B BRAUN
SHARING EXPERTISE

Ennovate® Cervical
SOLUTIONS BEYOND FUSION

SPINE SURGERY

AESCULAP® Ennovate® Cervical

POSTERIOR CERVICAL STABILIZATION SYSTEM

SURGICAL MANUAL

AESCULAP® Ennovate® Cervical

IT HAS NEVER BEEN EASIER

YOUR PASSION AND PRECISION DESERVES OUR APPRECIATION:

Ennovate® Cervical

The spinal column is one of the most important structures in the human body. We aim to protect and preserve its stability. Seeking new ways to better treat spinal disorders of our patients is what we strive for.

As a solution provider B. Braun offers durable, reliable and innovative products as well as partner services supporting safe procedures and good clinical outcomes. Our ambition to make cervical spine surgeons feel comfortable and safe using our surgical systems drove the passionate development of **Ennovate® Cervical**.

Our work in the field of spine surgery is dedicated to deliver state-of-the-art tools supporting and stabilizing the upper body, the center of the musculoskeletal system.

In continuous dialogue with surgeons B. Braun developed a comprehensive system platform enabling a highly efficient and intuitive handling of lumbar, thoracic and cervical spine surgery: Ennovate®. Ennovate® combines next generation implants and instruments with lean process workflows and provides smart solutions for the implantation of spinal implants.

With Ennovate® Cervical B. Braun provides innovative, intuitive and high-precision instruments and implants for the cervical and upper thoracic spine. Especially in complex cases we support your professionalism and expertise with state-of-the-art tools.

TABLE OF CONTENT

Together with surgeons we worked on the improvement of instruments and surgical techniques: Ennovate® Cervical offers surgeons the possibility to achieve optimal surgical outcomes in the occipital, atlantoaxial and subaxial region.

With our comprehensive spinal system we aim to offer the full range of possibilities – not only with additional navigation, but also for future-oriented technologies like the MIS approach. Smarter than the sum of its parts: The system offers dedicated occipital instruments allowing access and implantation even in difficult circumstances as well as a special C1 / C2 all-in-one instrumentation facilitating screw placement in the atlantoaxial region.

Finally, with its broad variety of connectors the Ennovate® Cervical system connects all parts forming one system platform.

Because your best surgical outcome is our aim.

NOTE

Ennovate® Cervical navigated instruments are described in the surgical technique guide 003202.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

A. POSTERIOR CERVICAL STABILIZATION

POSTERIOR CERVICAL STABILIZATION

PRE-OPERATIVE PLANNING AND EXPOSURE

PRE-OPERATIVE PLANNING

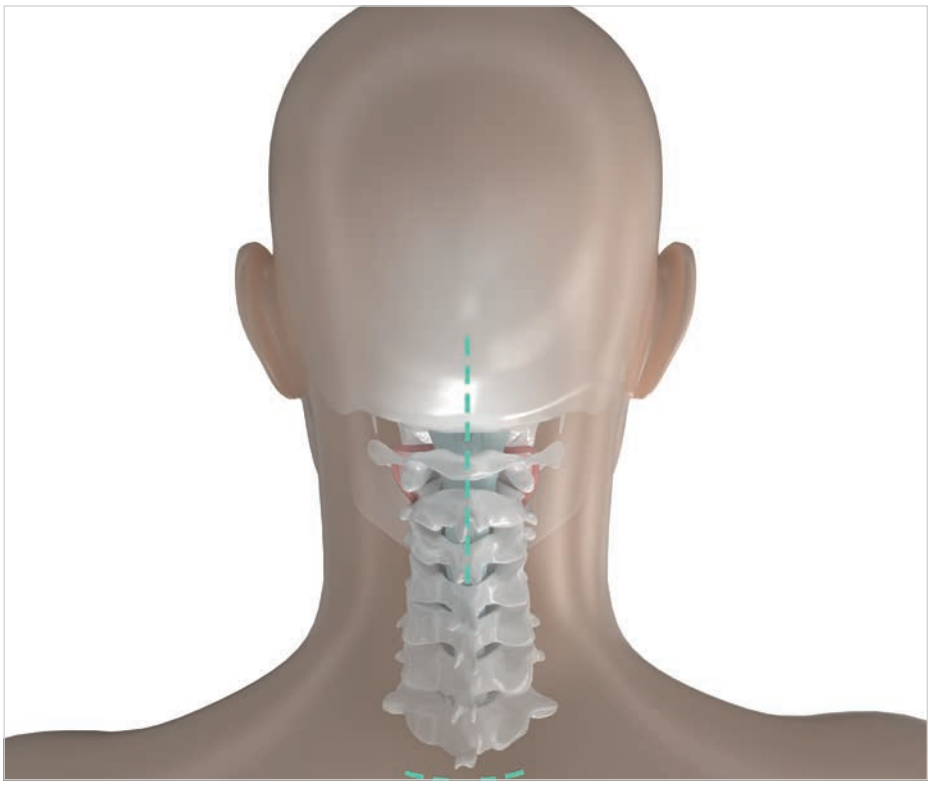
Use the appropriate imaging techniques for pre-operative planning.
The anatomical variations should be examined and the construct should be planned by identifying all system components required for the final construct.

Keep in mind that changes to the final configuration may become necessary based on intra-operative findings.

PATIENT POSITIONING

The patient is placed on the operating table in a prone position with the head supported in a holder. Whenever it is safe to do so, position the spine in physiological alignment. Accurate positioning is especially important when fixing the occiput to the cervical spine.

Confirm proper alignment using an image intensifier or radiograph prior to draping. The neck and shoulders are prepared and draped in the usual manner.



EXPOSURE

The initial incision is made in the midline and taken down through the subcutaneous tissue, to expose the area of the cervical and upper thoracic spine to be stabilized. A wide exposure is achieved extending to the lateral aspect of the facet joints in the cervical spine and the transverse processes in the thoracic spine.
Extend the Exposure to the External Occipital Protuberance (EOP) if the fusion aims to include the occiput.

INFORMATION

Care must be taken to avoid any injuries of spinal cord, nerve roots, vertebral arteries as well as interspinous ligaments and facet capsules at adjacent levels not to be fused.
This procedure should be modified according to specific surgical requirements.

POLYAXIAL SCREW FIXATION

To prepare for the polyaxial screws, remove all soft tissue and prepare the site.

OPENING THE CORTEX

The Center Punch (SZ050R) may be used to open the cortex. A raised edge is provided on the Center Punch to indicate when the ideal depth has been reached.

Alternatively, a 1 – 2 mm drill hole can be made using a small decortication burr.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
A. POSTERIOR CERVICAL STABILIZATION

DRILLING

Ennovate® Cervical offers a Variable Drill Guide (SZ054R) as standard and additionally Universal Drill Guides (SZ055R & SZ143R) designed for navigated procedures and preparation of ø 4.5 mm screws.
For better identification the Variable Drill Guide and corresponding drills are marked with a blue ring.

VARIABLE DRILL GUIDE

The Variable Drill Guide (SZ054R) can be used for the ø 3.5/3.6 mm and ø 4.0 mm screws. Select the appropriate drill and attach it to the desired Drill Handle (SZ002R or SZ003R). The positive stop of the drills are color-coded and indicate the appropriate screw diameter.

- The ø 2.3 mm Solid Drill (SZ019SU or SZ019R) is required for the ø 3.5/3.6 mm polyaxial screws (silver).
- The ø 2.8 mm Solid Drill (SZ020SU or SZ020R) is required for the ø 4.0 mm polyaxial screws (gold).

Set the desired depth to be drilled on the Variable Drill Guide by rotating the golden inner sleeve. The Variable Drill Guide offers a range of up to 40 mm in depth.
Insert the required drill into the Variable Drill Guide up to the positive stop and verify the exposed length of the drill.
Position the Variable Drill Guide at the desired entry site and advance the drill until the stop is reached.
To uncouple the Drill from the Drill Handle pull back the locking sleeve and remove the drill.

NOTE
Fixed 12 mm & 14 mm Drill Guides (SZ048R & SZ049R) are available on special request.

INFORMATION
Rotating the handle of the Universal Drill Guides is very useful to adjust the instrumentation into a more ergonomic working situation throughout all operative steps. Loosen the knob on the handle of the Universal Drill Guides and move the handle to the desired position. Once the desired position is reached, please tighten the knob (again).

UNIVERSAL DRILL GUIDE

To assemble the Universal Drill Guides (SZ055R & SZ143R) the appropriate drill guide tube is selected and attached to the drill guide body.
For quick identification the tubes are marked with a color-coded ring aaccording to screw diameter.

- The Tube for ø 3.5/3.6 mm screws has a silver ring.
- The Tube for ø 4.0 mm screws has a golden ring.
- The Tube for ø 4.5 mm screws has a green ring.

Select the appropriate drill and attach it to the desired Drill Handle (SZ002R or SZ003R) or motor system with an AO small coupling. The positive stop of the drills is color-coded and indicates the appropriate screw diameter.

- The ø 2.3 mm Solid Drill (SZ016R or SZ016SU) is required for ø 3.5/3.6 mm screws (silver)
- The ø 2.8 mm Solid Drill (SZ017R or SZ017SU) is required for ø 4.0 mm screws (gold)
- The ø 3.3 mm Solid Drill (SZ018R or SZ018SU) is required for ø 4.5 mm screws (green)

Set the depth to be drilled on the Universal Drill Guide (SZ055R) by rotating the golden inner sleeve. (up to 40 mm) When using the MIS Universal Drill Guide (SZ143R) follow the MIS surgical technique 003302.
Insert the drill into the Drill Guide up to the positive stop. Verify the exposed length of the drill. Position the Drill Guide at the desired entry site and advance the drill until the stop is reached.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

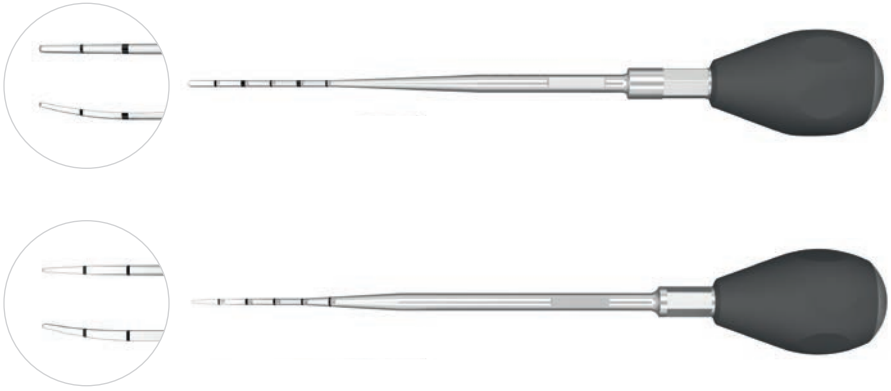
A. POSTERIOR CERVICAL STABILIZATION

BONE PROBING

As alternative to using drill guides pedicle preparation can be performed with Bone Probes.
The Bone Probes are available in blunt and sharp, straight and curved. All Bone Probes provide depth markings in 10 mm increments to indicate the advancement in the canal.

In addition to the Bone Probes with a tip diameter of 2.3 mm (SZ022R, SZ023R, FW674R, FW675R) the system also offers Bone Probes with a tip diameter of 2.8 mm for thoracic pedicle preparation (SZ024R, SZ026R, SZ027R).

Cervical Bone Probes



Thoracic Bone Probes

INFORMATION

- Cervical Bone Probes with tip diameter 2.3 mm are dedicated for ø 3.5/3.6 mm screws.
- Thoracic Bone Probes with tip diameter 2.8 mm are dedicated for ø 4.0 mm screws (marked with golden color-coding ring). Thoracic Bone Probes can also be used for preparation of ø 4.5 mm screws.

NOTE

Ennovate® Cervical offers a Thoracic Canulated Bone Probe (SZ024R) that can be assembled with an Obturator (SZ025R). The assembly can be inserted in the same manner as the solid Bone Probes. Once the desired depth is reached, the Obturator can be removed by loosening the golden knob counter-clockwise.

