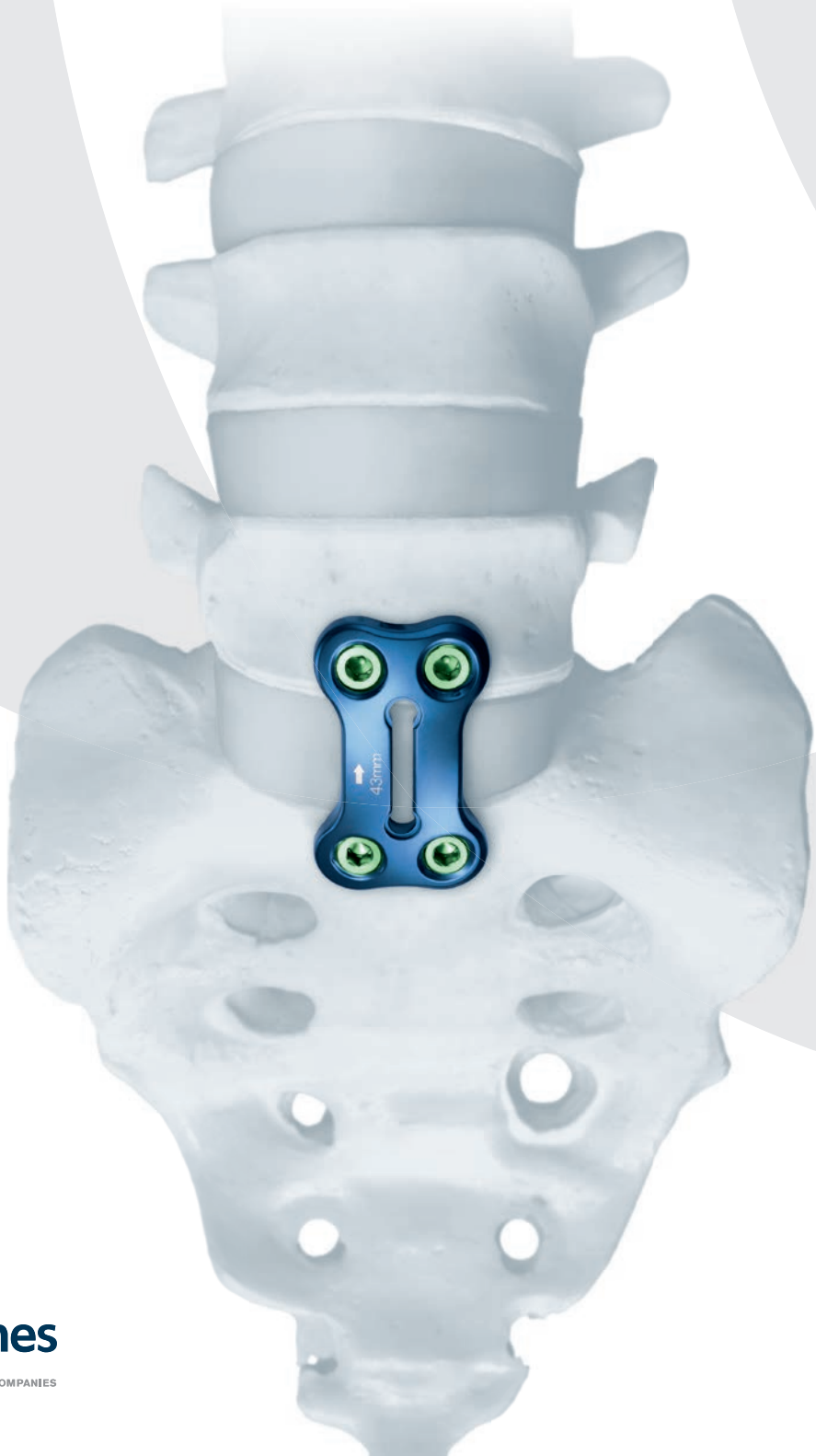
Anterior tension band plate to stabilize the lumbosacral spine

