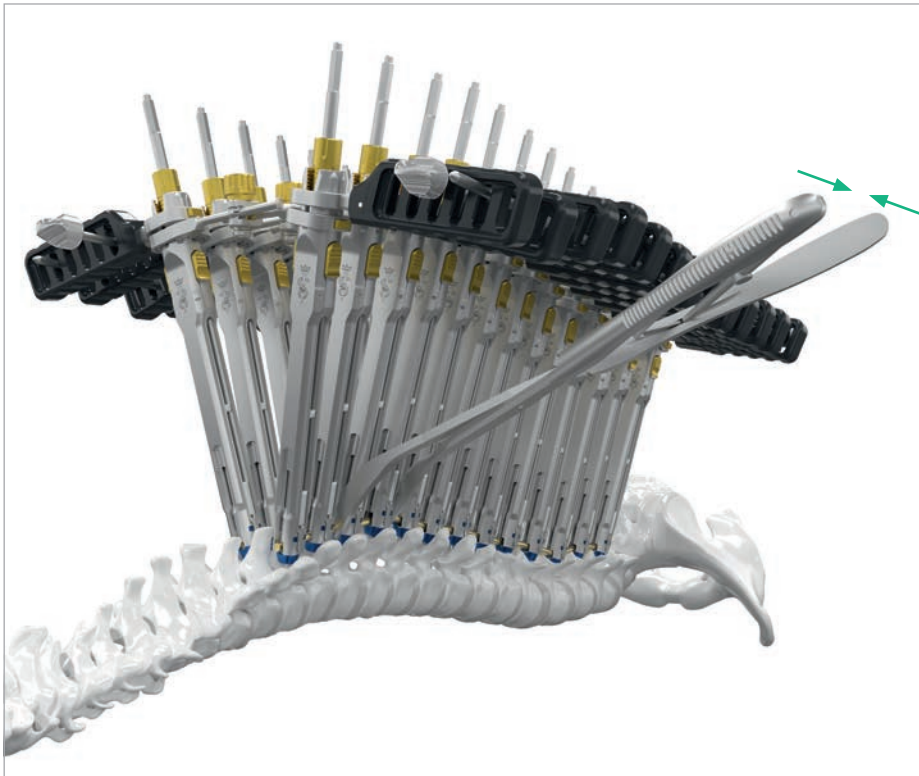
Parallel Compression and Distraction

- Prior to compression or distraction, slightly loosen the DT Rod Pusher/DT Combo Pusher for force transmission.

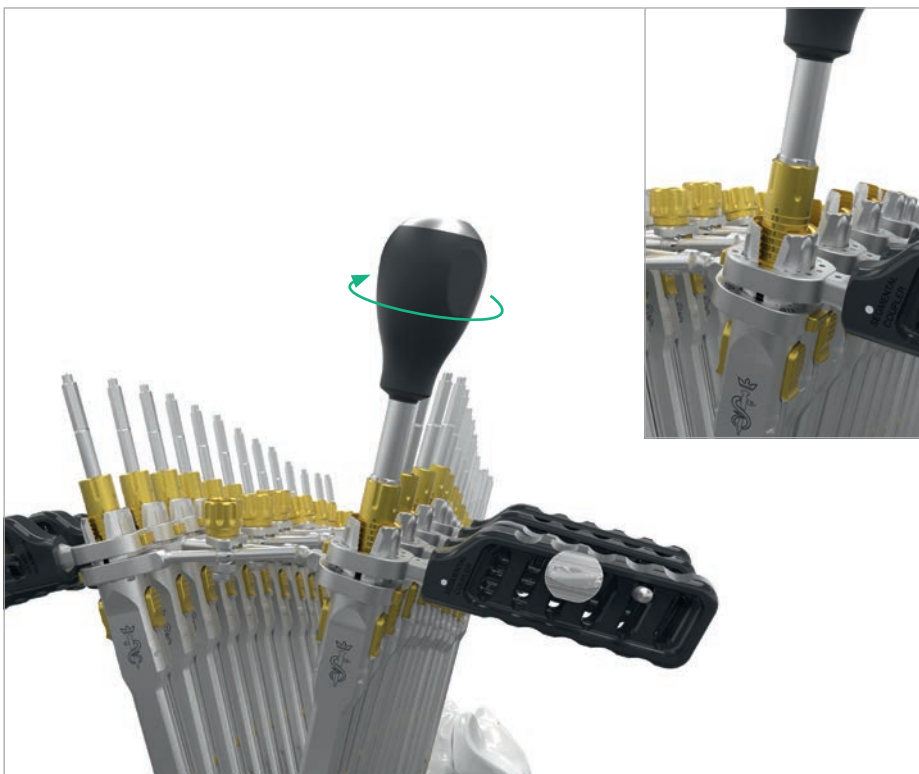


- For distraction, place the Distraction Forceps between the Tubes and squeeze the handles until the aimed correction is achieved. As a result, the distance between the loaded elements increases evenly.





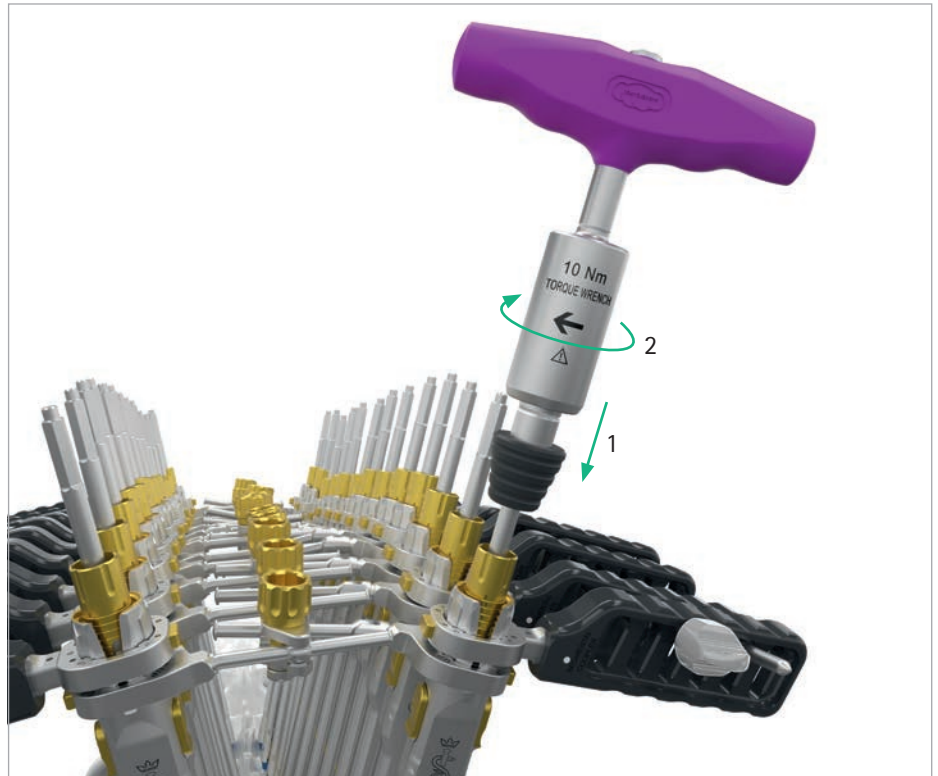
- For compression, place the Compression Forceps around the Tubes and squeeze the handles until the aimed correction is achieved. As a result, the distance between the loaded elements decreases evenly.



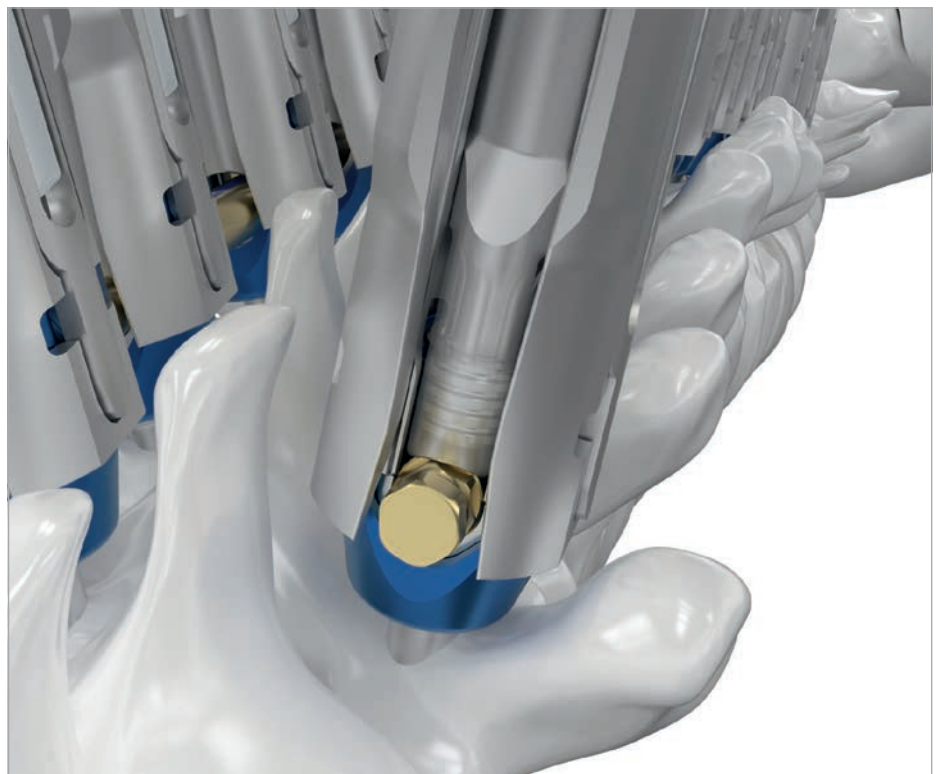
- Once the desired correction is achieved, use the PolyLock® assembly or Reduction/Tightening Handle to retighten the DT Rod Pusher/DT Combo Pusher to retain the position of the spinal segment.

Final Tightening

- Assemble the Torque Wrench by attaching the Torque Wrench Handle 10 Nm to the Set Screw Driver by sliding the hexagonal shaped portion of the shaft into the handle coupling until the stop (1).
- Segmental Couplers can be used as counter holder during final tightening.
- If desired, the Counter Torque Handle can be engaged to the Tubes instead.



- Turn the Torque Wrench clockwise (2) while firmly holding the Segmental Coupler/Counter Torque Handle until the Set Screw engages with the screw head and an acoustic signal sounds. The sound is an indicator that the final tightening of 10 Nm has been achieved.





Quick Tube Handling

- Prior to attachment, move the Quick Tube into its unlocked position by pressing both golden buttons and pulling the reduction spindle backwards until a positive stop is perceived.
- To assist instrument attachment to the screws, slide the Quick Tube over the screw head until the interface engages to it. Visual and tactile confirmation of the connection is recommended.



- For rod rotation, align the sagittal contour of the rod with the sagittal plane of the patient by using the Rod Gripper or Rod Rotation Wrench, or a combination of both.
- Reduce the rod by either pushing the golden spindle down or turning it until it contacts the rod. If needed, the Reduction/Tightening Handle may be used to facilitate rod pushing.
- Ensure that the rod stays in proper sagittal alignment during this procedure.

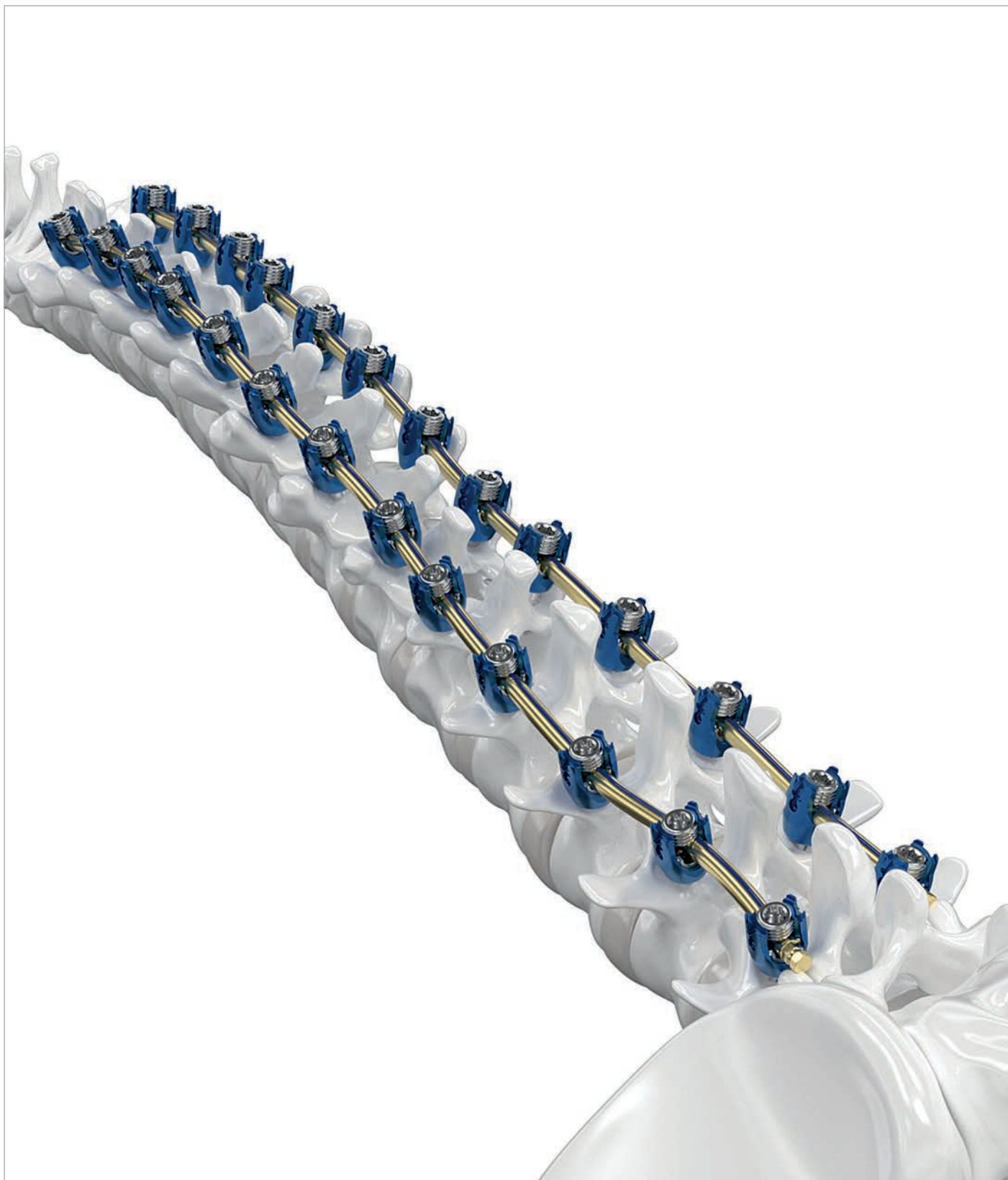
2 | Spinal Correction

- If desired, Set Screws can be inserted after full rod reduction to maintain the desired correction.
- For Set Screw placement, load a Set Screw on the Cmplx Set Screw Driver and ensure proper fixation of the implant based on its alignment with the laser marking on the instrument.