A K-Wire can then be inserted through the canulation of the Bone Probe. The Bone Probe can then be removed while the K-Wire remains in the pilot hole.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

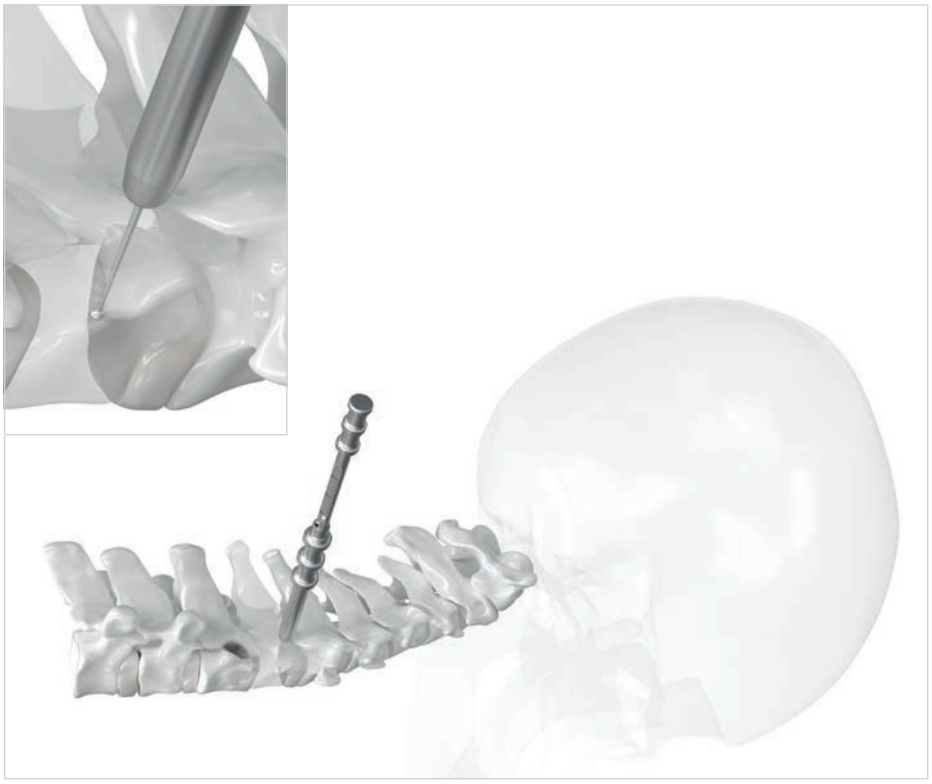
A. POSTERIOR CERVICAL STABILIZATION

DEPTH CONFIRMATION

Confirm the depth of the pilot hole and the integrity of the wall using the Sounder (SZ066R).

The Depth Gauge (FW042R) is marked in 2 mm increments and can be used to measure the desired depth of the hole by using the retractable sleeve.

The depth displayed reflects the actual screw length to be used as well as the depth of the hole, meaning that a 20 mm depth gauge reading represents not only 20 mm drill depth but also recommends selecting a 20 mm polyaxial screw.



OPTIONAL TECHNIQUE K-WIRE

Once the pilot hole is created Ennovate® Cervical offers the option to work with K-Wire guidance. Therefore, all screws are available in a canulated version.

- The K-Wire ø 1.5 mm (SZ011R or SZ011SU) may be used for ø 4.0 & ø 4.5 mm screws and is marked with a golden ring on the distal end.
- The K-Wire ø 1.0 mm (SZ010R or SZ010SU) may be used for ø 3.6 mm screws as they have a smaller canulation.

NOTE

When tapping and inserting polyaxial screws over a K-Wire make sure that the K-Wire does not advance forward.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
A. POSTERIOR CERVICAL STABILIZATION

TAPPING (OPTIONAL STEP)

Ennovate® Cervical screws are equipped with a fully threaded, tapered tip reducing the need to tap. However, Taps are provided for surgeon's preference.

The Ennovate® Cervical Taps are equipped with a self-retracting sleeve which prevents the risk of damaging surrounding tissue during tapping.

The Taps are color-coded in accordance with the appropriate screw diameter.

- The Tap for ø 3.5/3.6 mm screws (SZ051R) has a silver ring.
- The Tap for ø 4.0 mm screws (SZ052R) has a golden ring.
- The Tap for ø 4.5 mm screws (SZ053R) has a green ring.

Choose the appropriate Tap and attach the Ratchet Handle Straight by sliding the hexagonal portion of the tap shaft into the handle coupling until reaching the stop.

The Ratchet Handle can be set into forward (IN), locked (•), and reverse (OUT) position by rotating the collar of the handle. While maintaining the appropriate trajectory, manually tap the hole.

INFORMATION

The Ennovate® Cervical Taps are canulated to allow guided tapping over a K-Wire. The Taps have an integrated depth scale indicating the tapped depth.

NOTE

When tapping over a K-Wire make sure that the K-Wire does not advance forward. Verify the integrity of the pilot hole using the Sounder.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

A. POSTERIOR CERVICAL STABILIZATION

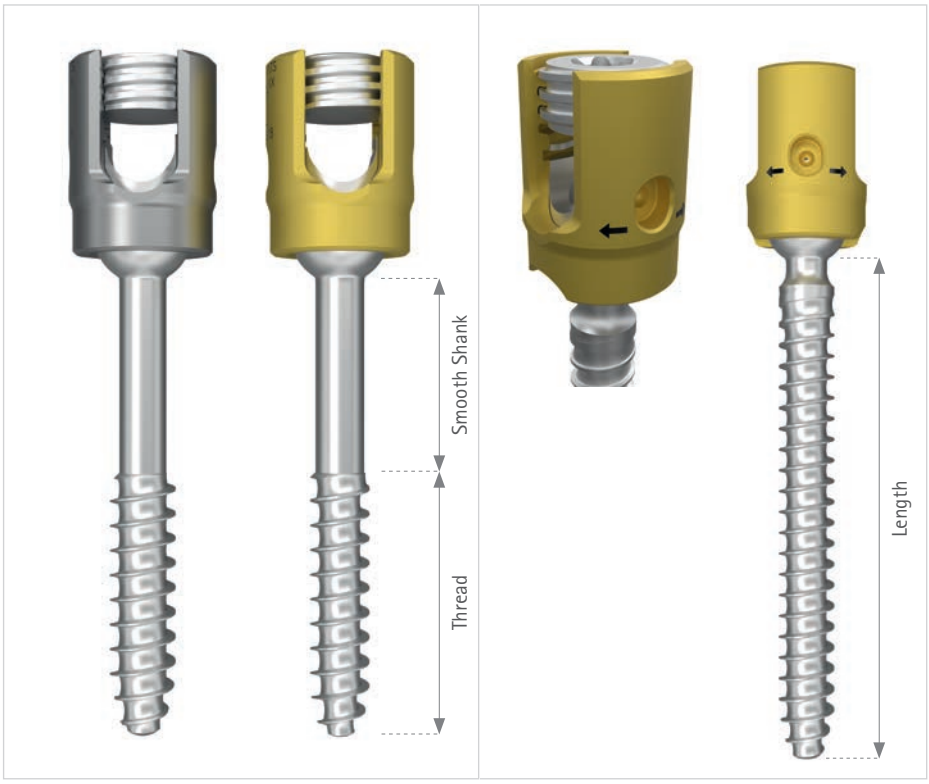
SCREW SELECTION

Ennovate® Cervical provides a wide variety of screw choices. Polyaxial screws offer a conical angulation of up to 45° in any direction. The screw length is measured from the tip of the screw to the sphere of the screw shaft (see right picture).

- ø 3.6 mm polyaxial screw
  - Length: 10–30 mm, in 2 mm increments
  - Silver screw head
  - Canulated
- ø 4.0 mm polyaxial screw
  - Length: 10–36 mm, in 2 mm increments
  - Golden screw head
  - Canulated
- ø 4.5 mm polyaxial screw
  - Length: 24–40 mm, in 2 mm increments
  - Green screw head
  - Canulated

NOTE

A selected range of solid screws ø 3.5 mm / ø 4.0 mm are available on special request.



- Smooth shank screws:
  - ø 3.6 mm canulated polyaxial screw
  - ø 4.0 mm solid polyaxial screw available on special request
  - Total length 26–40 mm
    Lengths beginning at 14 mm thread (up to 24 mm) and 12 mm smooth shank (up to 16 mm).
- ø 4.0 mm favored angle screws:
  - Length: 36–50 mm, in 2 mm increments
  - Golden screw head
  - 32° conical angulation
  - Provide additional angulation in the cephalad and caudal directions for a total of 110°.

SCREW INSERTION

With the pedicles or lateral mass prepared and the proper screw length determined, the appropriate polyaxial screws are inserted.

The Ratchet Handle (SZ001R) can be set into forward (IN), locked (•), and reverse (OUT) position by rotating the collar of the handle. To attach the Screwdriver (SZ063R) to the Ratchet Handle (SZ001R) insert the hexagonal shaped portion of the screwdriver shaft into the handle coupling until reaching the stop.

Place the tip of the Screwdriver assembly into the head of the screw. Rotate the golden knob clockwise to lock the threaded end of the Screwdriver (SZ063R) into the screw head. Proper fixation is reached when the screw shows restricted polyaxiality. Insert the screw while maintaining the appropriate trajectory.

After screw insertion rotate the golden knob counter-clockwise to release the Screwdriver.

INFORMATION

To ensure maximum polyaxiality of the screw, do not tighten the screw completely down to the bone. Leave a small gap below the head to allow rotation and angulation of the screw head.

The Ennovate® Cervical Screwdrivers are canulated to allow guided screw insertion over a K-Wire.

NOTE

When inserting screws over a K-Wire make sure that the K-Wire does not advance forward. Ensure that the K-Wire is removed after an appropriate amount of bone purchase is established.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
A. POSTERIOR CERVICAL STABILIZATION

SCREW HEAD ALIGNMENT

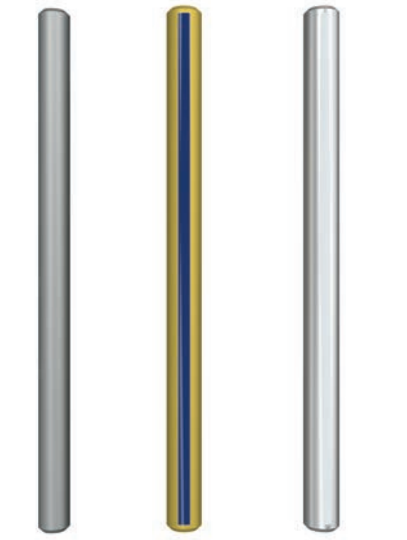
Once the screw is inserted, the position of the polyaxial head is optimized for rod insertion using the Screw Body Manipulator (SZ065R).

To facilitate rod placement, the polyaxial screw body can be rotated 360° and angled up to 45° in all directions.
The ø 4.0 mm favored angle screws provide additional angulation in the cephalad and caudal directions for a total of 110°.

In general, if the screw is inserted too far, polyaxial movement of the screw body will be impeded due to bone contact.
Do not tighten the screw completely down to the bone and leave a small gap below the head to allow rotation and angulation of the screw head.
In case the screw is inserted too deep, the screw could be turned counter-clockwise using the Ball End Screwdriver (SZ064R) until full polyaxial motion is achieved.

In the same manner, all polyaxial screws are inserted.

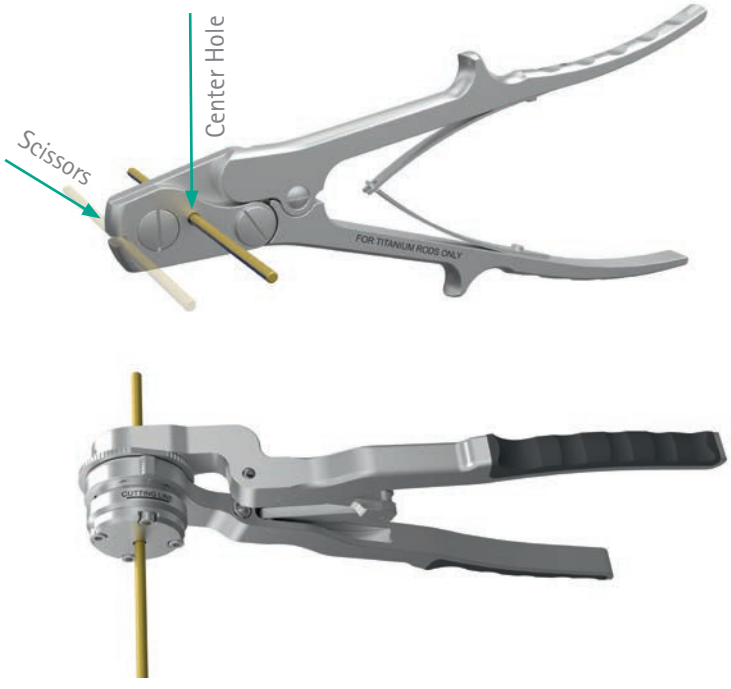
For differentiation the rods are color-coded:



3.5 mm titanium silver

4.0 mm titanium gold with blue line

4.0 mm cobalt chrome silver with white line



ROD INSERTION

ROD TEMPLATE

Rod Bending Templates can be used to aid in rod contouring or trimming to the required length. Rod Bending Templates are available in lenghts of 60 mm (SZ072SU), 150 mm (SZ073SU) and 290 mm (SZ074SU).

ROD SELECTION

Ennovate® Cervical offers multiple rod options: 3.5 mm & 4.0 mm titanium rods and 4.0 mm cobalt chrome rods for increased strength and stiffness.
Choose the appropriate rod length and material according to the construct demands and patient pathology.
All polyaxial screws are compatible with every rod diameter and material for enhanced procedural and logistical efficiency.