ATB Anterior Tension Band Plate

Surgical Technique



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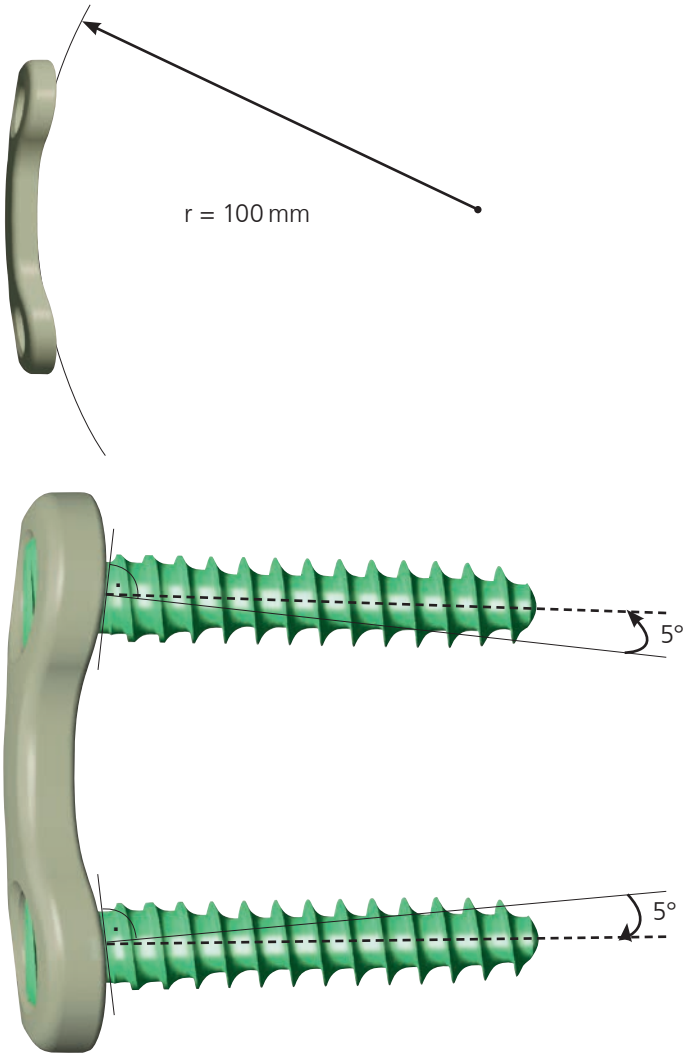
ATB. Anterior tension band plate to stabilize the lumbosacral spine

Comprehensive implant system
- Lumbar and sacral plate lines
  Lumbar: anterior or anterolateral approach
  Sacral: anterior approach
- Monosegmental and bisegmental plate lengths
- Lengthwise window to provide visualization of the bone graft
- Self-locking screws
- Titanium alloy (Ti-6Al-7Nb)

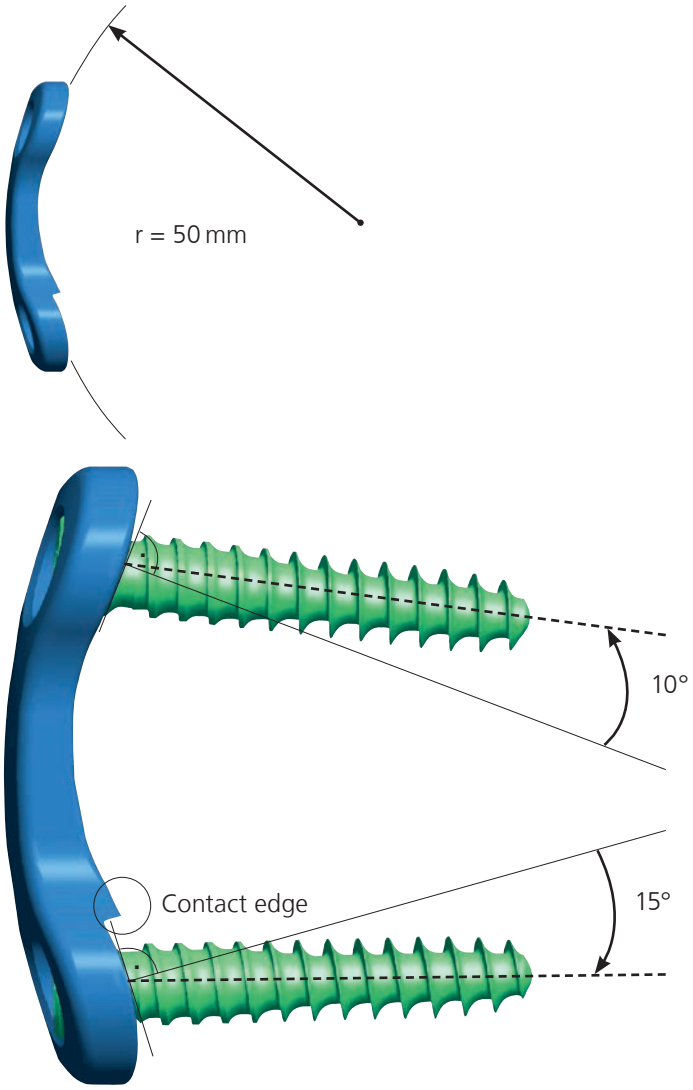
Adapted to the anatomy
- Low 3.5 mm profile
- Anatomical lordotic curvature
- Axial radius of 38 mm
- Sacral implant with special contact edge for the promontory