- Detach the Quick Tube from the screw head by pressing both golden buttons and pulling the reduction spindle backwards until a positive stop is perceived.
- Push on both golden marked portion of the connection arms, in order to disengage the connection to the screw head. Pull the whole instrument off the patient.

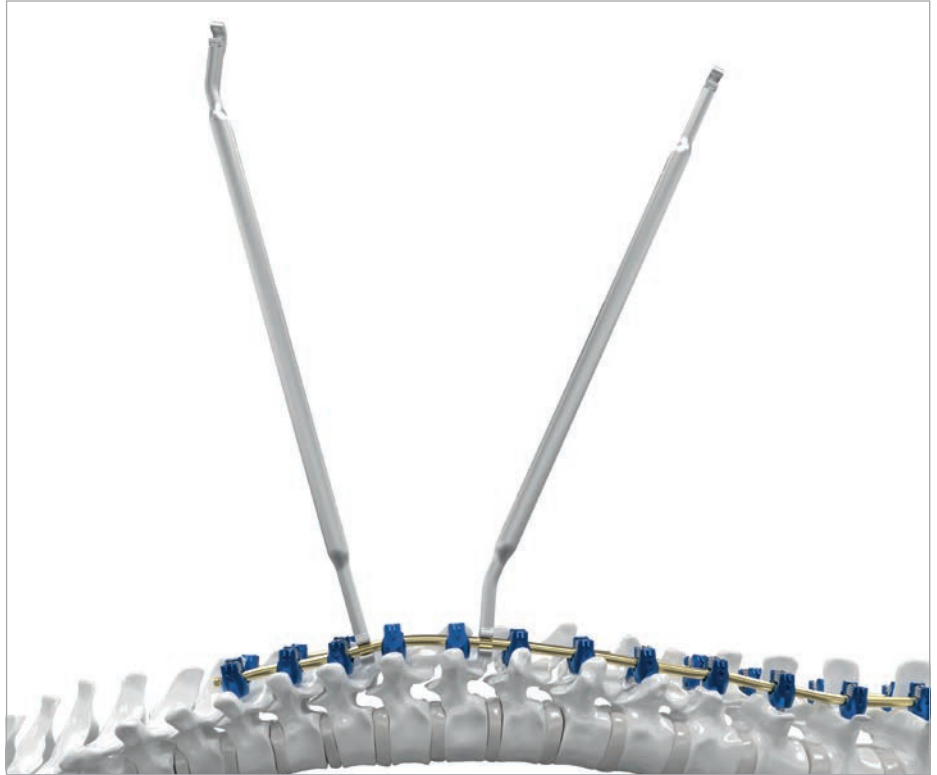




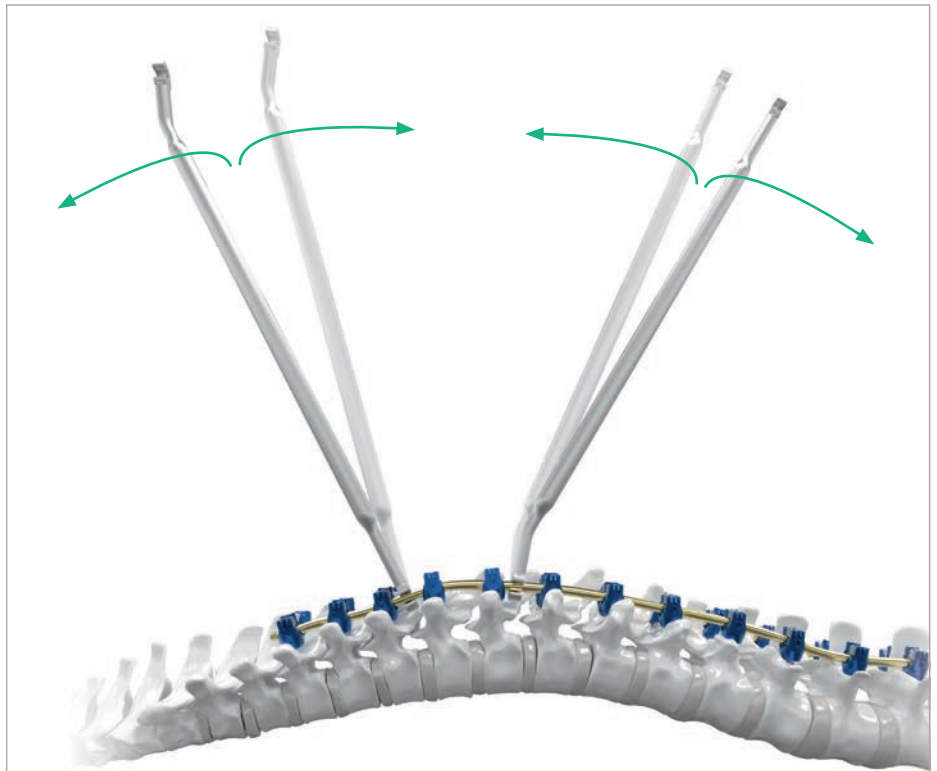
3 | In-situ Rod Contouring

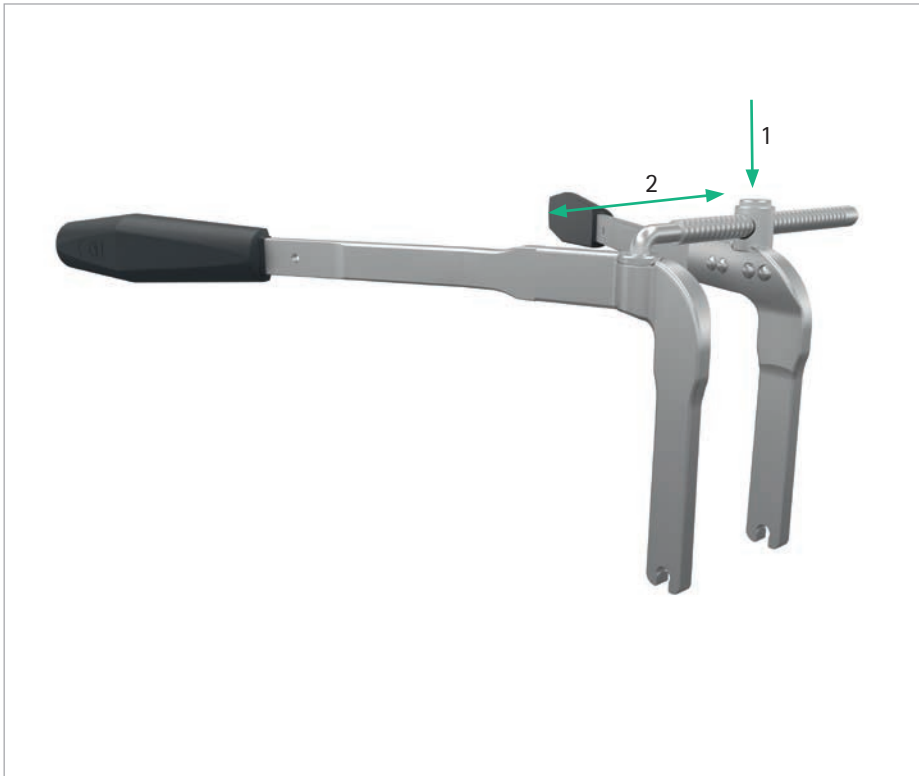
Sagittal Plane Contouring

- Sagittal Rod Benders may be used to improve or adjust kyphosis and lordosis.
- The instruments have a straight and angled connection interface, which influences the bending radius and the outcome of the rod curvature.
- Place the rod interface of both Sagittal Rod Benders on the rod section requiring bending.
- For small incremental bending, it is recommended to place the working ends as close together as possible.



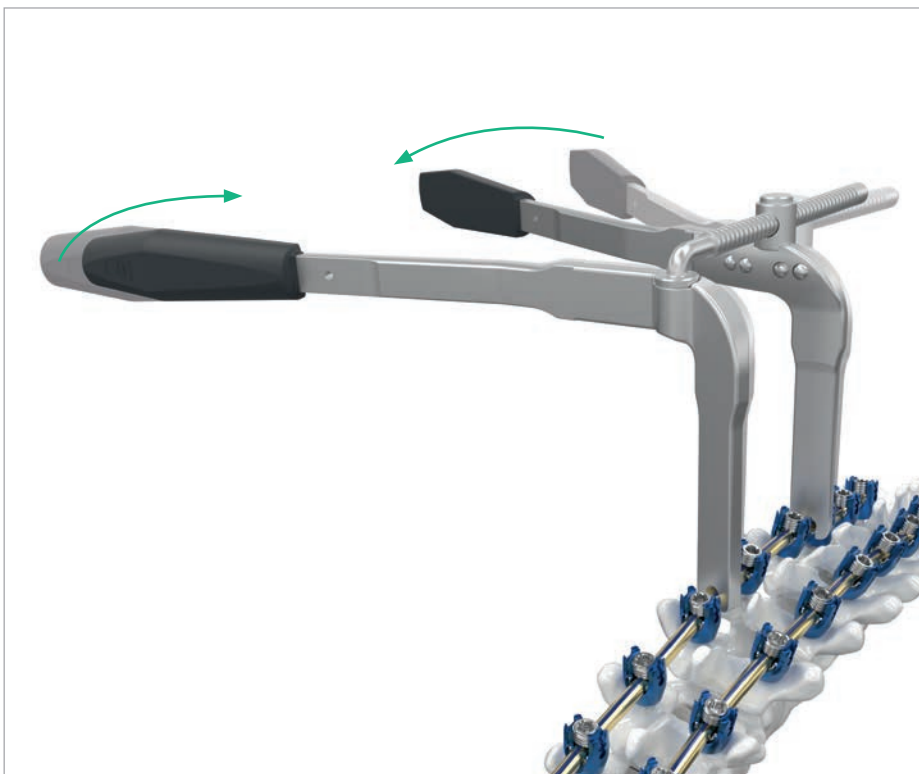
- By levering the upper portions of the Sagittal Benders together the rod is bent in a lordotic manner. By pulling the instruments away from each other the rod is bent kyphotically.





Coronal Plane Contouring

- Coronal Rod Benders may be used to improve coronal plane correction.
- The Coronal Benders have a connecting spindle which allow for the creation of large bending radii.
- If bigger bending radii are needed, press the button on the spindle (1) and adjust the distance between both Coronal Benders (2).

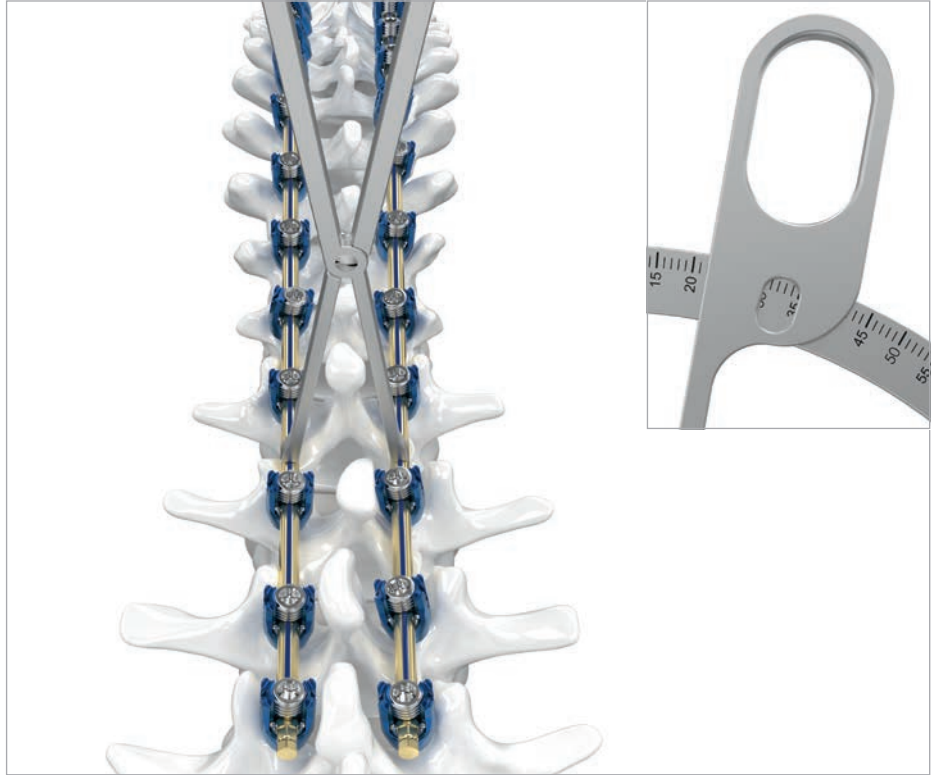


- Place the interface of both Coronal Benders on the rod section requiring bending.
- For small radii, arrange the handles of the Benders such that the female and male instrument parts can contact directly.
- For larger radii, arrange the Bender spindle connection such that the Benders form a substantially perpendicular connection to the rod.
- Squeeze or pull the handles until the desired bend is achieved.

4 | Connector Placement

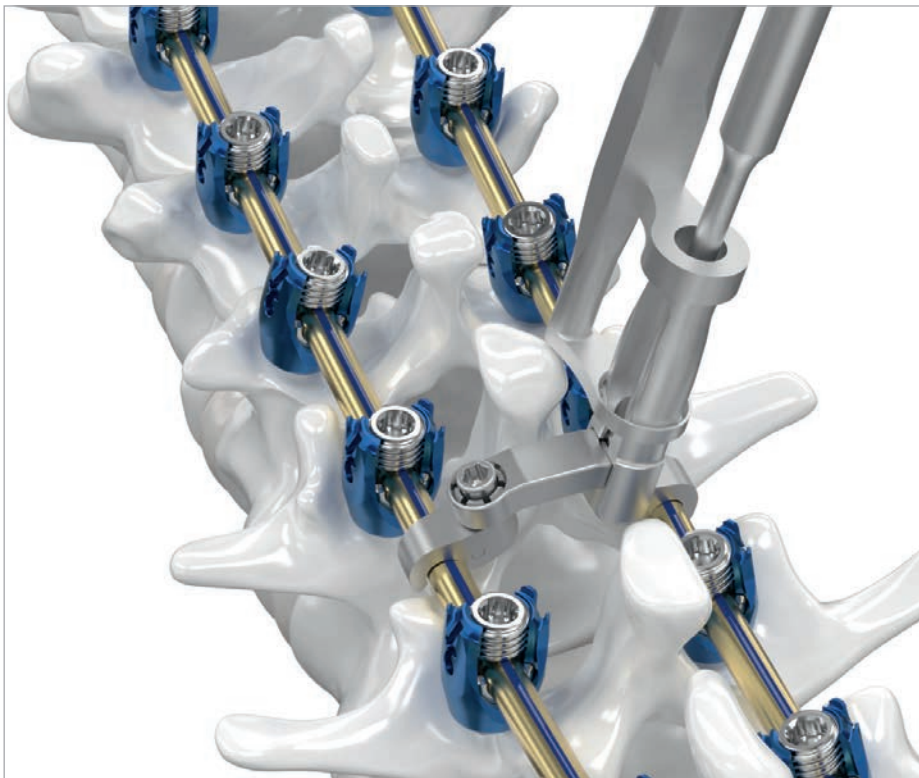
Cross Connectors

- Determine the appropriate length of the Connector by placing the Cross Connector Caliper on both rods.
- Choose the type of Connector based on the measured length and present patient anatomy.