ROD CUTTING

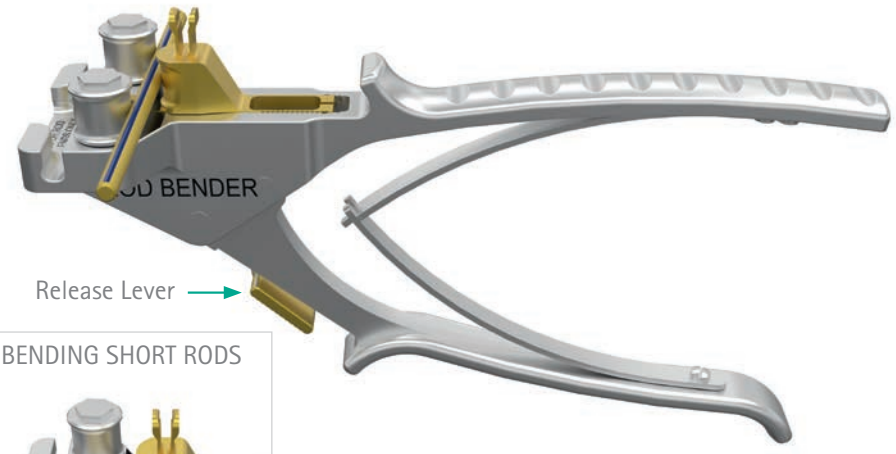
A Rod Cutter (SZ075R or SZ077R) can be used to cut the rod. In case the Rod Cutter SZ075R is used, the piece to be cut can be grasp with the Rod Holding Forceps (FW076R) to avoid projection. The rod can be either cut with the scissors part or the center hole within the Rod Cutter.
To cut cobalt chrome rods the Rod Cutter SZ077R is available. The Rod Cutter can also cut titanium rods. If the Rod Cutter SZ077R is used please make sure to cut the rod before bending the end parts of the rod so that the rod fits into the Rod Cutter.
Rotate the large knob clockwise until both lines are aligned. Slide the rod into the center hole of the Rod Cutter.
The rod will be cut at the side of the Rod Cutter marked with "cutting line". The cutting line is located ~8 mm from the face of the instrument. Repeatedly squeeze the handles until the rod is cut.

AESCULAP® Ennovate® Cervical

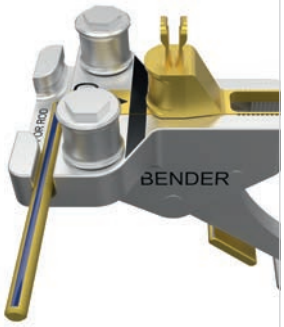
SURGICAL TECHNIQUE
A. POSTERIOR CERVICAL STABILIZATION

ROD BENDING

If rod contouring for titanium rods is needed use the Ennovate® Cervical Rod Bender (SZ076R). Insert the rod between the rollers and repeatedly squeeze the handle until the desired contouring is achieved.
As an optional bending guide, a Rod Bending Template (SZ072SU, SZ037SU & SZ074SU) can be inserted in the clamp on the distal roller for continuous visualization while bending.



BENDING SHORT RODS



BENDING

To release the rod from the Rod Bender, press the golden release lever and move the golden ratchet back to the starting position.

In case short rods need to be bent or the rod ends need to be contoured the rod can be inserted in one of the grooves in front of the rollers of the Rod Bender.

To bend cobalt chrome rods a regular Rod Bending Forceps FW024R is available. The rod bending forceps can also bend titanium rods.

INFORMATION

When using cobalt chrome rods please be aware that due to the material characteristics sharp bends (e.g. not smaller than radius 50 mm or 130°) should be avoided. If sharper bends are needed please carry out bendings in several steps while changing positions along the rod.

Alternative to the Rod Bender (SZ076R), Ennovate® Cervical offers Rod Bending Plates (FW036R) for surgeon's preference as well as In-Situ Rod Benders (SZ078R).

INFORMATION

- Always bend the Ennovate® Cervical rods in one direction only. Do not bend back the rods.
- For long Ennovate® Cervical rods, bending is carried out in several steps in order to avoid excessive or insufficient lordosis.

NOTE

Titanium is highly notch sensitive and therefore care must be taken during rod contouring to ensure that surface damage to the rod is minimal. This prevents potential fatigue failure of the implant.

When using cobalt chrome rods please be aware that due to the material characteristics sharp bends (e.g. not smaller than radius 50 mm or 130°) should be avoided. If sharper bends are needed please carry out bendings in several steps while changing positions along the rod.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

A. POSTERIOR CERVICAL STABILIZATION

ROD INSERTION

Insert the rod using the Rod Holding Forceps (FW076R).
The locking mechanism is engaged by closing the handle.
To release, squeeze the handles together so that the locking mechanism is disengaged.

SET SCREW

SET SCREW INSERTION

Load the set screw on one of the Set Screw Starters (SZ068R or SZ069R) and provisionally tighten the set screw into the polyaxial body until it contacts the rod.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

A. POSTERIOR CERVICAL STABILIZATION

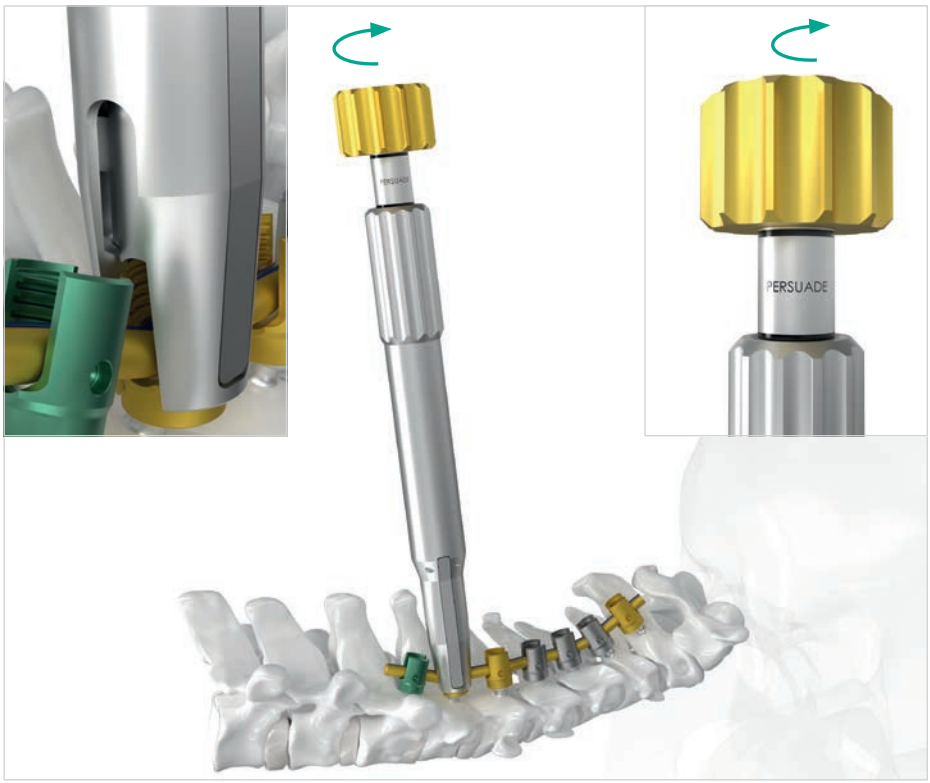
ROD PERSUASION

If required, the rod can be held down in the polyaxial screw body using the Rod Holding Forceps (FW076R) or a Rod Persuader (SZ080R, SZ081R, SZ082R).

ROD PERSUADER - IN LINE (SZ080R)

1. Pull the golden knob proximally so that the two arms at the distal end of the persuader move outwards. Then place the persuader over the head of the screw. By releasing the golden knob the two arms on the distal end of the Rod Persuader engage with the screw head.

2. Persuade the rod by turning the golden knob clockwise until the rod is fully seated in the screw head.
   While the Rod Persuader is attached, the set screw can be inserted through the Rod Persuader using the Single Ended Set Screw Starter (SZ069R).



3. To disengage the Rod Persuader turn the golden knob counter-clockwise as far as possible.
   This position is also indicated by the second laser marking.

4. To fully release the Rod Persuader pull the golden knob proximally to disengage the Rod Persuader from the screw head.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

A. POSTERIOR CERVICAL STABILIZATION

ROD PERSUADER – PISTOL STYLE (SZ082R)

Attach the Rod Persuader to the screw head by squeezing the handle. Persuade the rod by further squeezing the handle until the rod is fully seated in the screw head.

While the Rod Persuader is applied, the set screw can be inserted through the Rod Persuader using the Single Ended Set Screw Starter (SZ069R).

To disengage the Rod Persuader release the ratcheting bar so that the handle can move back to the starting position.

NOTE

Applying the Rod Persuader the set screw can only be inserted using the Single Ended Set Screw Starter (SZ069R).

ROD PERSUADER – BASIC (SZ081R)

Place the Rod Persuader over the screw head and ensure that the tip of the Rod Persuader is fully engaged below the head of the screw.

Squeeze the handle of the Rod Persuader to seat the rod into the head of the screw.

While the Rod Persuader is applied, the set screw can be inserted though the working port.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
A. POSTERIOR CERVICAL STABILIZATION

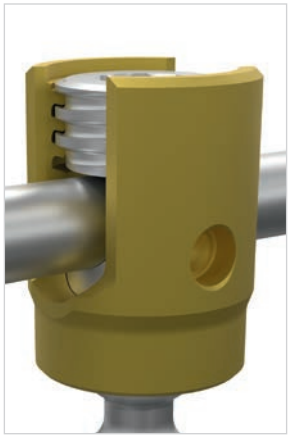
FINAL TIGHTENING

Assemble the Torque Wrench by attaching a Torque Limiting Handle (SZ005R or SZ006R) to the Set Screw Torque / Removal Shaft (SZ070R).
The Torque Wrench is used together with the Counter Torque Handle (SZ008R).
It is imperative to use the Counter Torque Handle to prevent applying the torque directly to the patient's spine, and also to ensure perpendicular placement of the Torque Handle Shaft thus simplifying correct tightening of the Set Screw.

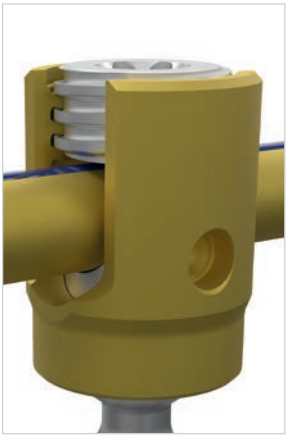
To tighten the loaded set screw to the predefined optimum torque of 2.8 N • m turn the Torque Wrench clockwise while firmly holding the Counter Torque Handle until an acoustic signal sounds.

The acoustic signal is an indicator that the final tightening of 2.8 N • m has been achieved. Visually doublecheck that the set screw is fully seated.

The final tightening to the specified torque of 2.8 N • m is the last stage of the instrumentation if none of the optional techniques, e. g. cross connector placement are used.



The set screw is located clearly below the top of polyaxial screw tulip after final tightening when using a ø 3.5 mm rod.



The set screw is located plane with the top of polyaxial screw tulip after final tightening when using a ø 4.0 mm rod.

REMOVAL

SET SCREW REMOVAL

In case set screw removal is necessary, the use of Set Screw Torque / Removal Shaft (SZ070R) with a Torque Limiting Handle (SZ005R or SZ006R) in combination with the Counter Torque Handle (SZ008R) is recommended.

SCREW REMOVAL

In case screw removal is necessary it can be performed using the Ball End Screwdriver (SZ064R).