	Sacral plates		Lumbar plates	
	Monosegmental	Bisegmental	Monosegmental	Bisegmental
Lordotic radius	r = 50 mm	r = 100 mm	r = 100 mm	r = 220 mm
Axial radius	r = 38 mm	r = 38 mm	r = 38 mm	r = 38 mm

Lumbar



Sacral

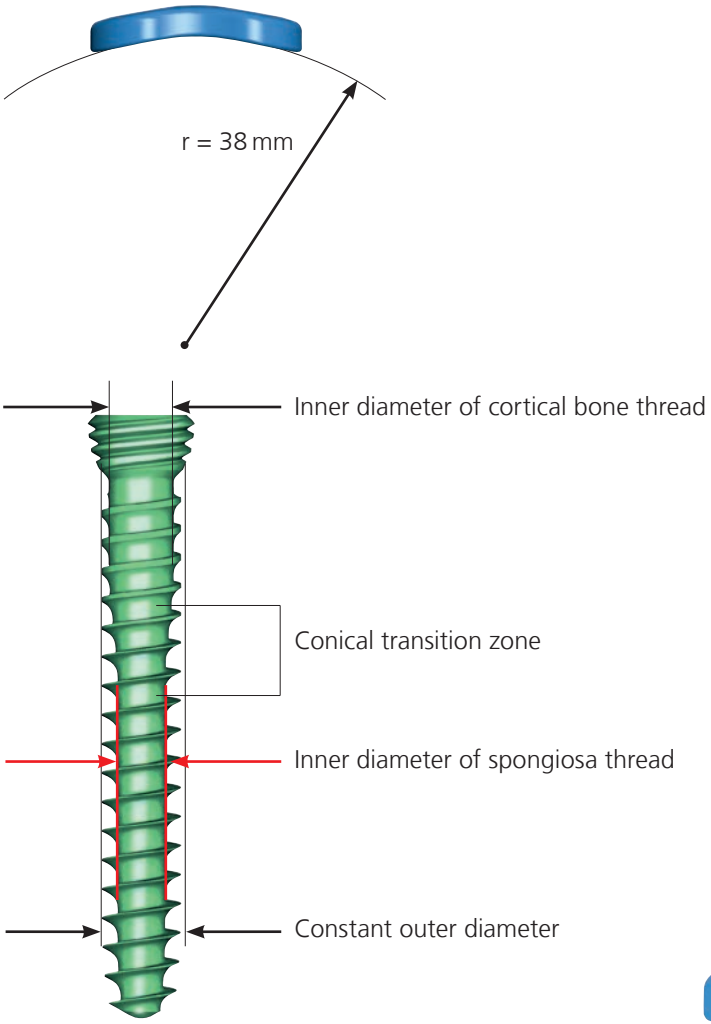


High resistance to extractive forces
Screw-head thread provides a form-fit with the plate

The cranial and medial screw axes are deflected from the radial axis
– Parallel alignment with the endplate
– Enhanced bone anchoring

Conical threaded holes allow +/– 5° angulation during insertion

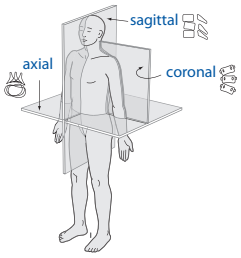
Dual Core Design
– Proximal cortical bone thread combined with the distal spongiosa thread enables bone-tailored anchoring
– Constant outer diameter provides fixation against tearing out
– Self-tapping
– Blunt screw tip