- Prior to implantation, ensure that the Cross Connector Set Screws do not interfere with the rods.
- For this, assemble the Connector Torque Wrench by attaching the Torque Wrench Handle 5 Nm to the Torque Wrench Shaft 5 Nm by sliding the square shaped portion of the shaft into the handle coupling until the stop.
- Fully seat the tip of the Connector Torque Wrench into the socket of the Cross Connector Set Screw and turn the Connector Torque Wrench counter-clockwise until a positive stop is perceived.





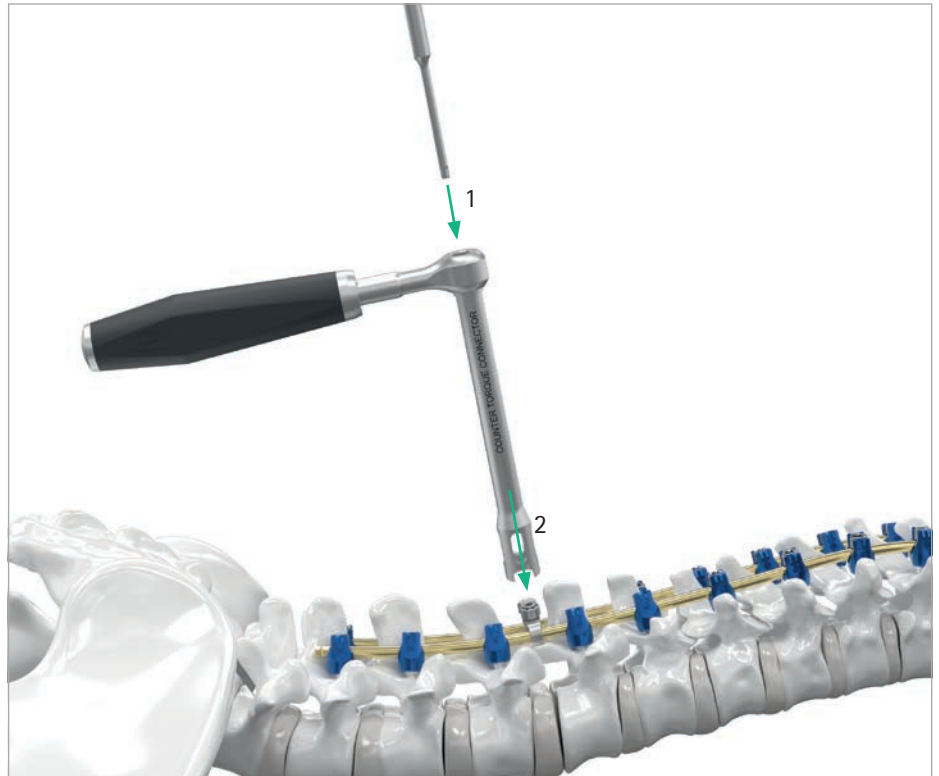
- For implantation, attach the Cross Connector Holder to the implant by sliding the instrument tip over one Cross Connector Set Screw and squeezing the handle until the first detent.
- Place both Cross Connector interfaces on the rods and ensure proper sitting.



- Fully seat the tip of the Connector Torque Wrench into the socket of the Cross Connector Set Screw.
- Turn the Connector Torque Wrench clockwise for provisional Cross Connector engagement to the rod.

4 | Connector Placement

- Insert the Connector Torque Wrench through the canulation of the Connector Counter Torque Handle so the tip is exposed (1).
- Engage the tip of the Connector Torque Wrench with the Cross Connector Set Screw and the tip of the Connector Counter Torque Handle with the Cross Connector (2).



- Turn the Connector Torque Wrench clockwise while firmly holding the Connector Counter Torque Handle until an acoustic signal sounds. The sound is an indicator that the final tightening of 5 Nm has been achieved.





4 | Connector Placement

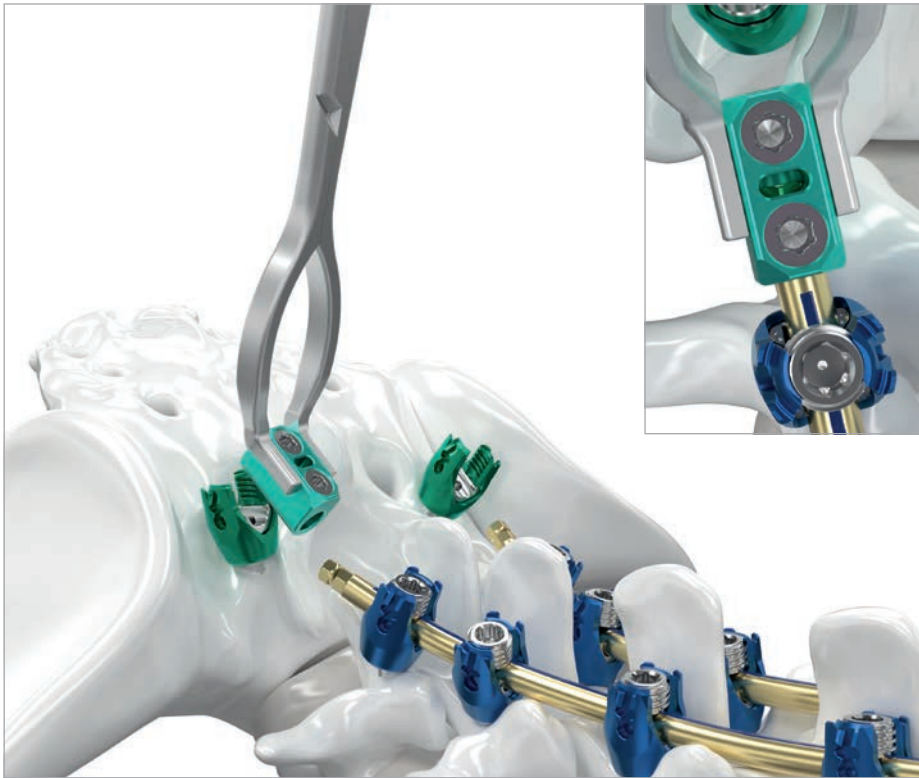
Axial Connectors

- Determine the appropriate length of the Axial Connector based on the present patient anatomy.
- Prior to implantation, ensure the Axial Connector Set Screws do not interfere with the rods.
- For this, assemble the Connector Torque Wrench by attaching the Torque Wrench Handle 5 Nm to the Torque Wrench Shaft 5 Nm by sliding the square shaped portion of the shaft into the handle coupling until the stop.



- Attach the Rod-to-Rod Holder to the implant by placing the instrument interface on the lateral notches on the implant and squeezing the handles together until proper fixation is reached.
- Fully seat the tip of the Connector Torque Wrench into the socket of the Axial Connector Set Screw and turn the Connector Torque Wrench counter-clockwise until a positive stop is perceived.





- Slide the Axial Connector onto the end of the existing rod and confirm adequate implant placement using the window on the Axial Connector.
- Fully seat the tip of the Connector Torque Wrench into the socket of the Axial Connector Set Screw.
- Turn the Connector Torque Wrench clockwise for provisional Axial Connector engagement to the rod.



- The extension rod can be placed inside the Axial Connector and secured by provisionally tighten the corresponding Axial Connector Set Screw.
- Secure the extension rod by additionally placing a Set Screw into the corresponding pedicle screw head.

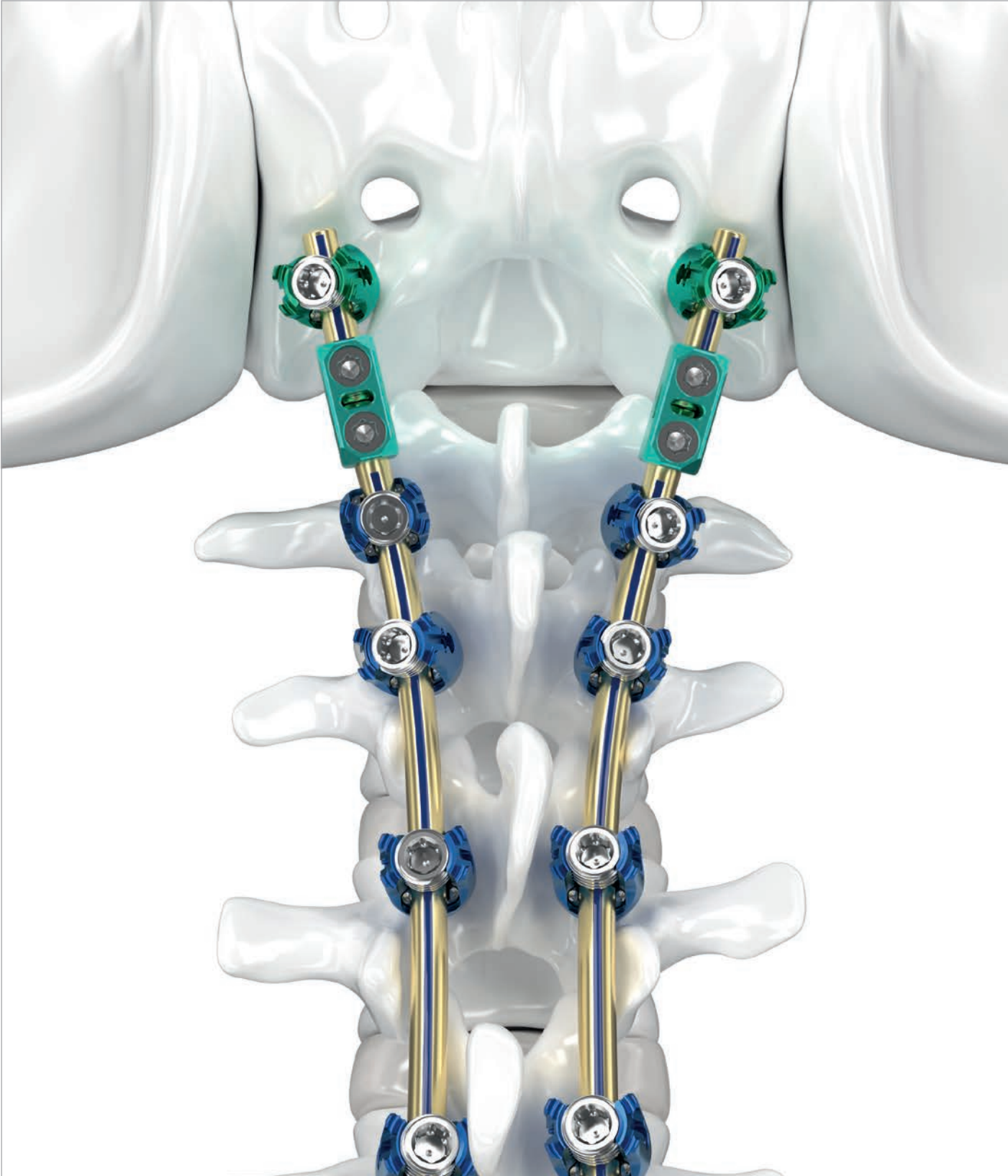
4 | Connector Placement

- Insert the Connector Torque Wrench through the canulation of the Connector Counter Torque Handle so the tip is exposed.
- Engage the tip of the Connector Torque Wrench with the Axial Connector Set Screw and the tip of the Connector Counter Torque Handle with the Axial Connector.



- Turn the Connector Torque Wrench clockwise while firmly holding the Connector Counter Torque Handle until an acoustic signal sounds. The sound is an indicator that the final tightening of 5 Nm has been achieved.