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

B. OCCIPITAL FIXATION

OCCIPITAL FIXATION

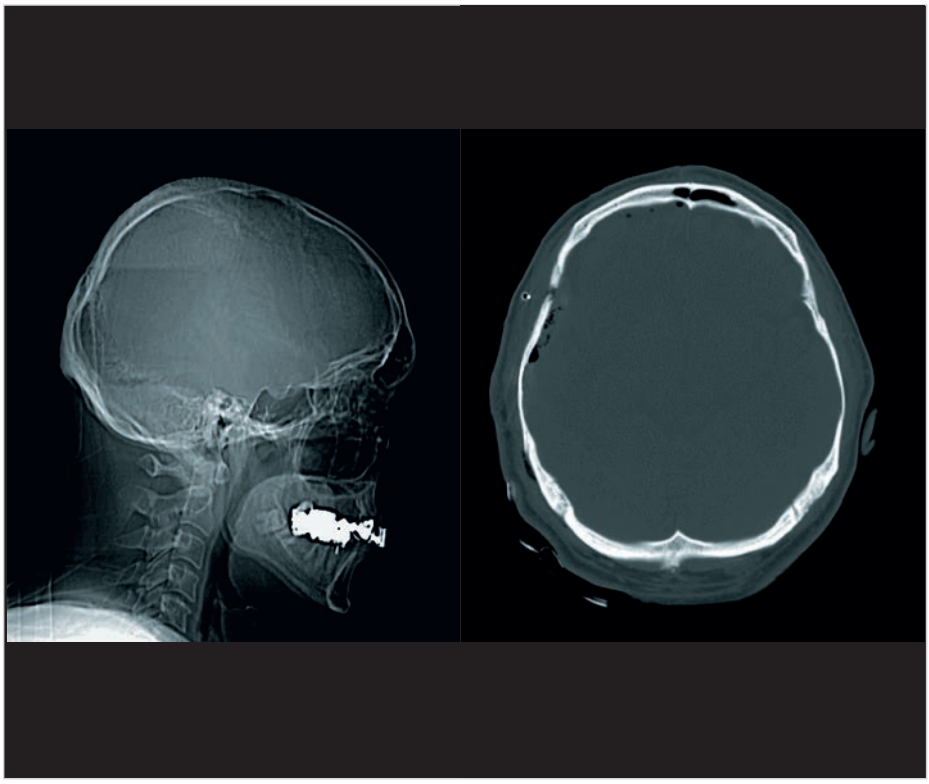
For fixing the occipitocervical region Ennovate® Cervical offers straight instruments that can be used in the majority of the cases.

However, in some cases the access to the occiput may be restricted and the occipital region cannot be accessed with straight instruments. Therefore, AESCULAP® Ennovate® Cervical offers a special Occipital Access Instrumentation (page 38).

STRAIGHT INSTRUMENTATION

PRE-OPERATIVE PLANNING

To ensure a safe procedure, it is recommended to measure the thickness of the occipital bone pre-operatively with the help of CT or other imaging possibilities.
The thickness indicates the length of occipital screws required for fixation intra-operatively.



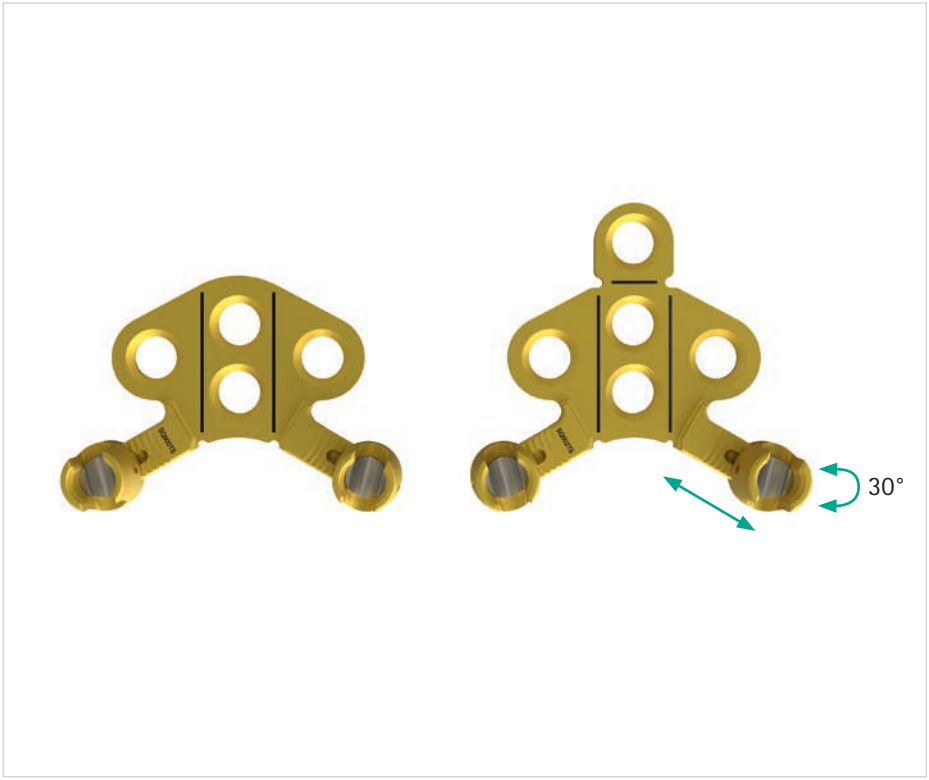


PLATE SELECTION AND CONTOURING

The Ennovate® Cervical system offers a small and a large occipital plate. The plates come in two different designs offering the choice between a 4- or a 5-hole option.

The plate size and design is chosen according to the anatomy of the respective patient.

After choosing the appropriate size the plate can be contoured up to 15° to accommodate the patient specific occipital anatomy. The laser marked lines on the occipital plate indicate where the plate can be bent using the Occipital Plate Bending Pliers (FW090R).
While bending avoid deforming the holes so that the locking mechanism stays intact.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
B. OCCIPITAL FIXATION

PLATE PLACEMENT

An Occipital Plate Holder (SZ101R) is available to facilitate placement of the occipital plate.

The occipital plate should be placed midline to the External Occipital Protuberance (EOP) and the foramen magnum.
The highest stability of the plate is achieved by midline fixation, as this is where the bone thickness is highest.

SCREW HOLE PREPARATION

After the plate design and size is determined, the screw holes can be prepared.

There are three fixed Occipital Drill / Tap Guides (SZ106R–SZ108R) available.
The two ends of the Occipital Drill / Tap Guides cover different depths (6/8, 10/12 and 14/16 mm).

Always use the corresponding Occipital Drill / Tap Guides when drilling and tapping for preparing the holes for ø 4.5 mm or ø 5.5 mm screws.

DRILLING

The desired drill depth can be determined by choosing the respective fixed Occipital Drill / Tap Guide (SZ106-108R). The guides can be clipped onto the Occipital Plate Holder (SZ101R) so that both instruments, (Occipital Plate Holder + Occipital Drill / Tap Guide) can be held with one hand.

The hole is prepared using a Drill (SZ102SU or SZ102R) and inserting it via the Occipital Drill / Tap Guide.

INFORMATION

It is recommended, that the first hole is prepared including tapping then to insert the first screw before further screws are prepared or implanted. The first screw holds the plate in place while drilling and tapping the other holes.
Even though the drill depth has been measured before surgery, proceed with care to prevent damage to the dura.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
B. OCCIPITAL FIXATION

TAPPING

The fixed Occipital Drill/Tap Guide can be left in place for tapping the pre-drilled hole.
Attach the Ratchet Handle Straight (SZ001R) to the Tap (SZ104R or SZ105R) by sliding the hexagonal portion of the Tap shaft into the handle coupling until reaching the stop.

Manually tap the hole through the Occipital Drill/Tap Guide.

Remove the Occipital Drill/Tap Guide before placing occipital screws.

SCREW INSERTION

Attach the Ratchet Handle Straight (SZ001R) to the Occipital Screwdriver (SZ111R) by sliding the hexagonal portion of the driver shaft into the handle coupling until reaching the stop. The occipital screw is inserted in the appropriate hole using the Occipital Screwdriver.

Since the bone thickness is highest at the External Occipital Protuberance (EOP) it is recommended to place the first screw in the EOP at the midline of the occiput.

Two types of screws are available:

- Gold ø 4.5 mm screws
- Blue ø 5.5 mm screws (serve as backup or rescue screws for the gold ø 4.5 mm screws)

Locking the occipital screws firmly in the plate with the Occipital Screwdriver is sufficient.
Do not overtighten the screws to prevent free spinning screws.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
B. OCCIPITAL FIXATION

When the first occipital screw is placed the Occipital Plate Holder can be removed by lifting the golden lever, which releases the instrument from the Occipital Plate.

Following the previously described steps all occipital screws are prepared and inserted.

ROD INSERTION

To connect the occipital plate to the cervical spine, pre-bent rods with ø 3.5 mm or ø 4.0 mm can be inserted into the rod receptacles.
For easier rod placement the rod receptacles allow translation and rotation.

If needed, the Rod Holding Forceps (FW076R) or the Occipital Counter Torque Wrench (SZ110R) can be used to assist the rod insertion.

SET SCREW INSERTION AND FINAL TIGHTENING

Start the set screw in the threaded portion of the rod receptacles using the Set Screw Starter (SZ069R or SZ068R).

If needed, the Occipital Counter Torque Wrench (SZ110R) or the Rod Holding Forceps (FW076R) can be used to persuade the rod and guide the set screw into the rod receptacles.

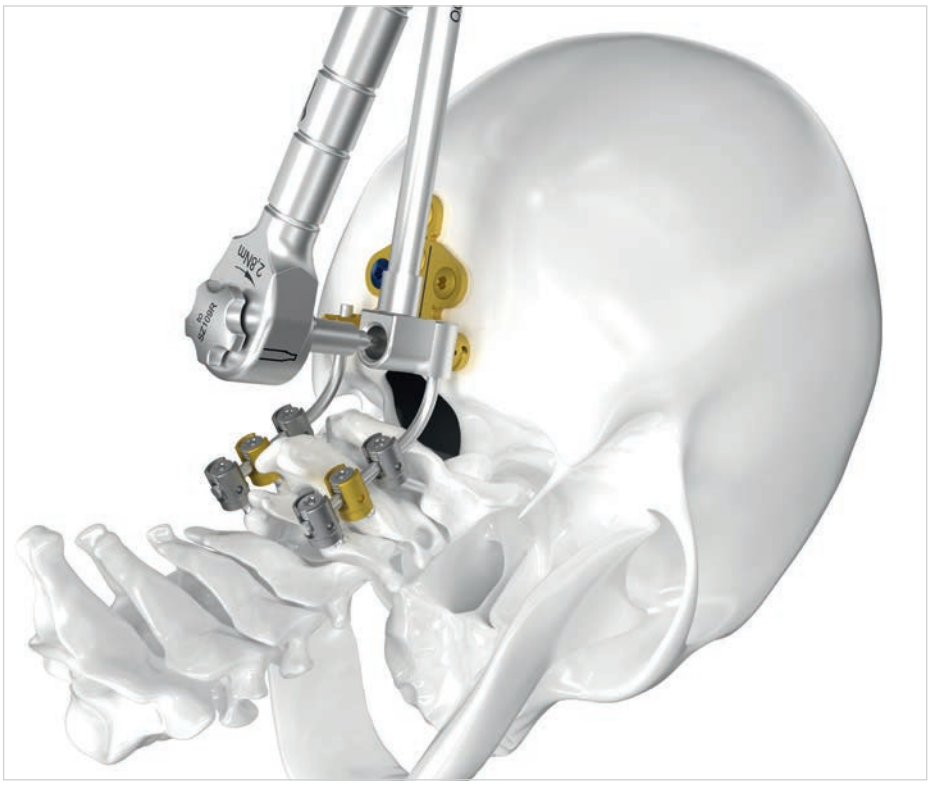
AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

B. OCCIPITAL FIXATION

Finally, the set screws are locked using the Occipital Torque Wrench (SZ109R).
The force (2.8 N • m) has to be countered with the Occipital Counter Torque Wrench (SZ110R).

Visually double check that the set screw is fully seated in the occipital rod receptacle.
The set screw is located below the top of the receptacle after final tightening when using a ø 3.5 mm rod.
The set screw is located plane with the top of the receptacle when using a ø 4 mm rod.



REVISION

In the event that an occipital screw needs to be removed, the Occipital Screw Remover (SZ112R) and the respective Occipital Screw Remover Shaft (SZ113R) are used in combination with the T-Handle (SZ004R).

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

B. OCCIPITAL FIXATION

ACCESS INSTRUMENTATION

OCCIPITAL ACCESS INSTRUMENTATION

In cases the access to the occipito-cervical region is restricted and cannot be accessed with straight instruments, e.g. in patients with a thoracic hunchback, Ennovate® Cervical offers a special Occipital Access Instrumentation. To deal with the limitations of these patients an Angled Gear Instrument (SZ116R) is available which can be used for drilling, tapping and screw insertion.
An integrated pusher allows to transfer the energy to the working end, so that the screw hole preparation and insertion runs smoothly even under difficult circumstances.

The Angled Gear Instrument is offered with a varietey of drill and tap bits (SZ120SU & SZ121SU). The depth for drilling and tapping can be adjusted from 6 to 16 mm by choosing the corresponding fixed drill Depth Stop (SZ119SU) that can be inserted over the corresponding bits.
A Screwdriver Bit (SZ123SU) allows to insert both occipital screws and set screws for the occipital rod receptacles.

The position of the pusher can be adjusted according to the available working space by releasing and retightening the golden wheel to achieve the required angulation.