AO Spine Principles

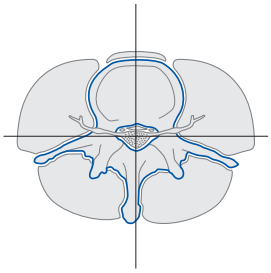
The four principles to be considered as the foundation for proper spine patient management underpin the design and delivery of the Curriculum: Stability – Alignment – Biology – Function.[1,2]

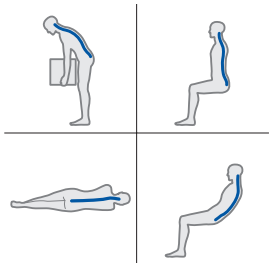
Stability
Stabilization to achieve a specific therapeutic outcome



Alignment
Balancing the spine in three dimensions

Biology
Etiology, pathogenesis, neural protection, and tissue healing





Function
Preservations and restoration of function to prevent disability

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[1] Aebi et al (1998)
[2] Aebi et al (2007)

Indications and Contraindications

Intended Use
The Anterior Tension Band (ATB) System is a comprehensive set of implants and instruments designed for anterior stabilization of the lumbar spine.

Indications
ATB plates are used from L1 to S1, strictly anterior below the bifurcation, and anterior or anterolateral above the bifurcation for:
- Degenerative intervertebral disc diseases,
- Spinal fractures (L1-S1),
- Spinal tumours (L1-S1),
- Pseudoarthrosis and
- Revisions after failed decompression surgery
- that have sufficient, biomechanically stable, ventral support.

Contraindications
ATB plates are contraindicated for:
- Scoliosis,
- Serious osteoporosis, especially in the case of osteoporotic fractures and
- Spondylolisthesis.

Surgical Technique
Standard procedure

1. Prepare the vertebrae

After exposing the site and insertion of a bone graft or an intervertebral disc or vertebral body replacement, free the vertebrae surfaces from osteophytes so that the ATB plate can lie flush on the surface.

2. Select plate size

Select the plate size so that the ATB plate bridges the inter-vertebral space including the bone graft, cage, or vertebral body replacement (VBR), and the screw holes lie next to the vertebral endplates.

Note: The plate lengths indicate the overall length.

Warning: Bending the ATB plates is not recommendable since the plate holes will deform, and the screws might not lock in the plate hole.

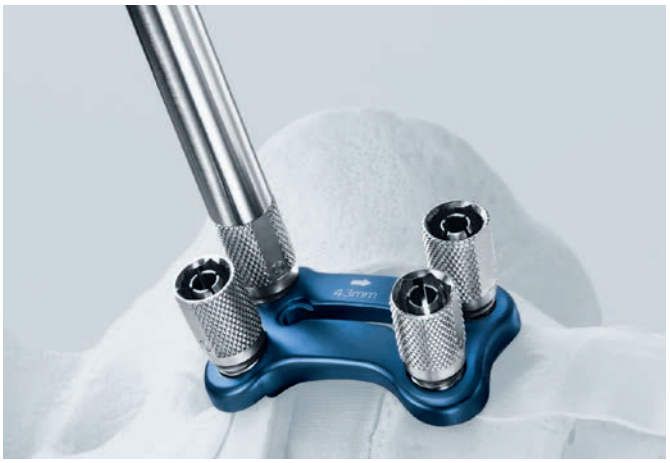
3. Affix drill guide to plate

Required instruments	
389.802	Threaded Drill Guide
389.801	Threaded Drill Guide Inserter, cannulated

Mount all of the required threaded drill guides in the plate holes. Place the drill guide inserter for inserting the plate on a suitable caudal drill guide.

Note: For direct anterior placement on the lumbar spine, the plate must be placed below the bifurcation of the great vessels.

4. Position the plate



Position the plate so that the screws can be introduced close to the vertebral endplates. This maximizes the anchoring in the bone.

Warning:
- In the case of a strictly anterior approach to the lumbar spine, the plate must be introduced below the bifurcation of the large vessels.
- When using a sacral ATB plate, the contact edge must lie on the promontory. When the orientation is correct, the engraved arrow points in a cranial direction.
- The angle for introducing screws into the cranial plate holes is 10°. Contrastingly, the screws are guided into the caudal plate holes at an angle of 15°. This makes it much easier for surgical approach and improves the anchoring of the screws in the promontory.