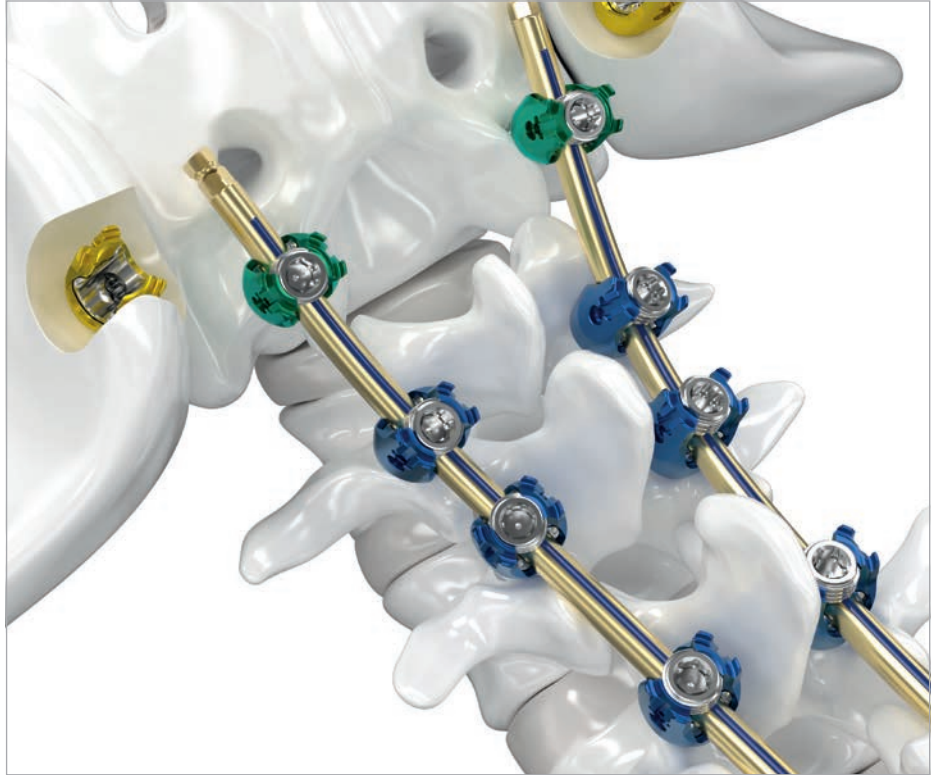




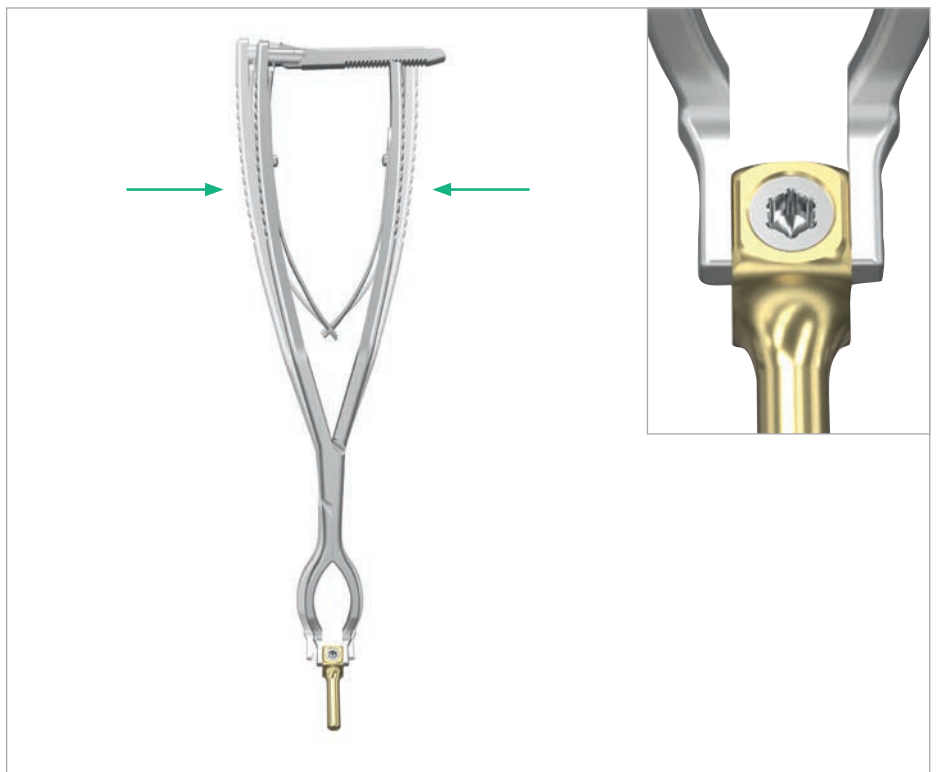
4 | Connector Placement

Lateral Offset Connectors

- Determine the appropriate type and length of the Lateral Offset Connector based on the present patient anatomy.
- Prior to implantation, ensure the Lateral Offset Connector Set Screw do not interfere with the rod.
- For this, assemble the Connector Torque Wrench by attaching the Torque Wrench Handle 5 Nm to the Torque Wrench Shaft 5 Nm by sliding the square shaped portion of the shaft into the handle coupling until the stop.



- Attach the Rod-to-Rod Holder to the implant by placing the instrument interface on the lateral notches on the implant and squeezing the handles together until proper fixation is reached.
- Fully seat the tip of the Connector Torque Wrench into the socket of the Lateral Offset Connector Set Screw and turn the Connector Torque Wrench counter-clockwise until a positive stop is perceived.





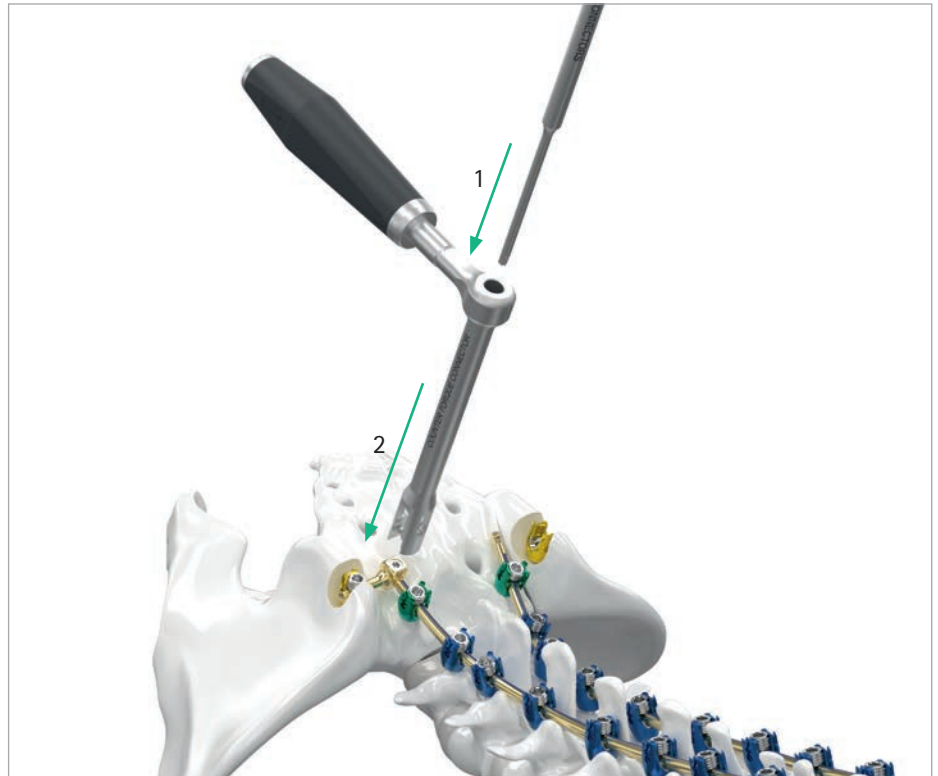
- For Closed Lateral Offset Connectors, slide the closed hole of the Lateral Offset Connector onto the overlapping rod of the existing construct.
- For Open Lateral Offset Connectors, attach the open interface of the Lateral Offset Connector onto the overlapping rod of the existing construct.
- Leverage the rod portion of the Lateral Offset Connector into the head of the screw to be connected.



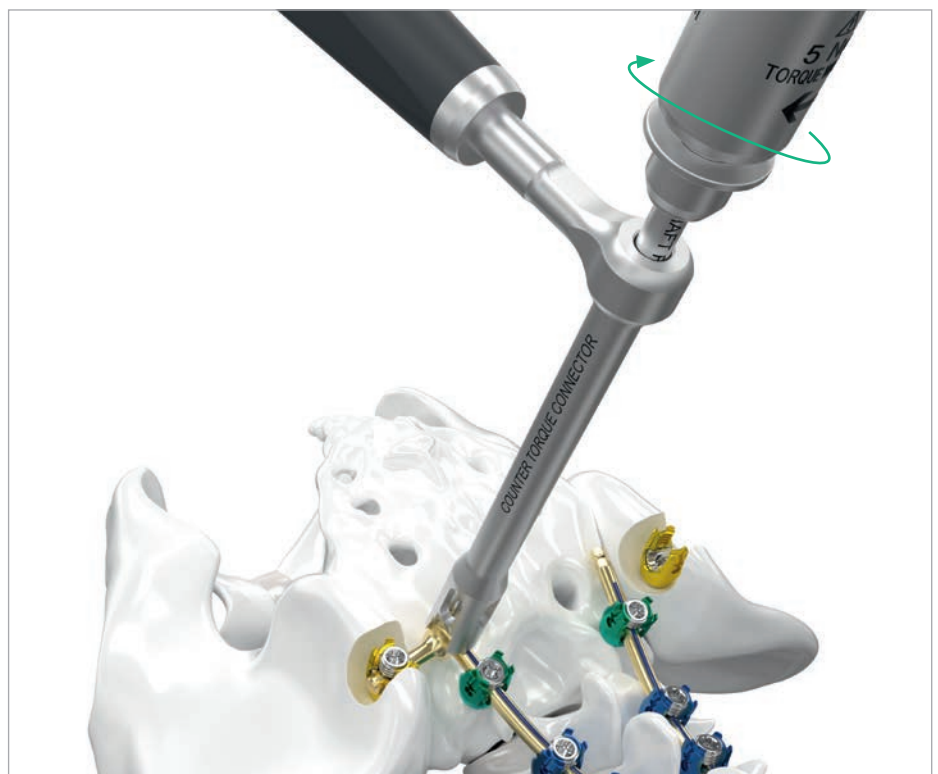
- Fully seat the tip of the Connector Torque Wrench into the socket of the Lateral Offset Connector Set Screw for provisional tightening.
- Secure the rod portion of the Lateral Offset Connector by additionally placing a Set Screw into the corresponding pedicle screw head.

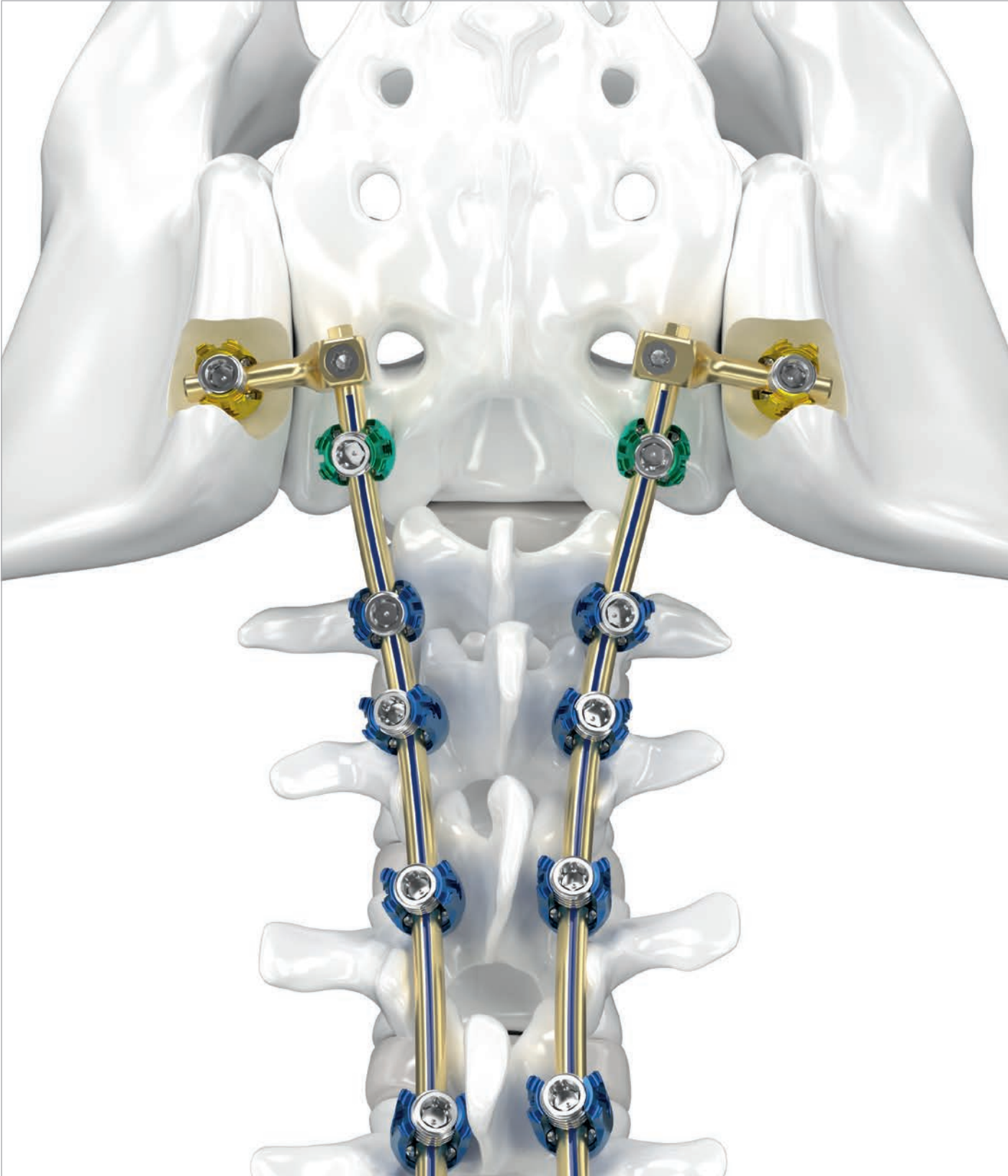
4 | Connector Placement

- Insert the Connector Torque Wrench through the canulation of the Connector Counter Torque Handle so the tip is exposed (1).
- Engage the tip of the Connector Torque Wrench with the Lateral Offset Connector Set Screw and the tip of the Connector Counter Torque Handle with the Lateral Offset Connector (2).



- Turn the Connector Torque Wrench clockwise while firmly holding the Connector Counter Torque Handle until an acoustic signal sounds. The sound is an indicator that the final tightening of 5 Nm has been achieved.





4 | Connector Placement

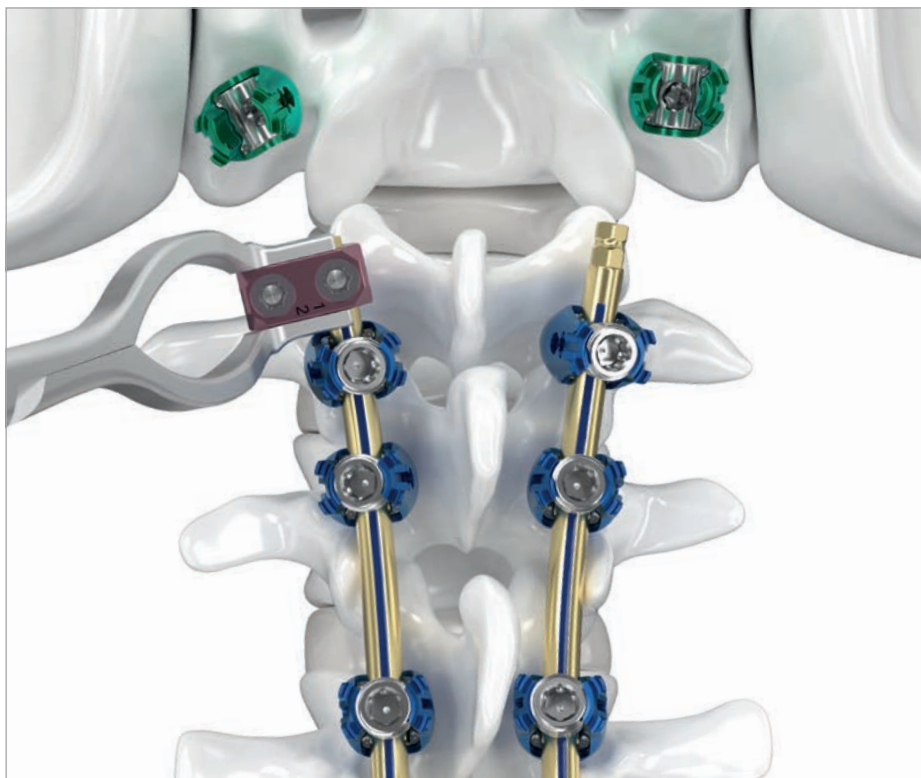
Domino Connectors

- Determine the appropriate type and length of the Domino Connector based on the present patient anatomy.
- Prior to implantation, ensure the Domino Connector Set Screws do not interfere with the rods.
- For this, assemble the Connector Torque Wrench by attaching the Torque Wrench Handle 5 Nm to the Torque Wrench Shaft 5 Nm by sliding the square shaped portion of the shaft into the handle coupling until the stop.