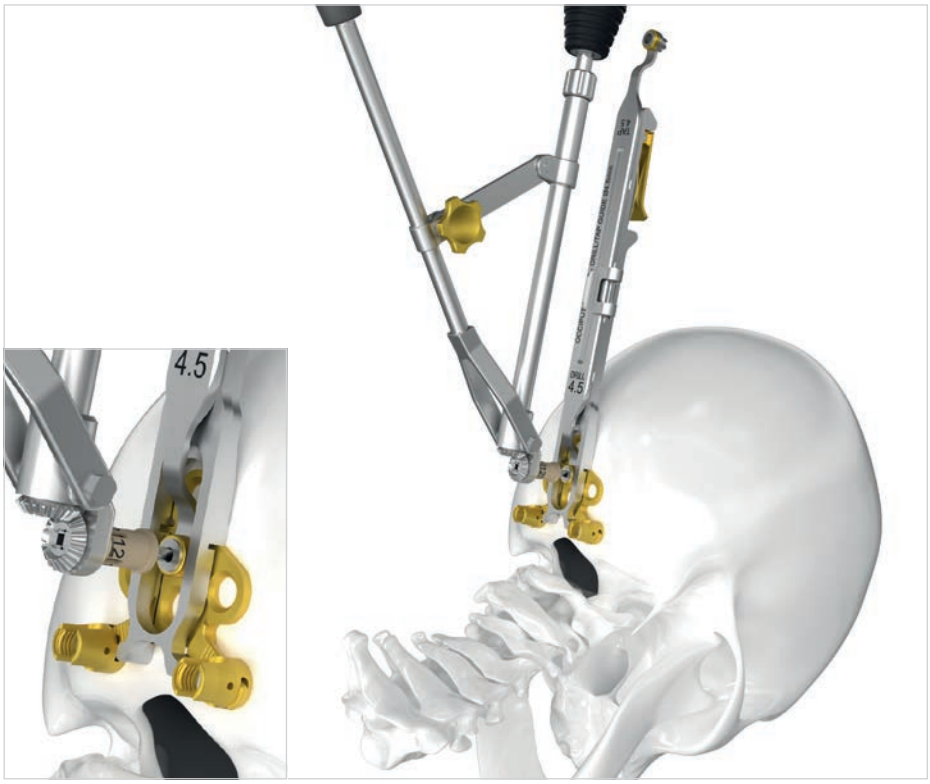
INFORMATION

It is recommended, that the first hole is prepared including tapping then to insert the first screw before further screws are prepared or implanted. The first screw holds the plate in place while drilling and tapping the other holes.
Even though the drill depth has been measured before surgery, proceed with care to prevent damage to the dura.

SCREW HOLE PREPARATION USING ACCESS INSTRUMENTS

DRILLING

Attach a handle or motor system to the Angled Gear Instrument (SZ116R) by sliding the hexagonal portion of the shaft into the handle coupling until reaching the stop.
The Drill Bit (of SZ120SU or SZ121SU) and the corresponding fixed Depth Stop (SZ119SU) is attached to the Angled Gear Instrument (SZ116R).
Two Drill/Tap Guides are available for ø 4.5 mm (SZ114R) and ø 5.5 mm screws (SZ115R).
The Drill/Tap Guides are double ended with one end for drilling and the other end for tapping.



NOTE
The Drill/Tap Guides can be clipped onto the Occipital Plate Holder (SZ101R) so that both instruments (Occipital Plate Holder + Occipital Drill/Tap Guide) can be held with one hand.

The Drill/Tap Guides have two functions.
1. *In combination with the Depth Stops the desired drilling depth is reached.*
2. *It helps guiding the drill perpendicularly to the plate.*

INFORMATION
Always use the Drill/Tap Guides when drilling.
Make sure that the corresponding end for drilling is used.
Make sure to hold the shaft of the Angled Gear Instrument parallel to the occipital plate while drilling.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
B. OCCIPITAL FIXATION

TAPPING

Before tapping disassemble the Depth Stop (SZ119SU) and Drill Bit (of SZ120SU or SZ121SU) from the Angled Gear Instrument (SZ116R) by using the provided Clamping Forceps (AN912R).
The Tap Bit (of SZ120SU or SZ121SU) and the corresponding fixed Depth Stop can then be assembled to the Angled Gear Instrument.
Attach a handle (e. g. SZ004R) to the Angled Gear Instrument by sliding the hexagonal portion of the shaft into the handle coupling until reaching the stop.

NOTE

The Drill/Tap Guides have two functions.

1. *In combination with the Depth Stops the desired tapping depth is reached.*
2. *It helps guiding the tap perpendicularly to the plate.*

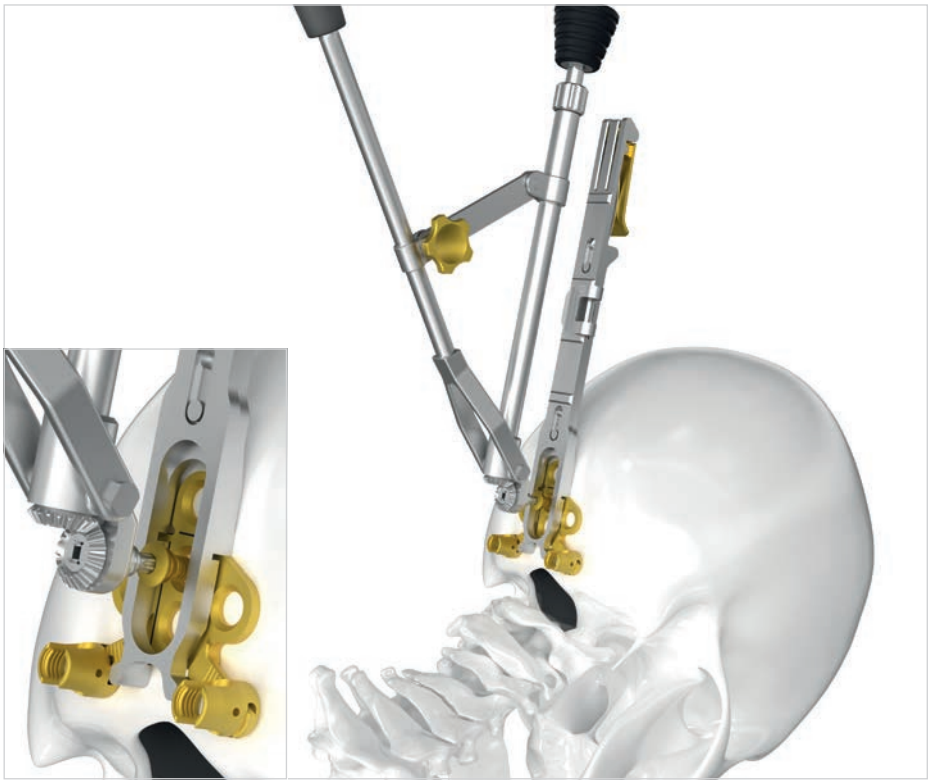
INFORMATION

Always use the Drill/Tap Guides when tapping.
Make sure to turn the Guide from the drilling end to the corresponding end for tapping.
Please make sure to hold the shaft of the Angled Gear Instrument parallel to the occipital plate while tapping.

SCREW INSERTION USING ACCESS INSTRUMENTS

Before the occipital screw can be inserted disassemble the Depth Stop (SZ119SU) and Tap Bit (of SZ120SU or SZ121SU) from the Angled Gear Instrument (SZ116R) by using the provided Clamping Forceps (AN912R). The handle (e. g SZ004R) remains attached to the Angled Gear Instrument (SZ116R).

The Screwdriver Bit (SZ123SU) and the corresponding occipital screw can then be assembled to the Angled Gear Instrument.



The occipital screw can now be inserted in the prepared hole.

Since the bone thickness is highest at the External Occipital Protuberance (EOP) it is recommended to place the first screw in the EOP at the midline of the occiput.

Two types of screws are available:

- Gold ø 4.5 mm screws
- Blue ø 5.5 mm screws (serve as backup or rescue screws for the gold ø 4.5 mm screws)

Locking the occipital screw firmly in the plate with the Angled Gear Instrument and the Screwdriver Bit is sufficient.
Do not overtighten the screws to prevent free spinning screws.

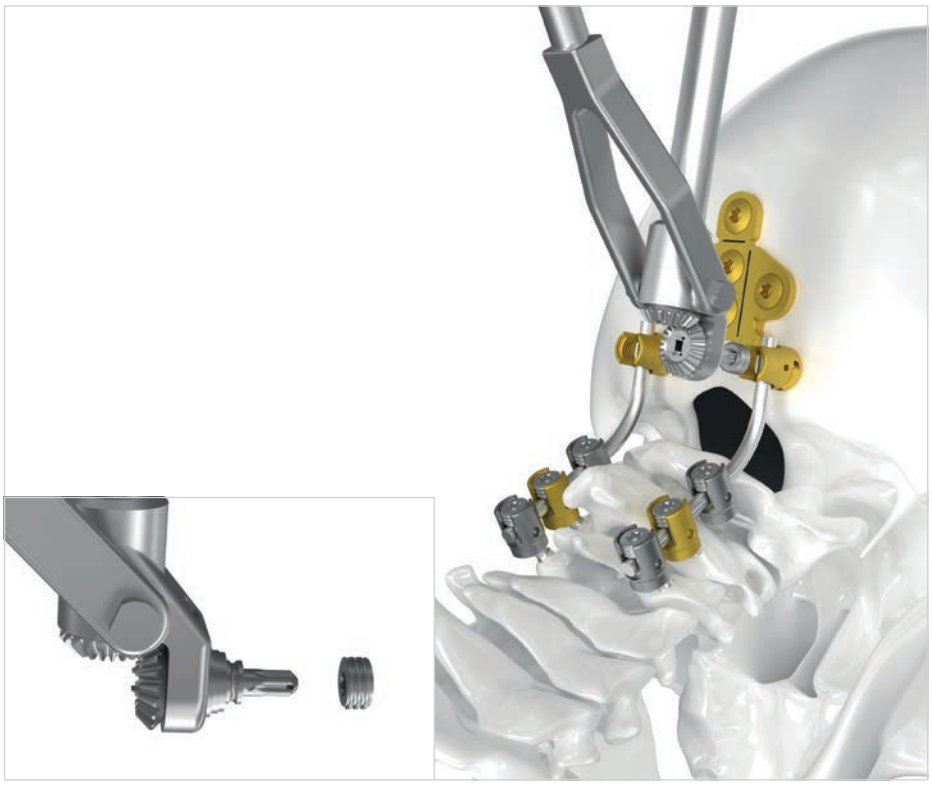
AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
B. OCCIPITAL FIXATION

SET SCREW INSERTION USING ACCESS INSTRUMENTS AND FINAL TIGHTENING

Start the set screw in the threaded portion of the rod receptacles using the Angled Gear Instrument (SZ116R) with Screwdriver Bit (SZ123SU).

If needed, the Rod Holding Forceps (FW076R) can be used to assist the rod insertion.



Finally, the set screws are locked using the Occipital Torque Wrench (SZ109R).
The force (2.8 N • m) has to be countered with the Occipital Counter Torque Wrench (SZ110R).

Visually double check that the set screw is fully seated in the occipital rod receptacle. The set screw is located below the top of the receptacle after final tightening when using a ø 3.5 mm rod.
The set screw is located plane with the top of the receptacle when using a ø 4 mm rod.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

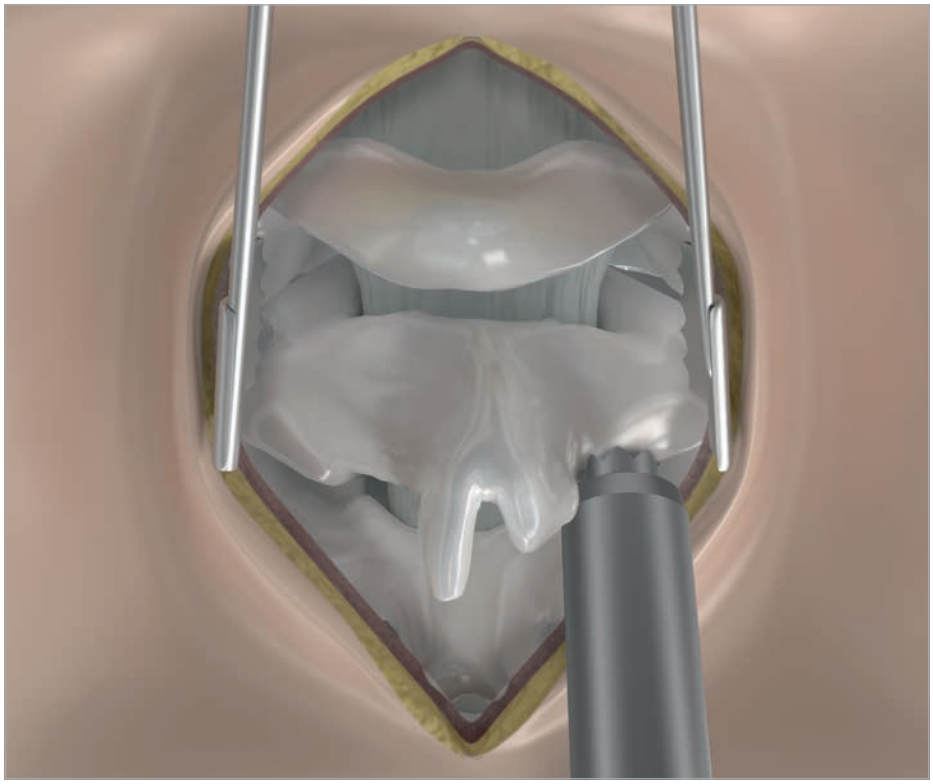
C. C1 / C2 TRANSARTICULAR STABILIZATION

C1 / C2 TRANSARTICULAR STABILIZATION

INRODUCTION

The Ennovate® Cervical C1 / C2 Instrumentation is based on the classical Magerl technique (1) for transarticular screw fixation. However, this instrumentation has been designed to reduce the size of the approach to a minimum, keeping approach related surgical trauma as insignificant as possible.
This technique involves standard exposure of the C1 / C2 area posteriorly and placement of screws bilaterally down the isthmus of C2 and across the C1 / C2 articulation to block movement and provide immediate internal fixation.