5. Temporarily fix the plate

Required instruments	
389.873	Fixation Pin, for temporary use
389.872	Introducer for Fixation Pin, for temporary use
389.803	Awl ∅ 3.3 mm, length 325 mm

Introduce the awl into the drill guide inserter, then through the plate hole, and perforate the cortical bone. The maximum awl penetration depth is 21 mm.

Affix the plate by temporarily by leaving the awl in the vertebrae.

Note: If the Awl is directly inserted through the drill guide, the drill depth will be 24 mm.

Place a fixation pin on the driver, and affix the plate to the vertebrae through the contralateral cranial drill guide. Lightly tapping in the fixation pin makes it easier to perforate the cortical bone.

Repeat the procedure for the remaining plate holes.

6. Prepare the first screw hole

Optional instruments	
389.826	Drill Bit ∅ 3.3 mm with Stop, 2-flute, length 322/40 mm
389.808	Drill Bit ∅ 3.3 mm, length 248 mm, for Quick Coupling
311.425	Handle with Quick Coupling
389.812	Tap for Cancellous Bone Screws ∅ 5.5 mm, length 248 mm

Remove the awl from the drill guide inserter. Remove the inserter together with the drill guide.

Alternative: By screwing out the drill guide inserter all the instruments can be removed in one step.

In the case of hard bone, remove the inserter and awl, but leave the drill guide. Mount the handle with the quick coupling on the drill bit ∅ 3.3 mm, and drill the screw hole further. The drill depth is 25 mm.

Additional tapping option: Mount the Tap on the Ratchet Wrench with T-handle, and pretap the thread.

7. Select screws

Required instruments	
319.090	Depth Gauge for Long Screws ∅ 3.5 mm, measuring range up to 110 mm

Determine the required screw length with the length indicator.

Note: The indicated lengths of the locking screws refer to the distance from the first thread on the shaft to the tip.

8. Insert screws

Required instruments	
388.652	Ratchet Wrench with T-Handle, with Hexagonal Quick-Coupling 6.0 mm
389.829	Screwdriver Shaft, hexagonal 3.5, with Hexagonal Coupling
389.814	Holding Sleeve, length 193 mm

Place the ratchet wrench with T-handle on the hexagonal screwdriver shaft, and introduce it into the holding sleeve. Take a 5.5 mm screw of the appropriate length and screw it into the prepared hole.

Insert the screw up to 3/4 its length. Then pull the holding sleeve upward, and continue to screw in the screw until the screw head is seated in the plate.

The final locking with the torque limiting T-handle is only done after all 5.5 mm locking screws have been inserted.

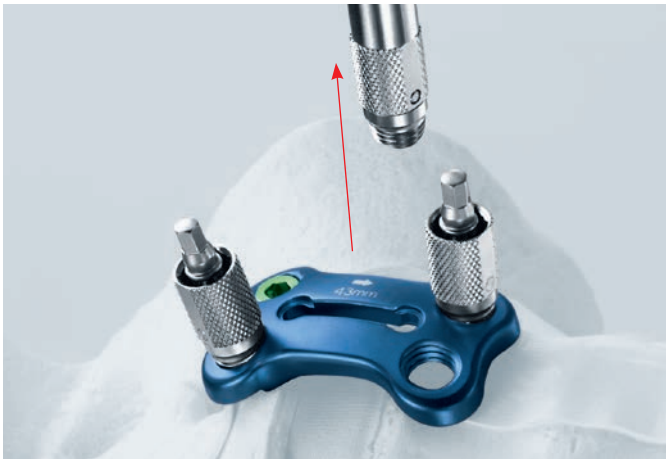
9. Remove fixation pins and set the remaining screws

Required instruments	
389.872	Introducer for Fixation Pin, for temporary use
389.801	Threaded Drill Guide Inserter, cannulated

For each screw, first remove the fixation pin with the driver.

Then remove the drill guide with the threaded drill guide inserter.

Note: After removing a temporary fixation pin, the awl is not required prior to screw insertion.



Then introduce the screw as described under item 8.

Begin to insert the other screws cross-wise. Repeat steps 7 and 8 for all screws.