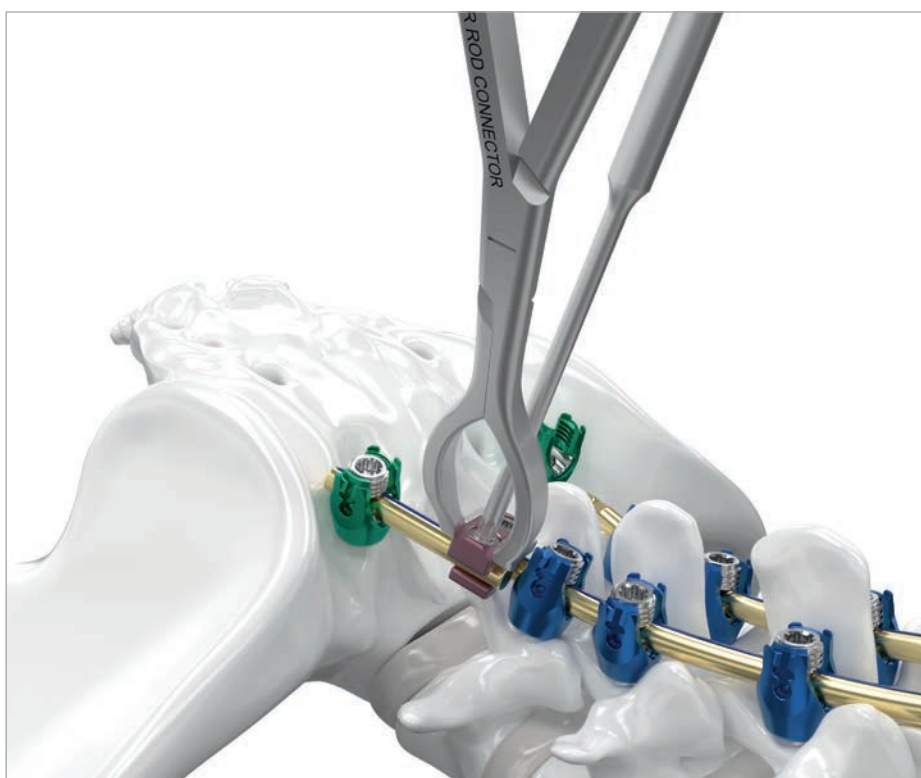


- Attach the Rod-to-Rod Holder to the implant by placing the instrument interface on the lateral notches on the implant and squeezing the handles together until proper fixation is reached.
- Fully seat the tip of the Connector Torque Wrench into the socket of the Domino Connector Set Screw and turn the Connector Torque Wrench counter-clock-wise until a positive stop is perceived.





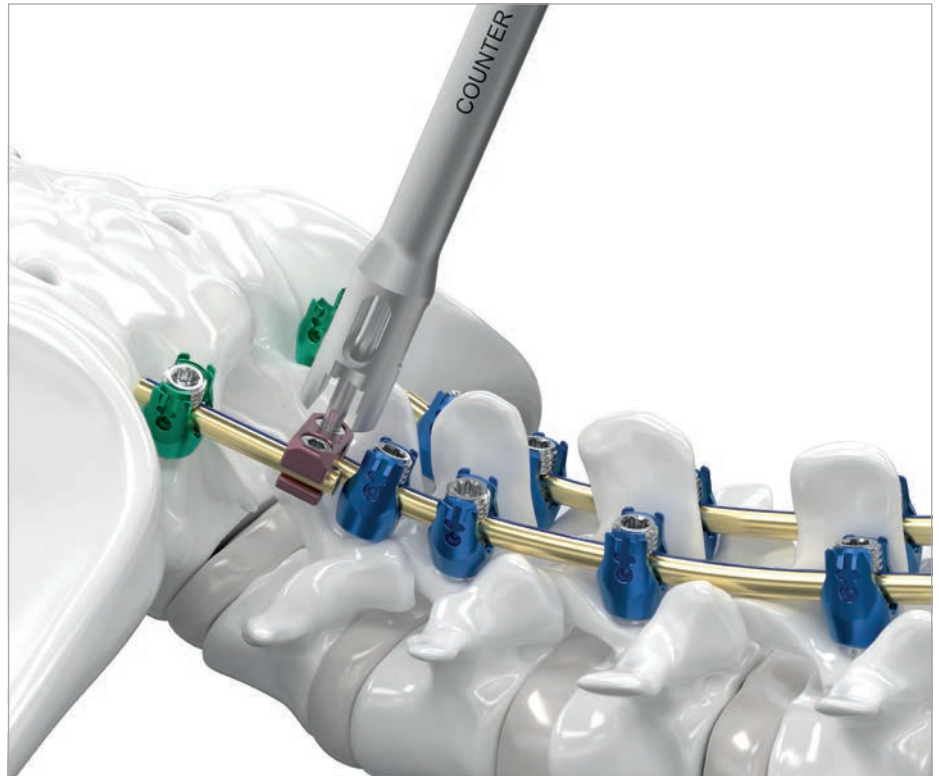
- For Closed / Open Connectors, slide the closed hole of the Domino Connector onto the overlapping rod of the existing construct. Engage the extension rod to the Domino Connector using the open hole.
- For Closed Connectors, slide the closed hole of the Domino Connector onto the overlapping rod of the existing construct. Slide the extension rod into the remaining hole and leverage the overlapping extension bar into the caudal pedicle screw head.



- Fully seat the tip of the Connector Torque Wrench into the socket of the Domino Connector Set Screw for provisional tightening.
- Ensure that the recommended sequence steps, which are marked on the Domino Connectors, are considered during final tightening.
- Secure the extension rod by additionally placing a Set Screw into the corresponding pedicle screw head.

4 | Connector Placement

- Insert the Connector Torque Wrench through the canulation of the Connector Counter Torque Handle so the tip is exposed.
- Engage the tip of the Connector Torque Wrench with the Domino Connector Set Screw and the tip of the Connector Counter Torque Handle with the Domino Connector.



- Turn the Connector Torque Wrench clockwise while firmly holding the Connector Counter Torque Handle until an acoustic signal sounds. The sound is an indicator that the final tightening of 5 Nm has been achieved.

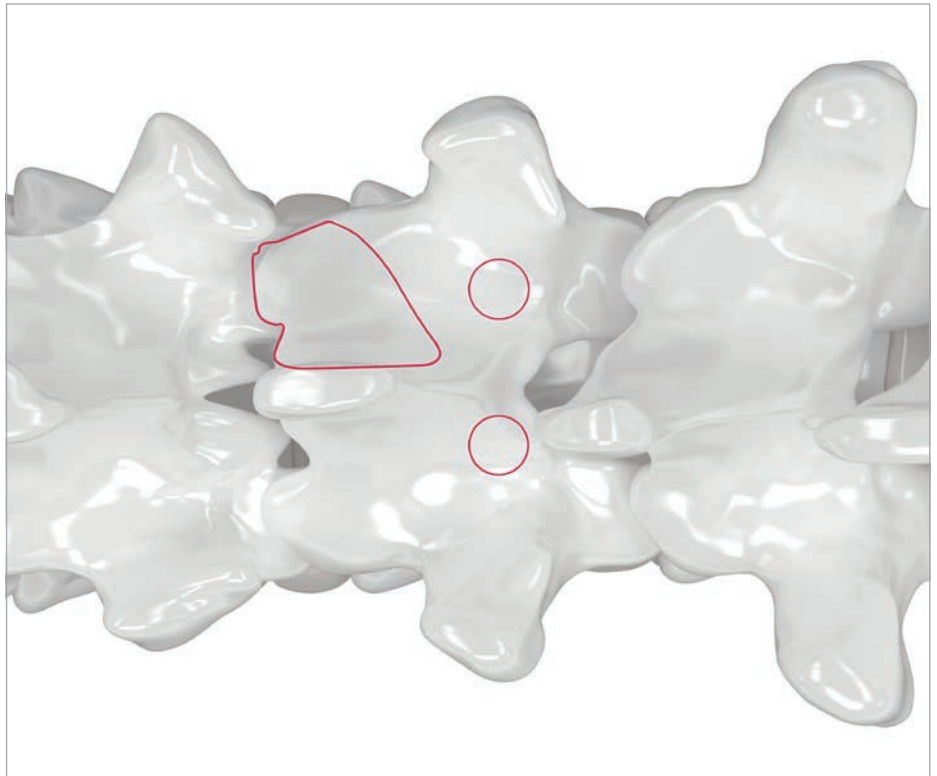




5 | Hook Placement

Pedicle Hook

- The Pedicle Hooks can be inserted in a cranial fashion typically between T1 and T10 and implanted in an infralaminar position.
- To ease insertion of the Pedicle Hook, a partial inferior facet excision should be performed.



- The Pedicle Preparator is carefully positioned under the inferior facet and above the superior facet joint and directed along the vertical axis of the vertebra until it reaches the inferior pedicle pole.
- Ensure that the tip is positioned around the inferior part of the pedicle.





- Slide the Hook Holder Tube over the Pedicle Hook until the interface engages to it. Visual and tactile confirmation of the connection is recommended.
- Place the Hook Pusher into the posterior part of the Pedicle Hook.

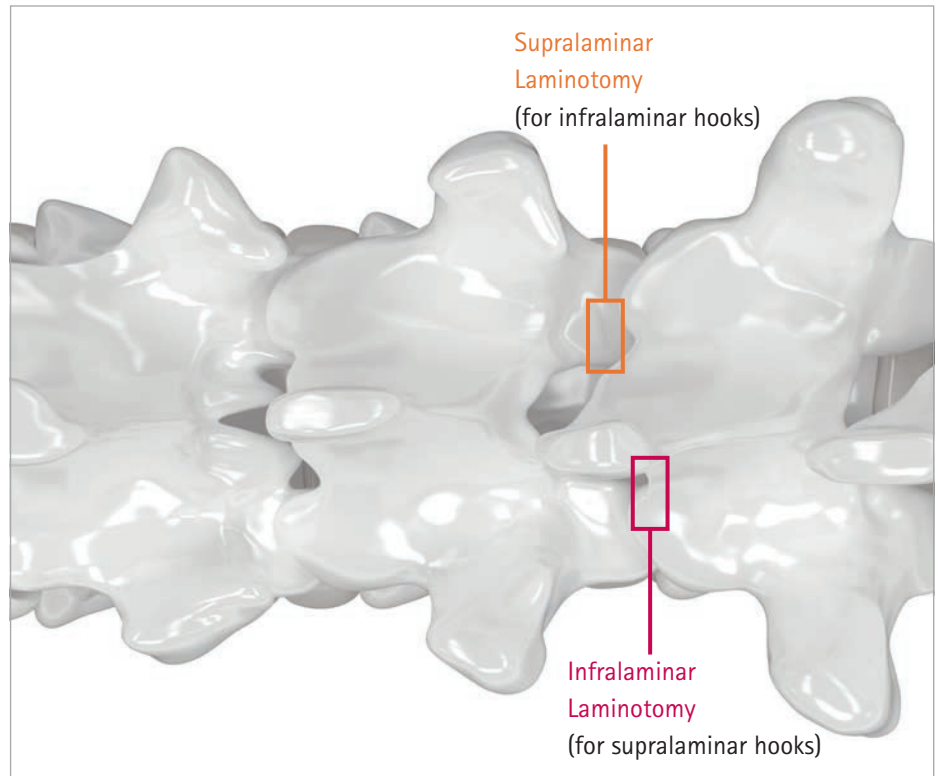


- The Pedicle Hook is inserted directly towards the inferior pedicle. Ideally the Pedicle Hook should sit in a very stable position within the residual facet joint firmly against the pedicle.
- If needed, a mallet can be used to impact the Hook Pusher to drive the Pedicle Hook.
- Once the rod has been seated final tightening of the construct can be performed. Please refer to the steps on page 45.

5 | Hook Placement

Lamina Hook

- The Lamina Hooks can be inserted in a cranial or caudal fashion anywhere within the thoracic or lumbar spine.
- In order to provide for an accurate passage of the hook blade into the central canal, Lamina Hooks are typically placed after bilateral partial removal of the ligamentum flavum and the performance of infralaminar and supralaminar laminotomies.

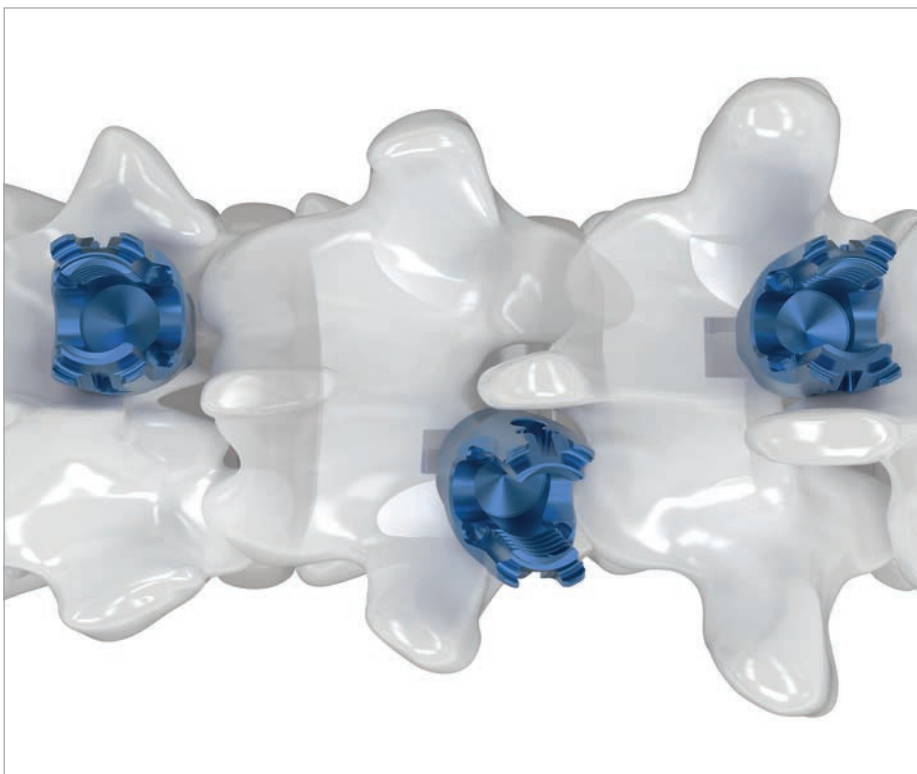


- Ensure that the space between laminar and peridural structures is adequate by using the Lamina Elevator.
- Care should be taken to ensure the body of the hook hugs the laminar surface both during and after insertion to avoid ventral encroachment of the spinal canal by the hook blade.