The Ennovate® Cervical All-in-One system, which is partly placed subcutaneously, not only makes the positioning of the implant more accurate and easier, but also protects the tissue while the instruments are guided safely into use.



INFORMATION

The possibility to rotate the handle of the All-in-One Guide is very useful for adjusting the instrument into a more ergonomic working situation throughout all operative steps with the All-in-One Guide.

Loosen the golden knob on the handle of the All-in-One Guide and rotate the instrument to the desired position. Once the desired position is reached, please tighten knob again.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

C. C1 / C2 TRANSARTICULAR STABILIZATION

C1 / C2 TRANSARTICULAR STABILIZATION

INSERTION OF ALL-IN-ONE GUIDE

Once the skin entrance site is determined, an approx. 1.5 cm stab incision is made through the skin, subcutaneous tissue and dorsal fascia. It can be dilated with a hemostatic forceps.

The conical tipped Obturator (SZ133R) is inserted in the All-in-One Guide (SZ131R) and locks into place once it is fully inserted.
A T-Handle (SZ004R) is available to help working the assembled instruments through the soft tissue into the surgical field. Using the T-Handle is optional and it may be attached to the Obturator by sliding the square shaft portion of the Obturator into the T-Handle coupling until reaching the stop.

Once the instrumentation is placed, its position can be adjusted due to the flexibility of the soft tissue. The aim is to place it at the precise entrance site for the screw, which is just above the inferior edge of the C2 inferior articular process.

To release the Obturator push the golden button on the All-in-One Guide so that the instrument can be removed.

NOTE
As an alternative to inserting both instruments together into the surgical field, the Obturator can also be inserted first. Once the T-Handle has been taken off, the navigated All-in-One Guide can be inserted over the Obturator.

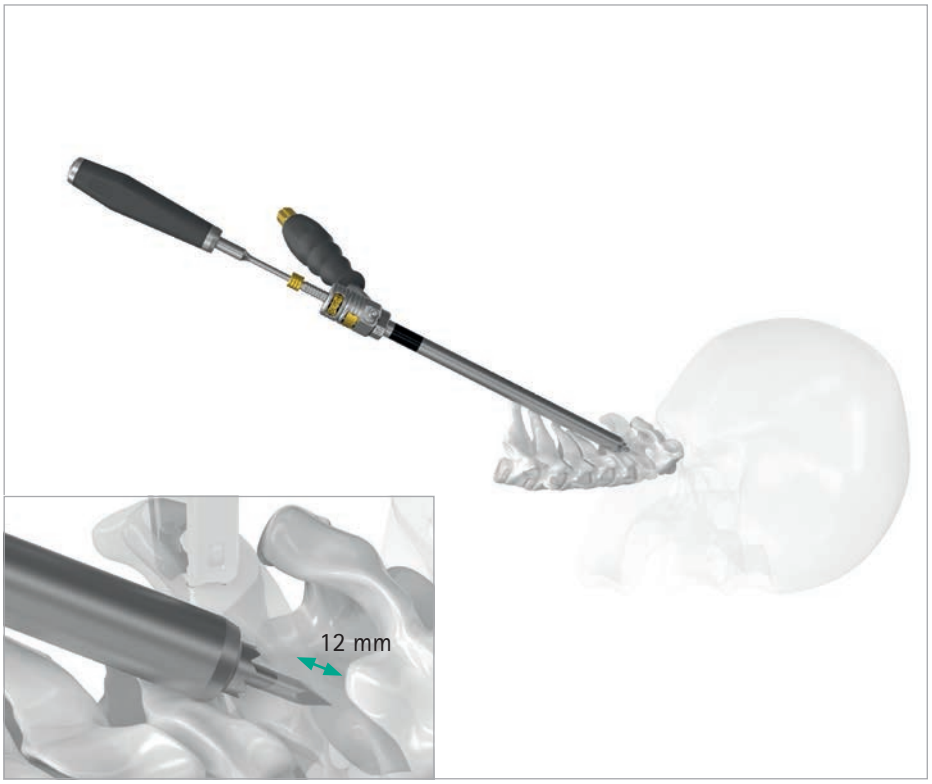
SCREW HOLE PREPARATION

OPENING THE CORTEX

After removing the Obturator (SZ133R), the Inner Drill Guide (SZ134R) can be inserted and locks automatically once it is fully seated.
Then the Cortical Punch (SZ132R) is inserted to open up the cortical bone layer.

INFORMATION

The depth stop can be set to the desired drilling depth already in this step.
The Cortical Punch has a positive stop in the Inner Drill Guide and protrudes 12 mm (independent of the depth stop).
The instrument can be removed.



AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
C. C1 / C2 TRANSARTICULAR STABILIZATION

DRILLING

To set the depth stop hold down the golden button on the Inner Drill Guide (SZ134R), slide the inner tube to the desired drilling depth and release the golden button to lock the depth stop in place.
Insert the C1/C2 ø 2.8 mm Solid Drill (SZ136SU or SZ136R) and drill the hole under fluoroscopic control through C2 into the lateral mass of C1.

INFORMATION

A special long version Sounder (FW671R) is available to be used through the long All-in-One Guide.

NOTE

A K-Wire ø 1.5 mm (SZ137SU or SZ137R) is optionally available and can be inserted after drilling to facilitate tapping and screw insertion over the K-Wire. When tapping and inserting polyaxial screws over a K-Wire make sure that the K-Wire does not advance forward.

TAPPING

Ennovate® Cervical screws are equipped with a fully threaded, tapered tip reducing the need to tap. However, Taps are provided for surgeon preference.

Attach the Ratchet Handle Straight (SZ001R) to the C1 / C2 Tap (SZ139R) by sliding the hexagonal portion of the tap shaft into the handle coupling until the stop.

Prior to tapping remove the Inner Drill Guide (SZ134R) from the All-in-One Guide (SZ131R) by pushing the golden release button.

Then insert the C1 / C2 Tap to tap the pre-drilled hole. The tap has a scale to reconfirm the depth.

The Ennovate® Cervical C1 / C2 Tap is canulated to allow guided tapping over a K-wire. When tapping over a K-wire make sure that the K-wire does not advance forward.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
C. C1 / C2 TRANSARTICULAR STABILIZATION

SCREW INSERTION

For transarticular screw fixation Ennovate® Cervical offers canulated polyaxial favored angle screws and solid bone screws.

Attach the Ratchet Handle Straight (SZ001R) to the C1 / C2 Screwdriver (SZ140R) by sliding the hexagonal portion of the screwdriver shaft into the handle coupling until reaching the stop.

POLYAXIAL SCREW

For attaching a polyaxial screw insert the tip of the C1 / C2 Screwdriver (SZ140R) into the head of the screw. Rotate the golden knob clockwise to lock the threaded end of the screw driver into the screw head.

Proper fixation is achieved as soon as the screw shows restricted polyaxicity.

With the All-in-One Guide remaining in-situ the screw can be inserted through the guide.

After screw insertion, rotate the golden knob counter-clockwise to release the screwdriver.

NOTE

When inserting polyaxial screws over a K-Wire make sure that the K-Wire does not advance forward. Ensure that the K-Wire is removed after an appropriate amount of bone purchase has been established.

BONE SCREW

For attaching a bone screw insert the tip of the C1/C2 Screwdriver (SZ140R) into the bone screw head. Then insert the Bone Screw Driver Shaft (SZ142R) through the Ratchet Handle Straight (SZ001R) into the C1/C2 Screwdriver. Turn the knob on the Bone Screw Driver Shaft to thread the shaft into the screw until it holds firmly.

With the All-in-One Guide remaining in-situ the screw can be inserted through the guide.

Once the bone screw is placed, turn the knob on the Bone Screw Driver Shaft counter-clockwise to release the shaft from the bone screw.

The procedure is then repeated on the contralateral side.

ROD INSERTION

After placing the remaining screws and/or occipital plate the rod can be inserted.

SET SCREW INSERTION AND FINAL TIGHTENING

With the rod in place the set screws can be inserted to fix the rod onto the polyaxial screws.
For set screw insertion and final tightening please follow the steps described on pages 21-26.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
D. OPTIONAL TECHNIQUES

CROSS CONNECTORS

Cross connector placement is based on specific case requirements and is recommended when additional torsional stability may be required.
A measurement is made between the two longitudinal rods at the position intended for the cross connector using the Caliper for Cross Connectors (SZ029R).

INFORMATION
Cross connectors should not be bent.

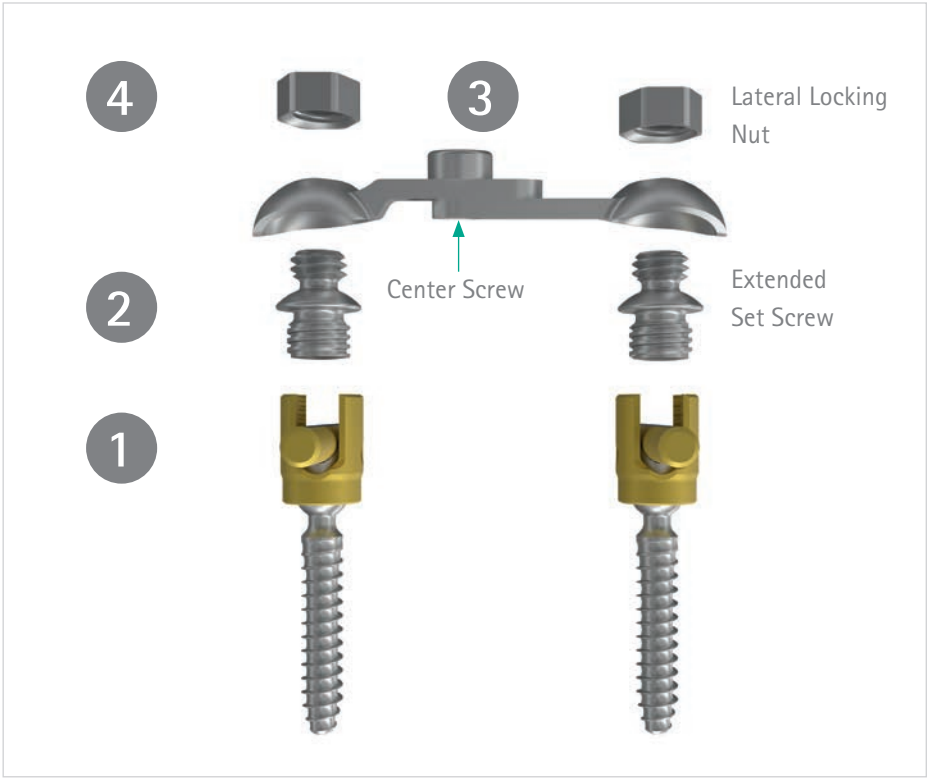
ROD-TO-ROD CROSS CONNECTORS

Once the appropriately sized connector has been determined, choose the cross connector for either ø 3.5 mm rods or ø 4.0 mm rods. For better differentiation the cross connectors for ø 4.0 mm rods are color-coded in gold and blue whereas the ø 3.5 mm have no color-coding.
Place the cross connector on the two longitudinal rods. Once placed correctly, tighten the set screws to the pre-defined torque of 2.8 N • m as for all other components (see page 26).

NOTE
Attach the Counter Torque Handle (SZ008R) next to the cross connector for final tightening.

ø 3.5 mm Rods

ø 4.0 mm Rods



HEAD-TO-HEAD CROSS CONNECTORS

In case the screw heads are in close proximity to another a head-to-head cross connector can be applied.