Notes: Sacral bisegmental ATB plates are introduced analogous to the surgical steps describe in 1–10.

Lumbar monosegmental and bisegmental ATB plates are also introduced according to surgical steps 1-10 with the following difference: They can be introduced from a lateral or anterolateral direction depending on the position of the bifurcation.

Common to all plates is that the screws must always be introduced close to the endplate.

10. Lock the screws

Required instruments	
321.133	Torque-limiting T-Handle, 7 Nm
389.829	Screwdriver Shaft, hexagonal 3.5, with Hexagonal Coupling

Place the torque-limiting T-handle on the hexagonal screwdriver shaft, and finally lock all screws.

A clear clicking from the T-handle signals that the necessary torque has been reached.

Surgical Technique
With compression

1. Prepare the vertebrae and plate

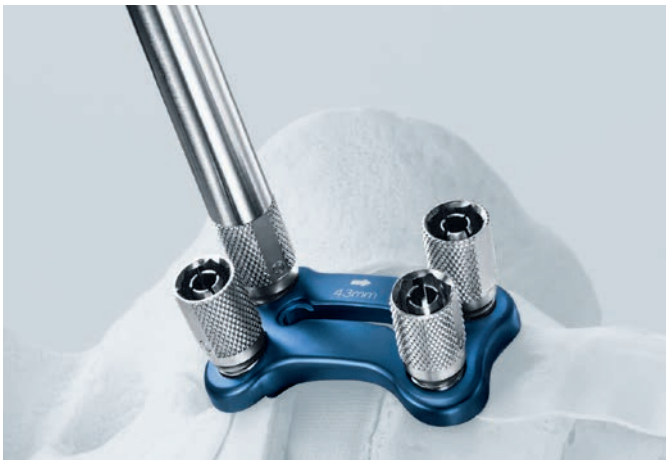
Required instruments	
389.802	Threaded Drill Guide
389.801	Threaded Drill Guide Inserter, cannulated

Prepare the vertebrae and plate as described in steps 1-3 of the standard procedure. Place the drill guide inserter on one of the two caudal drill guides.

2. Position the plate

Position the plate so that the caudal screws can be introduced close to the vertebral endplates. This maximizes the anchoring in the bone.

Warning:
- In the case of a strictly anterior approach to the lumbar spine, the plate must be introduced below the bifurcation of the large vessels.
- When using a sacral ATB plate, the contact edge must lie on the promontory. When the orientation is correct, the engraved arrow points in a cranial direction.
- The angle for introducing screws into the cranial plate holes is 10°. Contrastingly, the screws are guided into the caudal plate holes at an angle of 15°. This makes it much easier for surgical approach and improves the anchoring of the screws in the promontory.



3. Temporarily fix the Plate

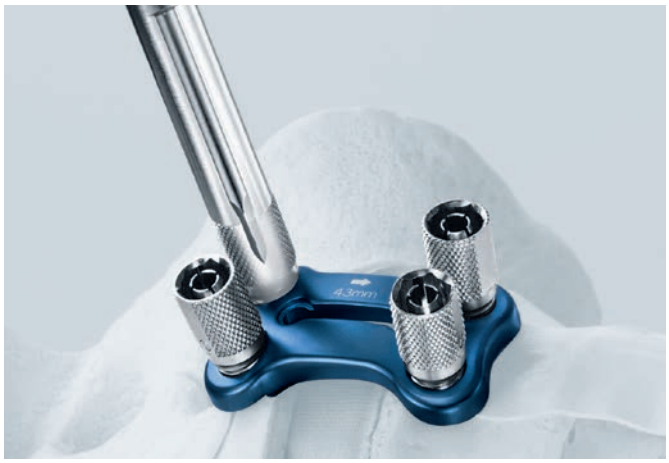
Required instruments	
389.873	Fixation Pin, for temporary use
389.872	Introducer for Fixation Pin, for temporary use
389.803	Awl ∅ 3.3 mm, length 325 mm