- Slide the Hook Holder Tube over the Lamina Hook until the interface engages to it. Visual and tactile confirmation of the connection is recommended.
- Place the Hook Pusher into the posterior part of the Lamina Hook.



- Lamina Hooks can be inserted on consecutive levels of the spine when required.
- When placing down-going angled and offset hooks, left hooks are used on the right side and vice versa. This allows the hook head to be in-line with the other fixation implants already in place.
- If needed, a mallet can be used to impact the Hook Pusher to drive the Lamina Hook.
- Once the rod has been seated final tightening of the construct can be performed. Please refer to the steps on page 47.

5 | Hook Placement

Transverse Process Hook

- The Transverse Process Hooks can be inserted in a cranial or caudal fashion typically between T1 and T10.
- Expose the cranial edge of the transverse process by separating the ligamentous attachments between the undersurface of the transverse process and the posterior arch of the rib, medial to the costotransverse joint.



- Slide the Hook Holder Tube over the Transverse Process Hook until the interface engages to it. Visual and tactile confirmation of the connection is recommended.
- Place the Hook Pusher into the posterior part of the Transverse Process Hook.





- The Transverse Process Hook is placed firmly against the superior transverse process ridge at the midpoint of the mediolateral portion of the transverse process.
- Ensure firm purchase along the superior edge of the transverse process.
- If needed, a mallet can be used to impact the Hook Pusher to drive the Transverse Process Hook.

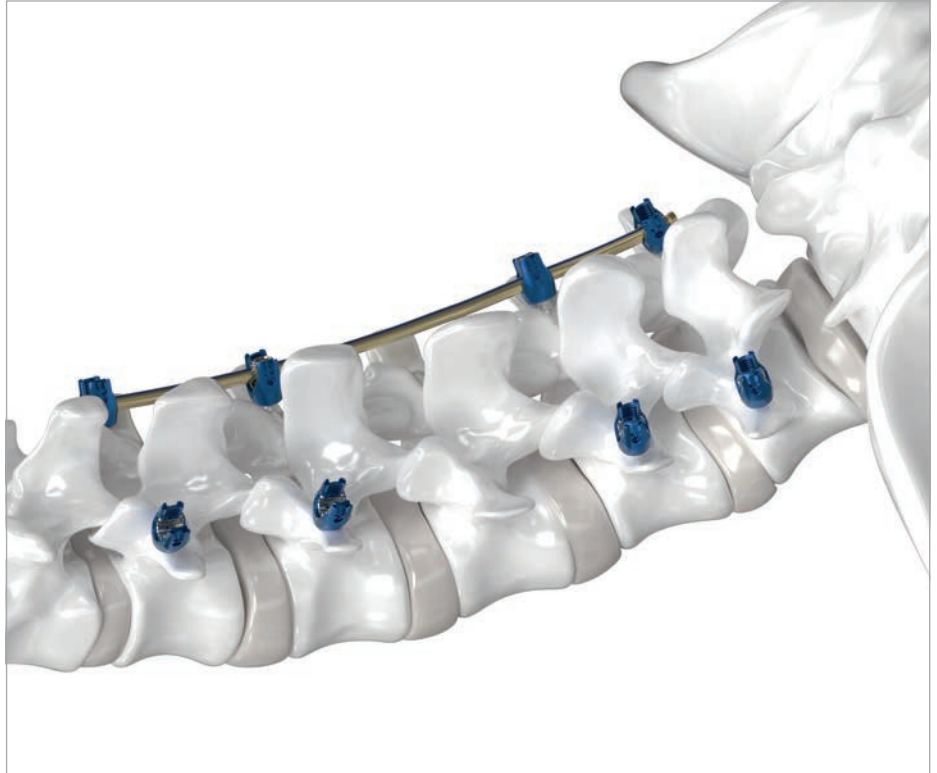


Final Tightening

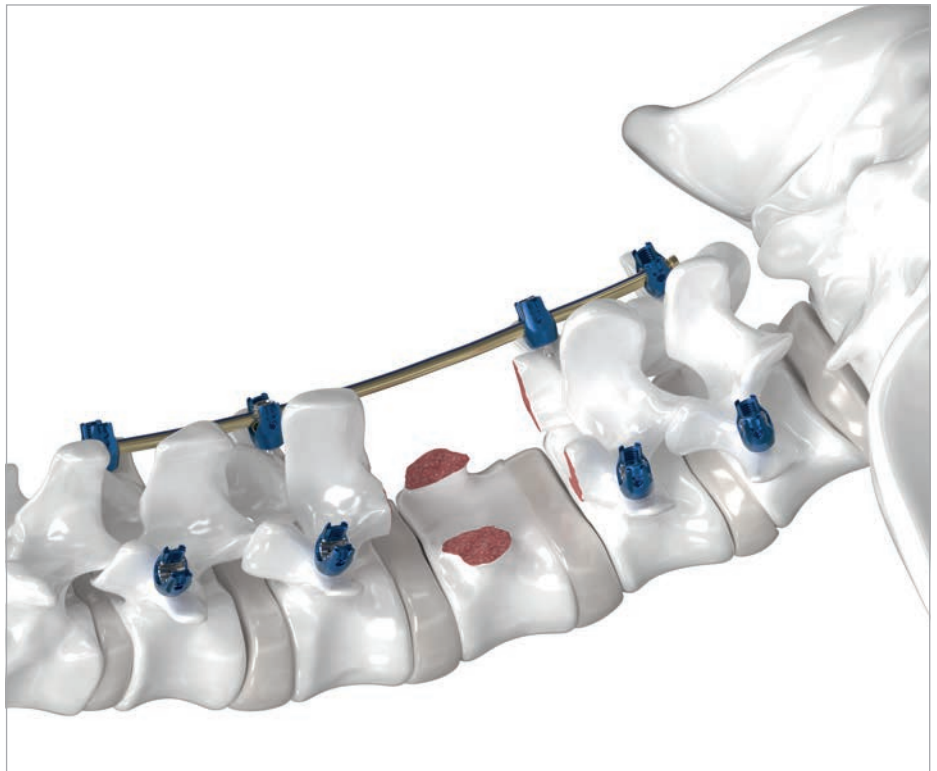
- Assemble the Torque Wrench by attaching the Torque Wrench Handle 10 Nm to the Set Screw Driver, sliding the hexagonal shaped portion of the shaft into the handle coupling until the stop.
- Load a Set Screw on the Set Screw Driver. Ensure proper fixation of the Set Screw based on its alignment with the laser marking.
- Insert the Torque Wrench through the canulation of the Counter Torque Handle so the tip is exposed. Engage the Counter Torque Handle to the hooks head.
- Turn the Torque Wrench clockwise while firmly holding the Counter Torque Handle until an acoustic signal sounds.

Preparation and Exposure

- Once exposure has been performed, it is recommended to place the instrumentation at the vertebral levels above and below the planned resection site.
- As the spine will become increasingly destabilized during the course of the procedure, it is recommended that the spinal hardware is implanted prior the beginning of the osteotomy.



- Once the preliminary exposure of the thecal sac has been achieved, foraminotomies should be performed at the vertebral levels above and below the targeted pedicles.
- Clearly expose the thecal sac, pedicles, transverse processes, and exiting nerve root. The neural elements can be mobilized using flat Nerve Root Retractors.
- The posterior elements can be removed with rongeurs, power burrs, drills or curettes.





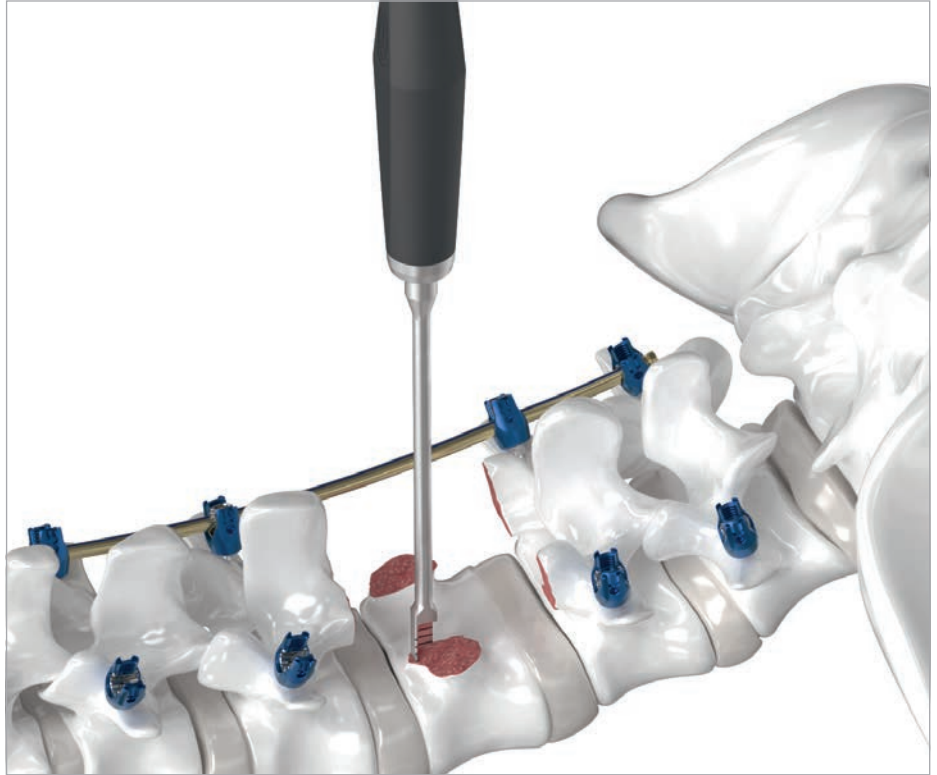
- A Vertebral Body Retractor is used to initiate a subperiosteal dissection of the vertebral body on which the osteotomy will be performed.
- The Vertebral Body Retractor is placed just caudal to the cranial disc space of that vertebral body and sweep anteriorly and lateral so the segmental vessels are swept anterior and lateral.
- The Vertebral Body Retractor is in its final position with the tip around the vertebral body at its anterior aspect. This anchors the Vertebral Body Retractor and allows good exposure of the vertebral body.
- The side button is pressed to retract the instrument to its final position.



- Once the Vertebral Body Retractor is in place, assessment for the resection is recommended.
- The Angular Templates may be used to assess the degree of bony removal needed to obtain the desired correction and to avoid under or over correction.
- Depth markings are labeled in 10 mm increments to determine the depth in the pedicle.
- The pointed end of the Angular Templates is suitable for PSO procedures, whereas the square ended portion are also designed for VCR techniques.

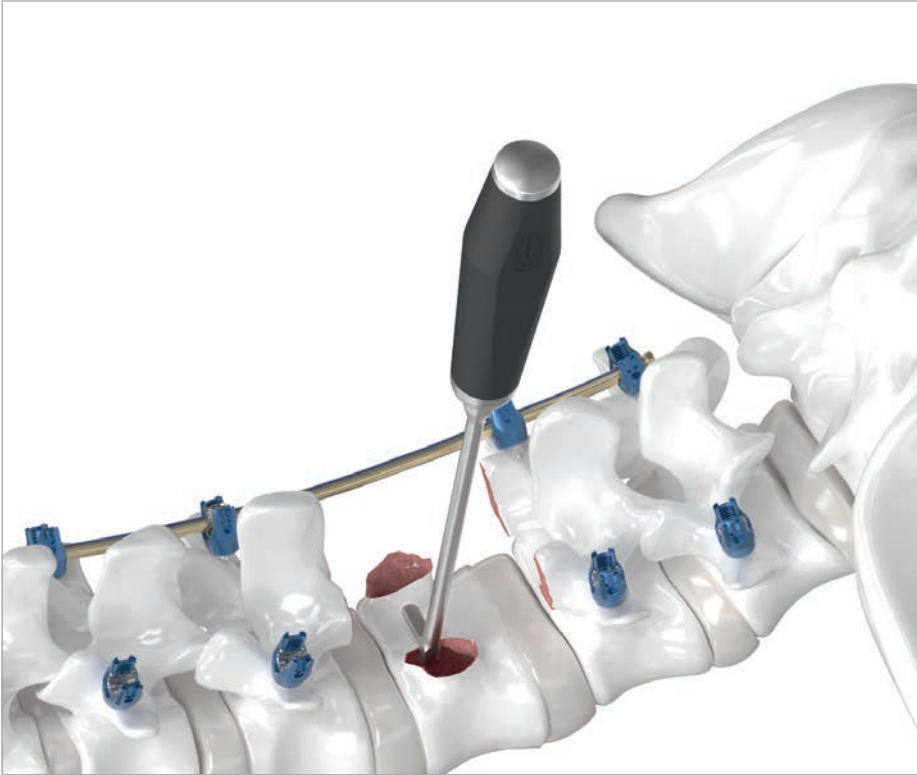
Bony Resection

- The vertebral body is resected by using L-Osteotomes. Before proceeding with the lateral wall resections, it is recommended to place at least one temporary rod, in order to prevent collapse, and/or subluxation of the surgical defect.
- The cranial aspect of the cut is made placing one edge of the L-Osteotome along the nerve root and the other edge placed along the dura. The edge of the L-Osteotome is along the lateral edge of the vertebral body.
- Using the wedge shape determined during the previous step, a single cut is made in the bone with the apex at the anterior vertebral body line. A second cut is made at the caudal edge of the planned resection.