1. Once the appropriately sized connector has been determined the extended set screw is placed and final tightened in the screw head in the same manner as the regular set screws (see page 26) with 2.8 N • m torque.
2. Attach the cross connector over the extended set screw and then place the lateral locking nuts over the cross connector. Provisionally handtighten the components.
3. Final tighten the center screw of the cross connector in the same manner as the regular set screws (see page 26) with 2.8 N • m torque.
4. Lastly, tighten the lateral locking nuts using the Locking Driver for Head-to-Head Cross Connectors (SZ089R) and a 2.8 N • m Torque Handle (SZ005R or SZ006R) together with the Counter Torque Handle (SZ008R).

INFORMATION

Always tighten the central screw of the head-to-head connector before tightening the lateral locking nuts.

NOTE

For this step the Counter Torque Handle (SZ008R) is attached next to the cross connector for final tightening.

INFORMATION

The head-to-head cross connectors allow angulations in the following planes: 45° lateral, 5° medial, 15° caudal and 15° cranial.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
D. OPTIONAL TECHNIQUES

ROD TRANSITION OPTIONS

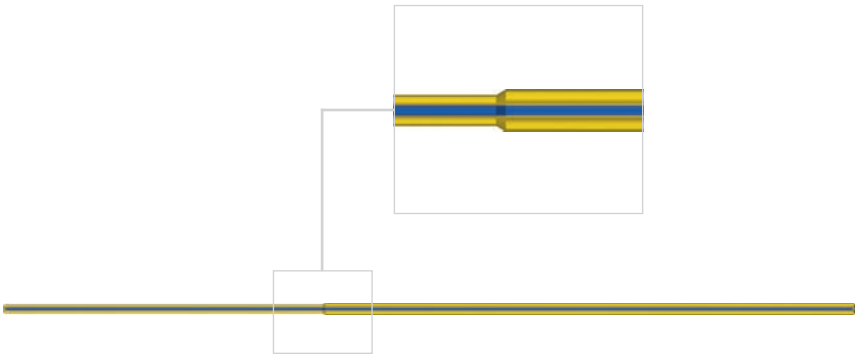
DOMINO CONNECTORS

Domino connectors allow to connect an existing spinal rod construct to a new spinal rod construct.
Ennovate® Cervical offers various rod transition options to best match the anatomical requirements.
Connector Templates (SZ030R-SZ035R) are available to help choosing the appropriate domino connector. The Handle for Connector Templates (SZ039R) can be used to support the insertion of templates.

Cervical domino connectors allow to connect two ø 3.5 mm or ø 4.0 mm rods and are color-coded in gold.
Thoracic domino connectors allow to connect a cervical ø 3.5 mm or ø 4.0 mm rod to a thoracic ø 5.5 mm rod. All thoracic rod options are colored in green.

The connectors are secured by tightening the pre-assembled set screws with the same 2.8 N • m of torque as for all other components (see page 26).

NOTE
Attach the Counter Torque Handle (SZ008R) next to the rod-to-rod connector for final tightening.



SQ009TS ø 4.0 – 5.5 mm, 400 mm, Ti-6Al-4V

DUAL DIAMETER ROD

The dual diameter rod allows the assembly of a construct that passes over the cervico-thoracic junction .
The part of the rod with ø 4.0 mm can be inserted into Ennovate® Cervical screws while the ø 5.5 mm rod part allows for connection of Ennovate® Thoracolumbar screws.

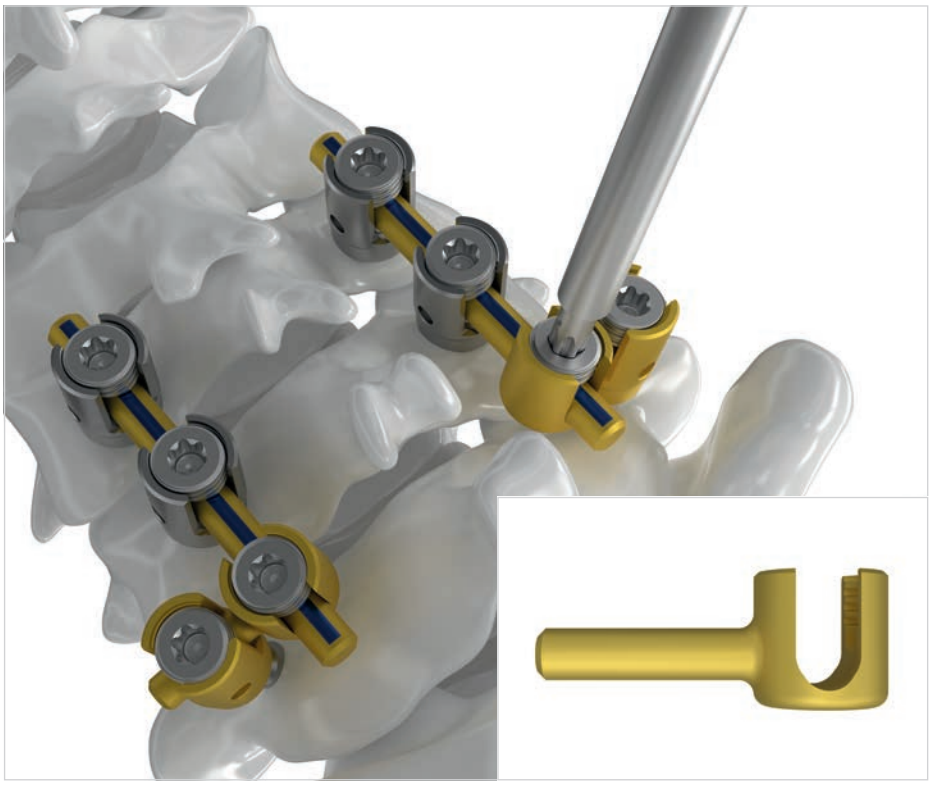
AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
D. OPTIONAL TECHNIQUES

LATERAL OFFSET CONNECTORS

LATERAL OFFSET CONNECTORS, STRAIGHT

Offset connectors can be used if a polyaxial screw or hook is placed lateral to the longitudinal axis of the rod.
The offset connector is first placed onto the rod and is then secured in the screw head using the same set screw as used for the polyaxial screw. Final tightening to 2.8 N • m of torque is the same as for all other components (see page 26).

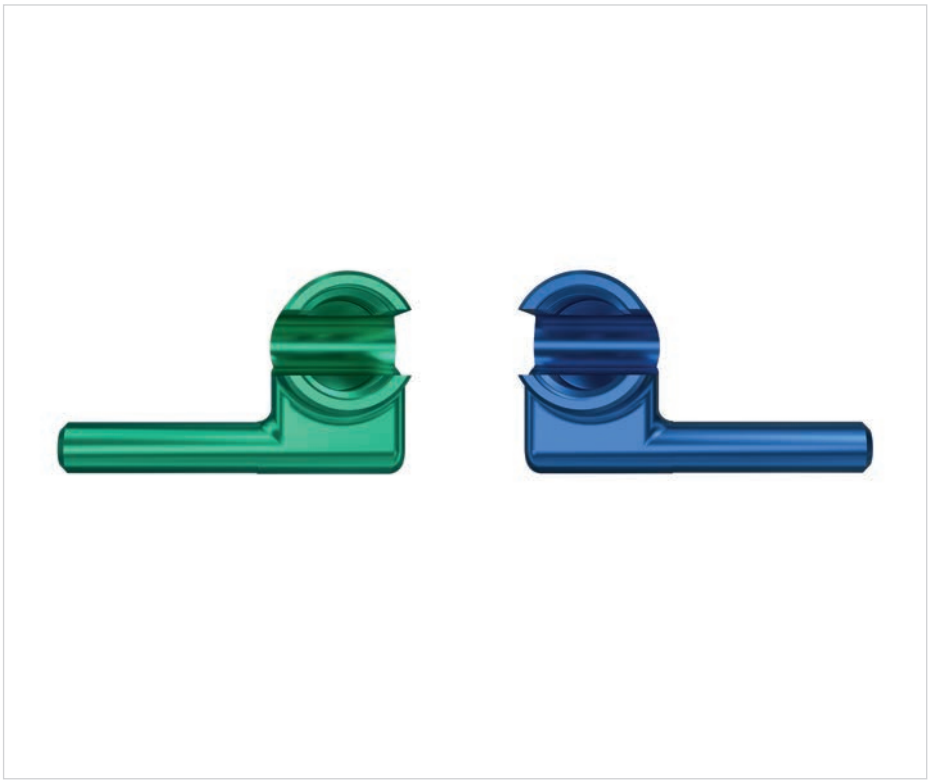


LATERAL OFFSET CONNECTORS, L-SHAPED

Lateral offset connectors L-shaped are available on special request to offer variable placement of hooks or polyaxial screws.
The lateral offset must first be placed onto the rod and then secured using the same set screw as for the hooks and polyaxial screws. Final tightening to 2.8 N • m of torque is the same as for all other components (see page 26).

NOTE
Attach the Counter Torque (SZ008R) next to the lateral offset connector, L-shaped for final tightening.

Lateral offset connectors are color-coded: blue for left, green for right. The length of the bar measures 7 mm.



COMPRESSION AND DISTRACTION

For compression or distraction Ennovate® Cervical offers the appropriate Forceps (FW427R and FW428R).
To achieve compression or distraction apply the forceps before tightening the set screws. One set screw may be tightened before starting the process in order to create an anchor point for compression / distraction.
Once the desired compression / distraction is achieved, fully tighten the (remaining) set screws (see page 26).

This technique may be useful especially for the placement of hooks in the cervical spine.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
D. OPTIONAL TECHNIQUES

LAMINAR HOOK PLACEMENT

Ennovate® Cervical offers four hook options: thick right, thick left, thin right and thin left.

The choice of the hook used depends on the thickness of the lamina. The thin throat size is 4.5 mm and the thick throat is 6.0 mm.

Before using laminar hooks prepare the lamina accordingly and dissect the ligamentum flavum. The Lamina Preparator (FW071R) or the Hook Holding Forceps (FW528R) can be used for this step.

The right or left thick or thin lamina hook is then selected and positioned on the lamina using the Hook Holding Forceps.

The process is repeated where other hooks are required as determined by the surgeon.

Once the rod is in place load the set screw on one of the Set Screw Starters (SZ069R or SZ068R). Provisionally tighten the set screw into the lamina hook until it touches the rod in the same manner as for the polyaxial screw (see page 21).

Final tightening to 2.8 N • m of torque is the same as for all other components (see page 26).

NOTE
Hooks are color-coded: blue for left, green for right.
Attach the Counter Torque Handle (SZ008R) next to the laminar hook for final tightening.

CABLE CONNECTOR

The cable connector is placed onto the ø 3.5 mm or ø 4.0 mm rod and then secured by the same set screw as for the polyaxial screw assembly (see page 21).

Final tightening to 2.8 N • m of torque is the same as for all other components (see page 26).

NOTE
Attach the Counter Torque Handle (SZ008R) next to the cable connector for final tightening.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE
D. OPTIONAL TECHNIQUES

INTRODUCTORY REMARKS

"In multilevel subaxial cervical stenosis, laminoplasty and laminectomy with fusion are the main treatment options. Several disadvantages of laminoplasty such as increasing neck pain, loss of motion and secondary cervical kyphosis have been described. This is mainly due to the approach-related muscle trauma. To decrease cervical muscle traumatization, a modified laminoplasty technique using a unilateral approach was first described by Roselli et al. (2). However, the indication for this less invasive procedure is limited to patients with lordotic cervical alignment and no or only moderate neck pain".

To overcome this limitation, Ennovate® Cervical offers a special laminoplasty plate that allows the combination of laminoplasty with unilateral lateral-mass (LM) screw fixation using the same less invasive unilateral approach.

NOTE

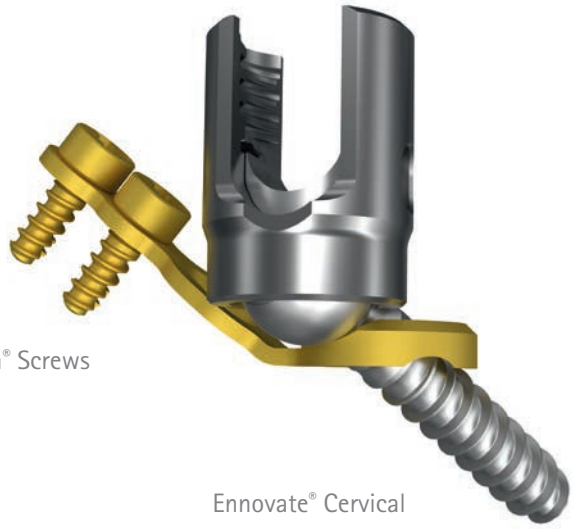
The Ennovate® Cervical laminoplasty plate can be bent to match the patient anatomy. Please refer to the surgical technique 047602 page 9 for additional information on plate bending, holding and insertion.