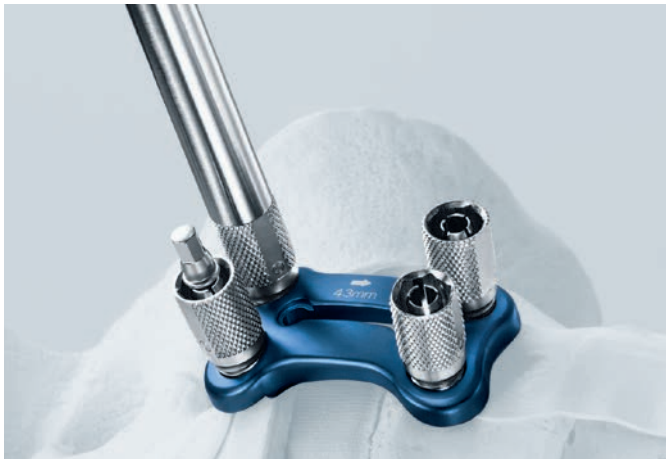
Introduce the awl into the drill guide inserter, then through the plate, and perforate the cortical bone. The maximum awl penetration depth is 21 mm.

Affix the plate temporarily by leaving the awl in the vertebrae.

Note: If the awl is directly inserted through the drill guide, the drill depth will be 24 mm.

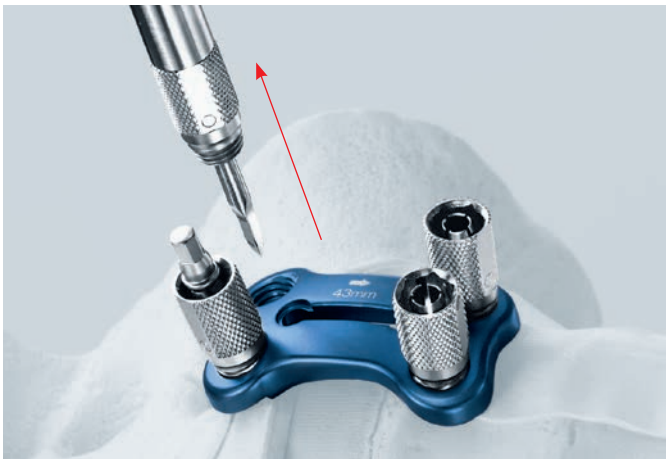
Place a fixation pin on the driver, and affix the plate to the vertebrae through the second caudal drill guide.





4. Insert caudal screws

Required instruments	
388.652	Ratchet Wrench with T-Handle, with Hexagonal Quick-Coupling 6.0 mm
389.829	Screwdriver Shaft, hexagonal 3.5, with Hexagonal Coupling
389.814	Holding Sleeve, length 193 mm



First remove the awl, then the threaded drill guide inserter together with the drill guide.

Alternative: By screwing out the drill guide inserter, all the instruments can be removed in one step.

In the case of hard bone, remove the inserter and awl, but leave the drill guide. Mount the handle with the quick coupling on the drill bit ∅ 3.3 mm, and drill the screw hole further. The drill depth is 25 mm.

Place the ratchet wrench with T-handle on the hexagonal screwdriver shaft, and introduce it into the holding sleeve. Pick up a 5.5 mm screw of the appropriate length, and screw it into the prepared **caudal** hole.

See page 9, step 7 on selecting the appropriate screw length.

Insert the screw up to 3/4 its length. Then pull the holding sleeve backward, and continue to screw in the screw until the screw head is seated in the plate.

The final locking with the torque limiting T-handle is only done after all 5.5 mm locking screws have been inserted.

Use the same procedure for the second caudal screw; the awl does not have to be used.

5. Insert Schanz screw

Required instruments	
496.779	Schanz Screw ∅ 6.2 mm, length 180/35 mm, for temporary use
388.656	Pedicle Awl ∅ 4.0 mm with Silicone Handle, length 255 mm, for Pedicle Screws ∅ 5.0 to 7.0 mm

Perforate the cortical bone of the cranial vertebrae using the pedicle awl.

Screw in the temporary Schanz screw with the ratchet wrench with T-handle. The distance to the upper edge of the plate should be at least 6 mm.

6. Perform compression

Required instruments	
324.078	Compression Forceps

Guide the cylindrical end of the compression forceps over the Schanz screw, and hook the hooked end on the caudal edge of the ATB plate.

Compress the segment with the forceps, and lock the forceps using the knurled nut.

7. Fix the plate

Required instruments	
389.873	Fixation Pin, for temporary use
389.872	Introducer for Fixation Pin, for temporary use

Place a fixation pin onto the driver, and insert it into the cranial plate hole closest to the compression forceps.