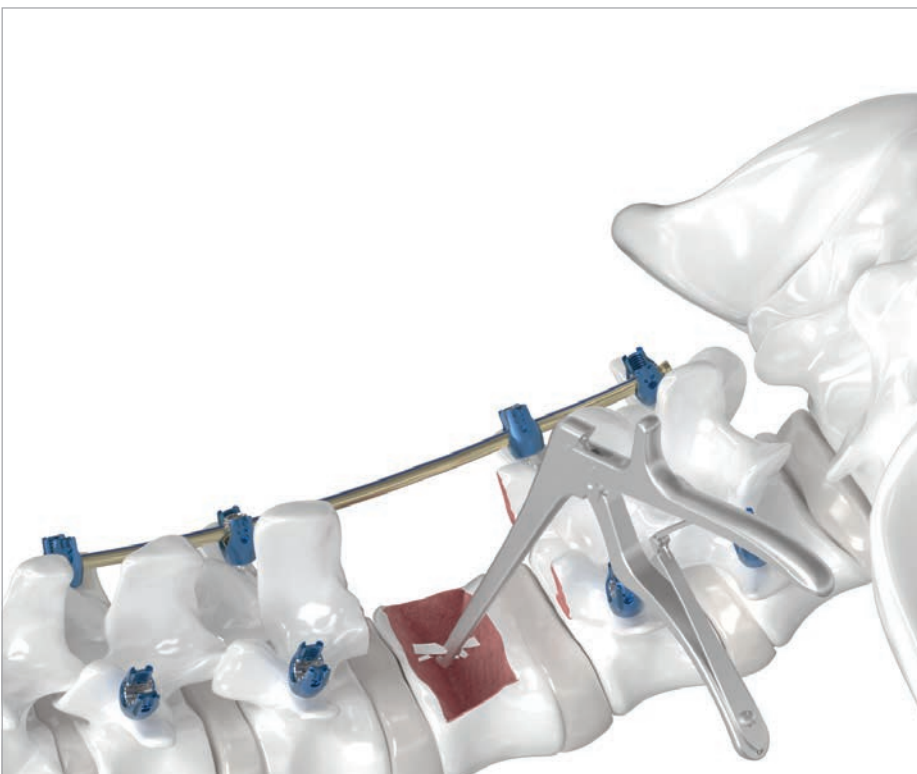


- Cancellous bone is removed using Elevators, Curettes and/or Rongeurs. Triangle Shavers may be used to assist in removing the desired wedge shape of cancellous bone by inserting and rotating through a transpedicular approach on each side.
- It is recommended to remove as much cancellous bone from the desired region as possible while leaving the cortical bone intact on the anterior wall to act as a pivot point.





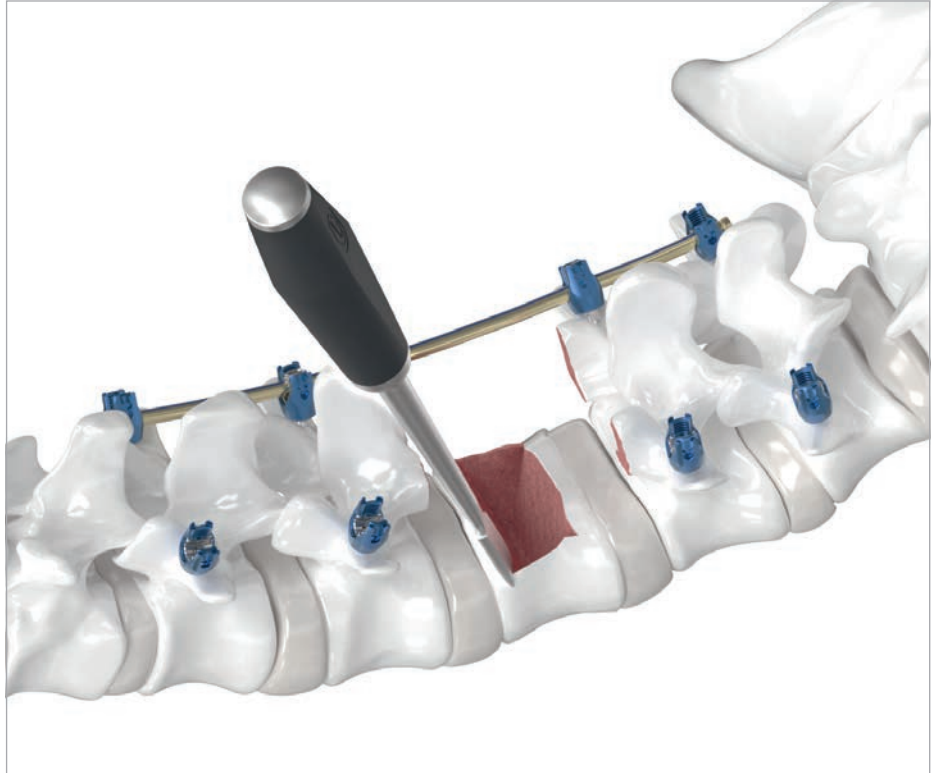
- The dura is dissected away from the posterior vertebral body wall. Once there are no adhesions, the toe of the Posterior Wall Punch is inserted between the dura and the posterior vertebral body wall.
- Care should be taken when advancing the instrument to incur the least amount, if any, dural retraction. The Posterior Wall Punch should be advanced until the tip is visible at least slightly past the contra-lateral aspect of the dura.
- Once in place, a mallet is used to strike the top of the Posterior Wall Punch and as a result the posterior vertebral body wall is fractured.
- The completeness of the resection is confirmed by palpating the ventral dura to ensure that there are no remaining bone fragments.



- Bone Punches or Rongeurs can be used to extract the posterior wall of the vertebral body. Ensure there are no bony fragments remaining this step and the following bone removal step.

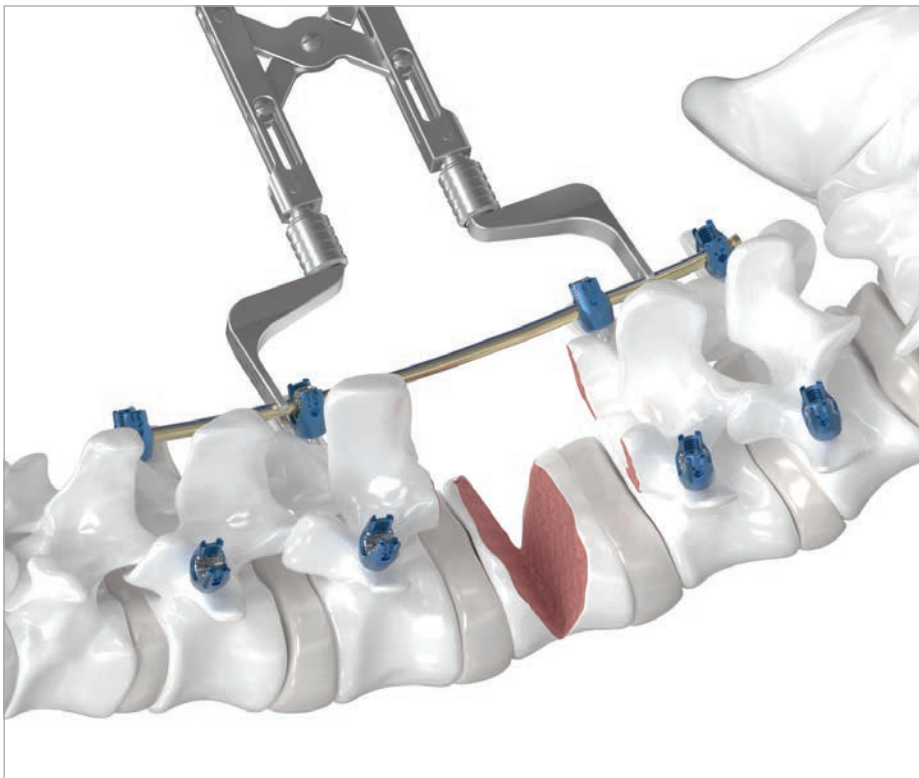
Osteotomy Closure

- If needed, Osteotomes can be utilized to remove the desired wedge of bone from the lateral aspect of the vertebral body.



- The dura, thecal sac and nerve roots are inspected to ensure that there is no compression or limited kinking. The amount of kinking and the amount of correction that are acceptable are based on the patient and surgeons judgement and experience.
- If not previously placed, a second temporary rod can be placed to help close the osteotomy. After proper contouring of the rod, insert it and insert the Set Screws.
- The bony elements should naturally relax and prior starting with the osteotomy closure.





- Carefully loosen the Set Screws, so that the weight of the abdomen provides initial closure of the osteotomy. While not required, if necessary Compressors and Distractors can be used to control the closure of the osteotomy site.
- If desired, a Distractor can be placed between the screws cranial and caudal to the osteotomy site and the Set Screws can be loosened gently. This prevents the weight of the abdomen abruptly closing the osteotomy site. A gentle closing of the osteotomy can be achieved by releasing the rack of the Distractor while holding the handles and releasing them slowly. A Compressor may be used for final closure of the defect.



- Once the closure has been completed, the temporary rods should be replaced with the rods intended for the final construct.
- The Set Screws should be final tightened and a spinal fusion should be performed, but only after ensuring that the neural elements remain free from compression by the surrounding bony and soft tissue.

Handles



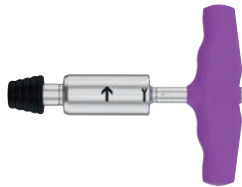
SZ222R
Ennovate® Ratchet Handle,
Straight



SZ224R
Ennovate® Ratchet Handle,
T-Shape



SZ225R
Ennovate® Ratchet Handle,
Drop Shape



SZ228R
Ennovate® Torque Wrench Handle,
10 Nm



SZ229R
Ennovate® Torque Wrench Handle,
5 Nm



SZ390R
Ennovate® Reduction/Tightening
Handle



SZ282R
Ennovate® Counter Torque Handle,
10 Nm

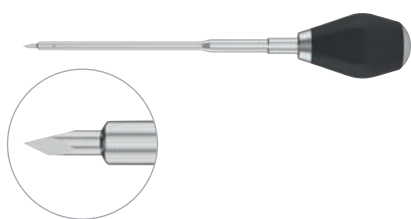


SZ292R
Ennovate® Counter Torque Handle,
5 Nm

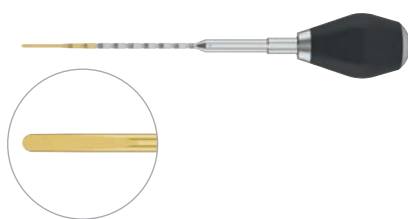


SZ335R
Ennovate® CMLX Counter Torque
Handle

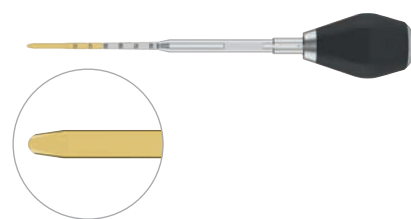
Preparation Instruments



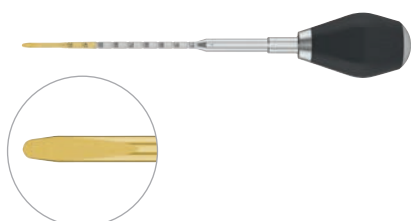
SZ241R
Ennovate® Pedicle Awl



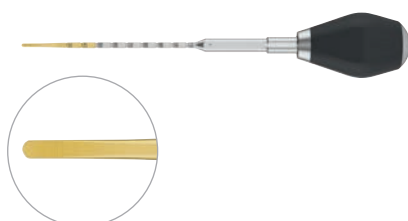
SZ242R
Ennovate® Lumbar Pedicle Probe,
Straight, Blunt tip



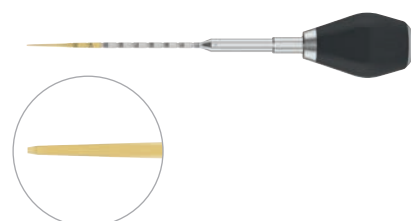
SZ376R
Ennovate® Lumbar Pedicle Probe,
Straight, Canulated



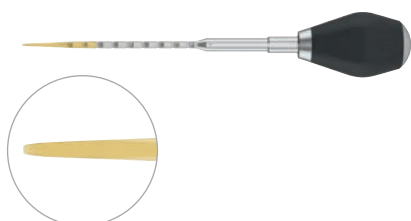
SZ263R
Ennovate® Lumbar Pedicle Probe,
Large, Straight, Blunt tip



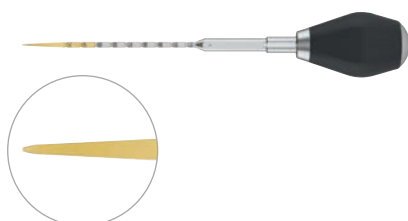
SZ243R
Ennovate® Lumbar Pedicle Probe,
Curved, Blunt tip



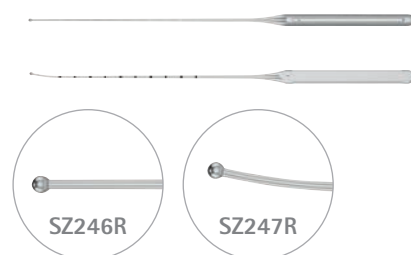
SZ244R
Ennovate® Thoracic Pedicle Probe,
Straight, Sharp tip



SZ264R
Ennovate® Thoracic Pedicle Probe,
Large, Straight, Sharp tip

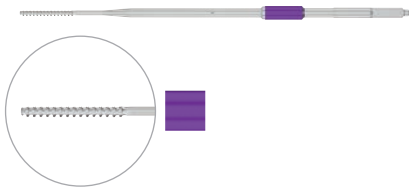


SZ245R
Ennovate® Thoracic Pedicle Probe,
Curved, Sharp tip

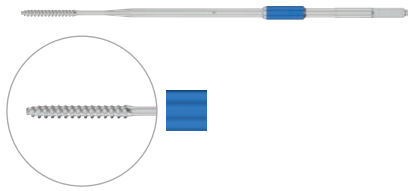


SZ246R/SZ247R
Ennovate® Pedicle Sounder,
Straight/Curved

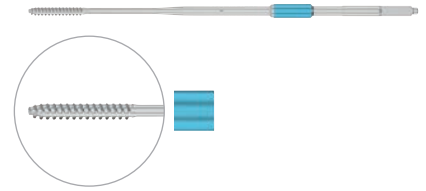
Preparation Instruments



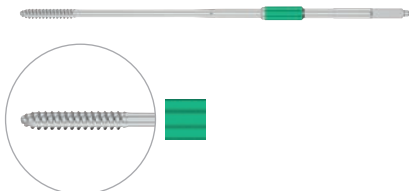
SZ254R
Ennovate® Screw Tap for Ø 4.5 mm,
Canulated



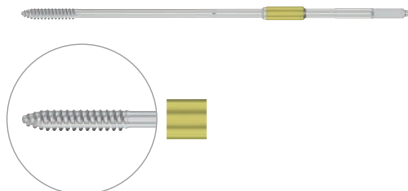
SZ255R
Ennovate® Screw Tap for Ø 5.5 mm,
Canulated



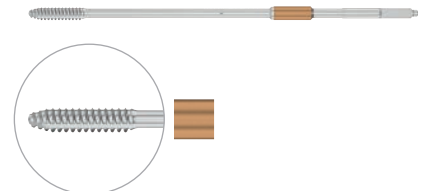
SZ256R
Ennovate® Screw Tap for Ø 6.5 mm,
Canulated