LAMINOPLASTY PLATE

SURGICAL TECHNIQUE

A unilateral subaxial approach with detachment of muscles on one side is performed based on the surgical approach described by Kothe et al. (3).
After exposure of the laminae and lateral mass from C3-C6 pilot holes are created in each lateral mass as described on pages 4-12.
The contralateral side (hinge side) of each lamina is fractured at its laminofacet junction. This can be done by an elevation of the (opening-side) lamina.
The opening of the laminae is stabilized with Ennovate® and SecureSpan® implants. The Ennovate® Cervical laminoplasty plate is designed to adapt ø 3.5 mm Ennovate® Cervical screws in the lateral hole and SecureSpan® screws in the medial holes. The laminoplasty plate is placed and fixed to the lamina with a polyaxial lateral mass screw.

Ennovate® Cervical laminoplasty plate



SecureSpan® Screws

Ennovate® Cervical polyaxial 3.5 mm screw

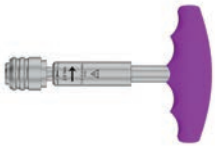
For the insertion of the screws, please refer to pages 14-15. Ensure that the body of the lateral mass screw directly contacts the caudal border of the laminoplasty plate hole. This firmly fixes the laminoplasty plate to the lamina.
Always place the Ennovate® Cervical lateral mass screw before placing screws on the lamina. To fix the plate on the lamina, please use the AESCULAP® SecureSpan® screws and follow the hole preparation & screw insertions described in 047602 page 12 - 13. Once all screws are placed double check that the plate is firmly attached to the bone. The unilateral instrumentation is completed with the insertion and fixation of the rod as described on page 16-26.

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – BASIC

	Article No.	Description
	**SZ001R**	Ennovate® Cervical Ratchet Handle Straight
	**SZ002R**	Ennovate® Cervical Drill Handle Tear Drop Style
	**SZ003R**	Ennovate® Cervical Drill Handle Palm Style
	**SZ005R**	Ennovate® Cervical Torque Limiting T-Handle
	**SZ006R**	Ennovate® Cervical Torque Limiting Handle Straight
	**SZ008R**	Ennovate® Cervical Counter Torque Handle
	SZ016SU/R	Ennovate® Cervical ø 2.3 mm Solid Drill for Universal Drill Guide

	Article No.	Description
	SZ017SU/R	Ennovate® Cervical ø 2.8 mm Solid Drill for Universal Drill Guide
	SZ019SU/R	Ennovate® Cervical ø 2.3 mm Solid Drill for Variable/Fixed Drill Guide
	SZ020SU/R	Ennovate® Cervical ø 2.8 mm Solid Drill for Variable/Fixed Drill Guide
	**SZ050R**	Ennovate® Cervical Center Punch
	**SZ048R**	Ennovate® Cervical Fixed Drill Guide, 12 mm
	**SZ049R**	Ennovate® Cervical Fixed Drill Guide, 14 mm
	**SZ054R**	Ennovate® Cervical Variable Drill Guide for ø 3.5/3.6 and 4.0 mm Screws

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – BASIC

	Article No.	Description
	**SZ055R**	Ennovate® Cervical Universal Drill Guide OPEN/NAV (incl. 3.5/3.6 & 4.0 mm Tube)
	**SZ143R**	Ennovate® Cervical MIS Universal Drill Guide (incl. 3.5/3.6 & 4.0 mm Tube)
	SZ058R	Ennovate® Cervical Tube 4.5 mm for Universal Drill Guide
	**SZ063R**	Ennovate® Cervical Screwdriver
	**SZ064R**	Ennovate® Cervical Ball End Screwdriver
	**SZ065R**	Ennovate® Cervical Screw Body Manipulator
	**SZ066R**	Ennovate® Cervical Sounder

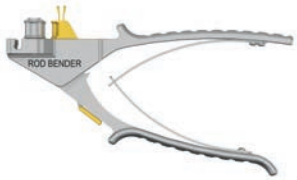
	Article No.	Description
	SZ068R	Ennovate® Cervical Set Screw Starter Double-Ended
	**SZ069R**	Ennovate® Cervical Set Screw Starter Single-Ended
	**SZ070R**	Ennovate® Cervical Set Screw Torque/Removal Shaft
	**FW076R**	Ennovate® Cervical/S$^{4®}$ Cervical Rod Holding Forceps
	SZ073SU	Ennovate® Cervical Rod Bending Template 150 mm
	**SZ075R**	Ennovate® Cervical Rod Cutter
	**SZ077R**	Ennovate® Cervical Rod Cutter CoCr

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – BASIC

	Article No.	Description
	**SZ076R**	Ennovate® Cervical Rod Bender
	**FW024R**	Spinal Rod Bending Forceps
	**SZ080R**	Ennovate® Cervical Rod Persuader In-Line
	SZ010SU/R	Ennovate® Cervical K-Wire ø 1.0 mm for ø 3.6 mm Screws (2 pcs)
	SZ011SU/R	Ennovate® Cervical K-Wire ø 1.5 mm for ø 4.0 and ø 4.5 mm Screws (2 pcs)
	**FW042R**	Ennovate® Cervical/S4® Cervical Pedicle Depth Gauge
	**SZ022R**	Ennovate® Cervical Bone Probe Blunt Straight

	Article No.	Description
	**SZ023R**	Ennovate® Cervical Bone Probe Blunt Curved
	**SZ024R**	Ennovate® Cervical Bone Probe Thoracic Straight Canulated
	**SZ025R**	Ennovate® Cervical Obturator for Bone Probe SZ024R
	**SZ026R**	Ennovate® Cervical Bone Probe Thoracic Straight
	**SZ027R**	Ennovate® Cervical Bone Probe Thoracic Curved
	**FW674R**	Ennovate® Cervical/S⁴® Cervical Bone Probe Straight
	**FW675R**	Ennovate® Cervical/S⁴® Cervical Bone Probe Curved

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – BASIC COMPLEMENTARY

	Article No.	Description
	**SZ081R**	Ennovate® Cervical Rod Persuader Basic
	**SZ082R**	Ennovate® Cervical Rod Persuader Pistol Style
	**SZ051R**	Ennovate® Cervical Tap ø 3.5/3.6 mm
	**SZ052R**	Ennovate® Cervical Tap ø 4.0 mm
	**SZ029R**	Ennovate® Cervical Caliper for Cross Connectors
	**SZ030R**	Ennovate® Cervical Template for SQ020TS Domino ø 3.5/4.0 - ø 3.5/4.0 mm
	**SZ031R**	Ennovate® Cervical Template for SQ021TS Domino ø 3.5/4.0 - ø 5.5 mm

	Article No.	Description
	**SZ032R**	Ennovate® Cervical Template for SQ022TS Domino Axial ø 3.5/4.0 - ø 3.5/4.0 mm
	**SZ033R**	Ennovate® Cervical Template for SQ023TS Domino Axial ø 3.5/4.0 - ø 5.5 mm
	**SZ034R**	Ennovate® Cervical Template for SQ024TS Domino Lateral ø 3.5/4.0 - ø 5.5 mm
	**SZ035R**	Ennovate® Cervical Template for SQ025TS Domino Lateral ø 3.5/4.0 - ø 3.5/4.0 mm
	**SZ036R**	Ennovate® Cervical Template for SQ010TS Offset Connector
	SZ039R	Ennovate® Cervical Handle for Connector Templates
	**SZ089R**	Ennovate® Cervical Locking Driver for Head-to-Head Cross Connector

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – BASIC COMPLEMENTARY

	Article No.	Description
	SZ018SU/R	Ennovate® Cervical ø 3.3 mm Solid Drill for Universal Drill Guide
	**SZ053R**	Ennovate® Cervical Tap ø 4.5 mm
	SZ072SU	Ennovate® Cervical Rod Bending Template 60 mm
	SZ074SU	Ennovate® Cervical Rod Bending Template 290 mm
	**SZ078R**	Ennovate® Cervical In-Situ Rod Bender
	**FW071R**	Ennovate® Cervical/S⁴® Cervical Lamina Preparator
	**FW528R**	Ennovate® Cervical/S⁴® Cervical Hook Holding Forceps

	Article No.	Description
	**FW427R**	Ennovate® Cervical/S⁴® Cervical Compression Forceps
	**FW428R**	Ennovate® Cervical/S⁴® Cervical Distraction Forceps
	**FW036R**	Ennovate® Cervical/S⁴® Cervical Rod Bending Plates (2pcs)

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – OCCIPITAL FIXATION

	Article No.	Description
	**SZ004R**	Ennovate® Cervical T-Handle
	**FW090R**	Ennovate® Cervical / S4® Cervical Occipital Plate Bending Pliers
	**SZ101R**	Ennovate® Cervical Occipital Plate Holder
	**SZ102R**	Ennovate® Cervical Occipital Drill ø 2.9 mm
	**SZ103R**	Ennovate® Cervical Occipital Drill ø 3.9 mm
	**SZ104R**	Ennovate® Cervical Occipital Tap ø 4.5 mm
	**SZ105R**	Ennovate® Cervical Occipital Tap ø 5.5 mm
	**SZ106R**	Ennovate® Cervical Occipital Drill/Tap Guide for ø 6/8 mm Screws

	Article No.	Description
	**SZ107R**	Ennovate® Cervical Occipital Drill/Tap Guide for ø 10/12 mm Screws
	**SZ108R**	Ennovate® Cervical Occipital Drill/Tap Guide for ø 14/16 mm Screws
	**SZ109R**	Ennovate® Cervical Occipital Torque Wrench
	**SZ110R**	Ennovate® Cervical Occipital Counter Torque Wrench
	SZ111R	Ennovate® Cervical Occipital Screwdriver
	SZ112R	Ennovate® Cervical Occipital Screw Remover
	**SZ113R**	Ennovate® Cervical Occipital Screw Remover Shaft

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – OCCIPITAL ACCESS

	Article No.	Description
	**SZ114R**	Ennovate® Cervical Occipital Access – Drill/Tap Guide ø 4.5 mm
	**SZ115R**	Ennovate® Cervical Occipital Access – Drill/Tap Guide ø 5.5 mm
	**SZ116R**	Ennovate® Cervical Occipital Access – Angled Gear Instrument
	**SZ123SU**	Ennovate® Cervical Occipital Access – Screwdriver Bit
	**SZ119SU**	Ennovate® Cervical Occipital Access - Depth Stops Set (6 mm - 16 mm)
	**SZ120SU**	Ennovate® Cervical Occipital Access - Drill and Tap Bit Set for ø 4.5 mm Screws
	**SZ121SU**	Ennovate® Cervical Occipital Access - Drill and Tap Bit Set for ø 5.5 mm Screws
	**AN912R**	Clamping Forceps

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

E. INSTRUMENTS

Ennovate® Cervical – C1/C2 TRANSARTICULAR SCREW FIXATION

	Article No.	Description
	**SZ004R**	Ennovate® Cervical T-Handle
	**SZ131R**	Ennovate® Cervical C1/C2 All-in-One Guide
	**SZ132R**	Ennovate® Cervical C1/C2 Cortical Punch
	**SZ133R**	Ennovate® Cervical C1/C2 Obturator
	**SZ134R**	Ennovate® Cervical C1/C2 Inner Drill Guide
	SZ136SU/R	Ennovate® Cervical C1/C2 ø 2.8 mm Solid Drill
	SZ137SU/R	Ennovate® Cervical C1/C2 & MIS K-Wire Long ø 1.5 mm for ø 4.0 & ø 4.5 mm Screws (2 pcs)

	Article No.	Description
	**SZ139R**	Ennovate® Cervical C1 / C2 Tap ø 4.0 mm
	**SZ140R**	Ennovate® Cervical C1 / C2 Screwdriver
	**SZ141R**	Ennovate® Cervical C1 / C2 Ball End Screwdriver
	SZ142R	Ennovate® Cervical C1 / C2 Bone Screw Screwdriver Shaft
	FW671R	Ennovate® Cervical C1/C2 / S4® Cervical Sounder Long

AESCULAP® Ennovate® Cervical

SURGICAL TECHNIQUE

F. REFERENCES

(1) Magerl F, Seemann P-S. Stable Posterior Fusion of the Atlas and Axis by Transarticular Screw Fixation. In: Kehr P, Weidner A, editors. Cervical Spine I: Strasbourg 1985. Vienna: Springer Vienna; 1987. p. 322–7.

(2) Roselli R, Pompucci A, Formica F, Restuccia D, Di Lazzaro V, Valeriani M et al. Open-door laminoplasty for cervical stenotic myelopathy: surgical technique and neurophysiological monitoring. J Neurosurg 2000; 92(1 Suppl):38–43.

(3) Kothe R, Schmeiser G, Papavero L. Open-door laminoplasty : What can the unilateral approach offer? Oper Orthop Traumatol 2018; 30(1):3–12.

AESCULAP® – a B. Braun brand

Aesculap AG | Am Aesculap-Platz | 78532 Tuttlingen | Germany
Phone +49 7461 95-0 | Fax +49 7461 95-2600 | www.aesculap.com

003102 0221/PDF/1