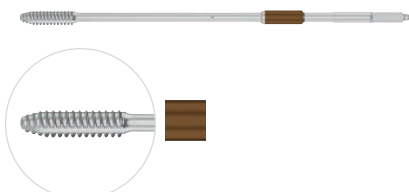
SZ257R
Ennovate® Screw Tap for Ø 7.5 mm,
Canulated



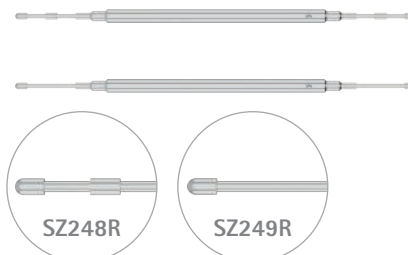
SZ258R
Ennovate® Screw Tap for Ø 8.5 mm,
Canulated



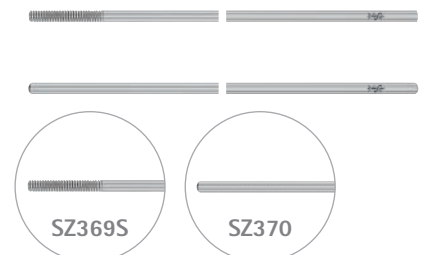
SZ259R
Ennovate® Screw Tap for Ø 9.5 mm,
Canulated



SZ260R
Ennovate® Screw Tap for Ø 10.5 mm,
Canulated



SZ248R/SZ249R
Ennovate® Pedicle Marker,
Dual Band/Single Band



SZ369S/SZ370
Ennovate® Guide Wire,
Stainless Steel/Nitinol



SZ351R
Ennovate® Pedicle Preparator



SZ352R
Ennovate® Lamina Elevator



SZ353R
Ennovate® Transverse Process
Elevator

Implantation Instruments



SZ262R
Ennovate® Screwdriver,
Canulated



SZ265R
Ennovate® Screw Head Adjuster



SZ196-SZ198
Spinal Rod Template
(120, 300 and 500 mm), re-usable*



SZ072SU-SZ074SU
Spinal Rod Template
(60, 150 and 290 mm), sterile*



SZ272R
Ennovate® Rod Holder



SZ280R
Ennovate® Set Screw Driver,
with handle



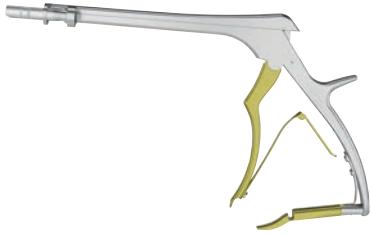
SZ391R
Ennovate® Set Screw Driver,
with coupling



SZ354R
Ennovate® CMPLX Set Screw Driver,
with handle



SZ291R
Ennovate® Connector Caliper



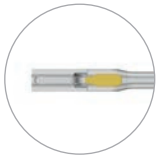
SZ290R
Ennovate® Cross Connector Holder



SZ295R
Ennovate® Rod Connector Holder



SZ297R
Ennovate® Torque Wrench Shaft,
5 Nm



SZ357R
Ennovate® Hook Holder



SZ358R
Ennovate® Hook Pusher

Reduction and Manipulation Instruments



SZ270R
Ennovate® Rod Bender



SZ332R
Ennovate® Rod Gripper



SZ333R
Ennovate® Rod Rotation Wrench



SZ342R/SZ343R
Ennovate® Sagittal Rod Bender,
Left/Right



SZ344R
Ennovate® Coronal Rod Bender,
Left



SZ345R
Ennovate® Coronal Rod Bender,
Right



SZ393R
Ennovate® PolyLock® Key



SZ273R
Ennovate® Rod Pusher



SZ275R
Ennovate® Rod Reducer, Fork Style



SZ334R
Ennovate® Quick Tube, Long



SZ359R
Ennovate® Quick Tube, Short



SZ336R
Ennovate® Derotation Tube



SZ339R
Ennovate® DT Insert Pusher



SZ340R + SZ355R
Ennovate® DT Rod Pusher +
Set Screw Driver



SZ341R
Ennovate® DT Combo Pusher



SZ328R
Ennovate® CMLX Transverse
Coupler, Size S



SZ329R
Ennovate® CMLX Transverse
Coupler, Size M



SZ338R
Ennovate® CMLX Transverse
Coupler, Size L

Reduction and Manipulation Instruments



SZ337R
Ennovate® CMLX Segmental
Coupler



SZ346R
Ennovate® CMLX Segmental
Coupler, Size S



SZ347R
Ennovate® CMLX Segmental
Coupler, Size M



SZ348R
Ennovate® CMLX Segmental
Coupler, Size L



SZ349R
Ennovate® CMLX Segmental
Coupler, Size XL



SZ350R
Ennovate® CMLX Segmental
Coupler, Size XXL

Compression and Distraction Instruments



SZ233R
Ennovate® Parallel Distractor



SZ234R
Ennovate® Parallel Compressor



SZ252R
Ennovate® Tips for Parallel
Distractor and Compressor,
Straight



SZ253R
Ennovate® Tips for Parallel
Distractor and Compressor,
Offset



FW281R
Ennovate® Distraction Forceps,
On the rod, Straight



FW184R
Ennovate® Distraction Forceps,
On the rod, Offset

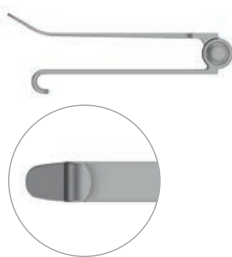


FW210R
Ennovate® Compression Forceps,
Below screw head



FW282R
Ennovate® Compression Forceps,
On the rod, Offset

Osteotomy Instruments



SZ430R

Ennovate® CMLX Vertebral Body Retractor, 15 mm



SZ431R

Ennovate® CMLX Vertebral Body Retractor, 20 mm



SZ424R

Ennovate® CMLX Angular Template, 25°



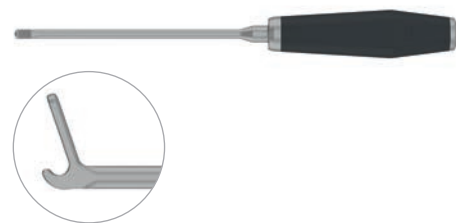
SZ425R

Ennovate® CMLX Angular Template, 30°



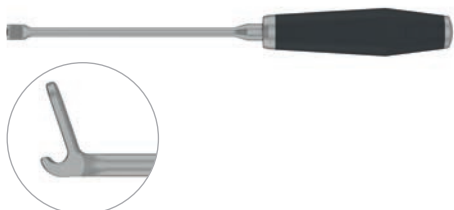
SZ426R

Ennovate® CMLX Angular Template, 35°



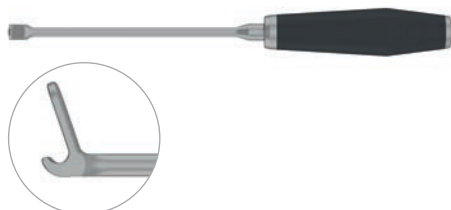
SZ451R

Ennovate® CMLX Posterior Wall Punch, 20 mm



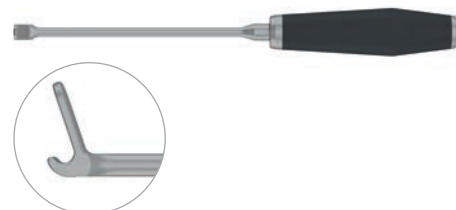
SZ452R

Ennovate® CMLX Posterior Wall Punch, 20 mm, Large tip



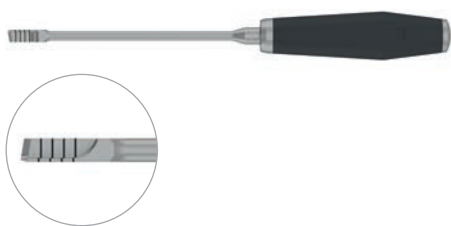
SZ453R

Ennovate® CMLX Posterior Wall Punch, 25 mm

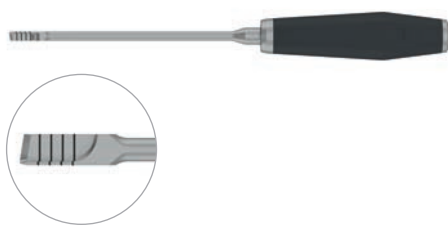


SZ454R

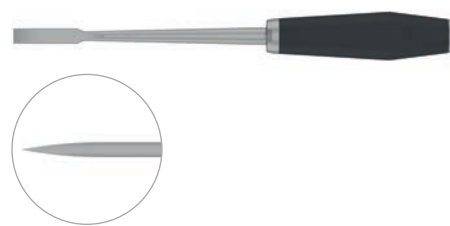
Ennovate® CMLX Posterior Wall Punch, 25 mm, Large tip



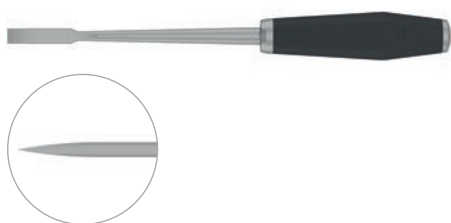
SZ433R
Ennovate® CMLX L-Osteotome,
6 mm x 8 mm



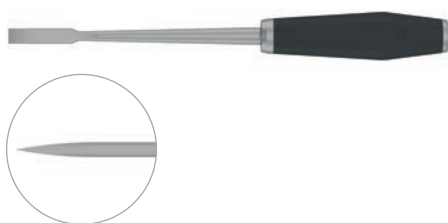
SZ434R
Ennovate® CMLX L-Osteotome,
8 mm x 6 mm



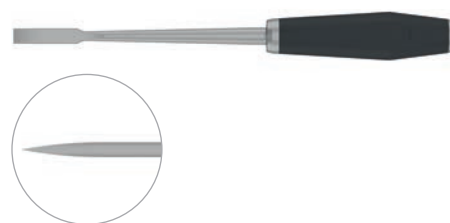
SZ435R
Ennovate® CMLX Osteotome,
Straight, 6 mm



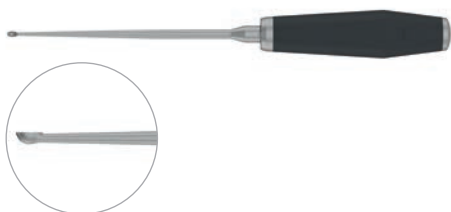
SZ436R
Ennovate® CMLX Osteotome,
Straight, 10 mm



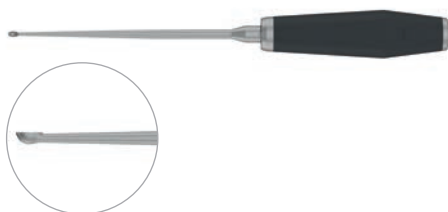
SZ437R
Ennovate® CMLX Osteotome,
Straight, 13 mm



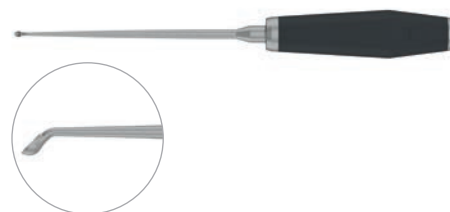
SZ438R
Ennovate® CMLX Osteotome,
Straight, 18 mm



SZ440R
Ennovate® CMLX Curette, Straight,
Small working end

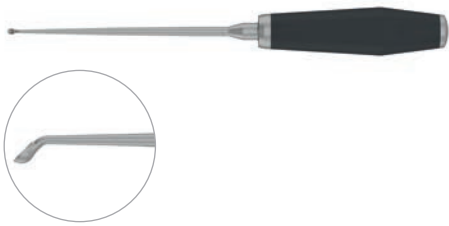


SZ441R
Ennovate® CMLX Curette, Straight,
Large working end

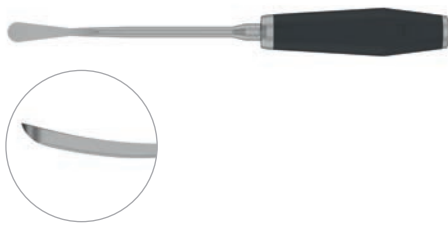


SZ442R
Ennovate® CMLX Curette, Curved,
45°, Small working end

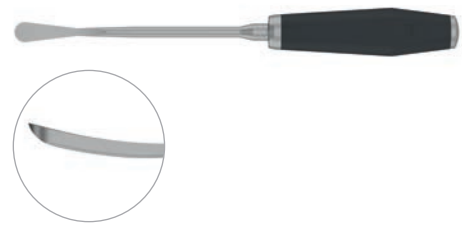
Osteotomy Instruments



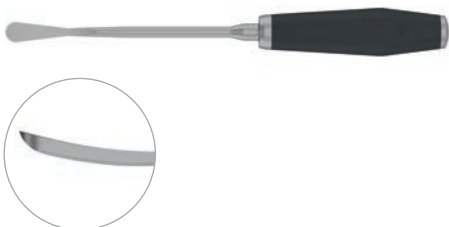
SZ443R
Ennovate® Cmplx Curette, Curved,
45°, Large working end



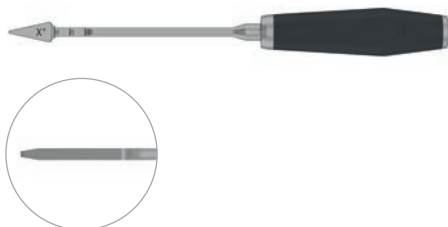
SZ447R
Ennovate® Cmplx Elevator, Curved,
6 mm



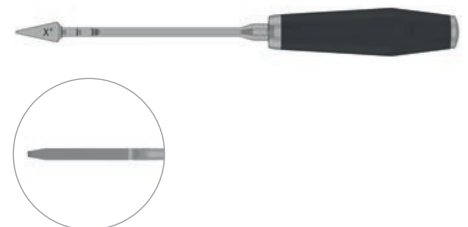
SZ448R
Ennovate® Cmplx Elevator, Curved,
10 mm



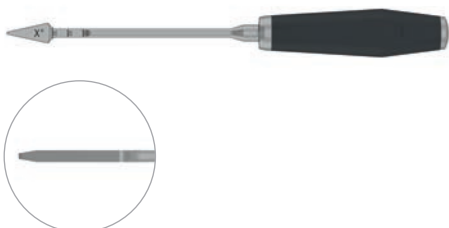
SZ449R
Ennovate® Cmplx Elevator, Curved,
13 mm



SZ444R
Ennovate® Cmplx Triangle Shaver,
25°



SZ445R
Ennovate® Cmplx Triangle Shaver,
30°



SZ446R
Ennovate® Cmplx Triangle Shaver,
35°



FJ052R
Bayonet Nerve Root Retractor,
10 mm



FJ053R/FJ054R
Bayonet Nerve Root Retractor,
12 mm/14 mm

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