Lightly tapping in the fixation pin makes it easier to perforate the cortical bone.

8. Insert cranial screws

Required instruments	
389.803	Awl ∅ 3.3 mm, length 325 mm
389.801	Threaded Drill Guide Inserter, cannulated
388.652	Ratchet Wrench with T-Handle, with Hexagonal Quick-Coupling 6.0 mm
389.829	Screwdriver Shaft, hexagonal 3.5, with Hexagonal Coupling
389.814	Holding Sleeve, length 193 mm

Insert the awl through the cannulated threaded drill guide inserter into the free cranial plate hole, and perforate the cortical bone.

First remove the awl, then the threaded drill guide inserter and the drill guide.

Alternative: By screwing out the threaded drill guide inserter, all the instruments can be removed in one step.

Place the ratchet wrench with T-handle on the hexagonal screwdriver shaft, and introduce it into the holding sleeve.

Pick up a 5.5 mm screw of the appropriate length, and screw it into the prepared cranial hole.

Insert the screw up to 3/4 its length. Then pull the holding sleeve backward, and continue to screw in the screw until the screw head is seated in the plate.

The final locking with the torque limiting T-handle is only done after all 5.5 mm locking screws have been inserted.

Use the same procedure for the second cranial screw; the awl does not have to be used.

9. Lock the screws

Required instruments	
321.133	Torque-limiting T-Handle, 7 Nm
389.829	Screwdriver Shaft, hexagonal 3.5, with Hexagonal Coupling

Release the compression forceps and remove it.

Place the torque-limiting T-handle on the hexagonal screwdriver shaft, and finally lock all screws.

A clear clicking from the torque-limiting T-handle signals that the necessary torque has been reached.

Notes: Sacral, bisegmental ATB plates are inserted analogous to surgical steps 1–9 described in: "Compression surgical technique."

Lumbar monosegmental and bisegmental ATB plates are also introduced according to these surgical steps with the following difference: They can be introduced from an anterior or anterolateral direction depending on the position of the bifurcation.

Common to all plates is that the screws must always be introduced closed to the endplate.

Implants

ATB plates

Lumbar plates
Anterior or anterolateral approach and positioning

ATB lumbar plates 5.5, monosegmental, titanium alloy (TAN), green

Art. No.	Length
449.061	35 mm
449.062	37 mm
449.063	39 mm
449.064	41 mm
449.065	43 mm
449.066	45 mm
449.067	47 mm
449.068	49 mm
449.069	51 mm

ATB lumbar plates 5.5, bisegmental, titanium alloy (TAN), green

Art. No.	Length
449.081	77 mm
449.082	81 mm
449.083	85 mm
449.084	89 mm
449.085	93 mm
449.086	97 mm
449.087	101 mm
449.088	105 mm
449.089	109 mm

Sacral plates

Strictly anterior approach and positioning
The plates are provided with an arrow pointing in a cranial direction for correct placement

ATB sacral plates 5.5, monosegmental, titanium alloy (TAN), blue

Art. No.	Length
449.071	35 mm
449.072	37 mm
449.073	39 mm
449.074	41 mm
449.075	43 mm
449.076	45 mm
449.077	47 mm

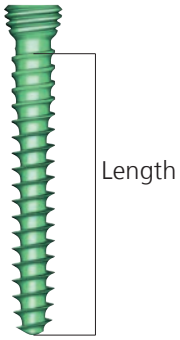
ATB sacral plates 5.5, bisegmental, titanium alloy (TAN), blue

Art. No.	Length
449.101	77 mm
449.102	81 mm
449.103	85 mm
449.104	89 mm
449.105	93 mm
449.106	97 mm
449.107	101 mm

Locking screws

Cancellous bone locking screws ∅ 5.5 mm, self-tapping, titanium alloy (TAN), green

Art. No.	Length
489.140	20 mm
489.142	22 mm
489.145	24 mm
489.147	26 mm
489.150	28 mm
489.154	30 mm
489.156	33 mm
489.160	36 mm



Instruments

389.801	Threaded Drill Guide Inserter, cannulated	
389.801	Threaded Drill Guide	
389.872	Introducer for Fixation Pin, for temporary use	
389.873	Fixation Pin, for temporary use	
389.803	Awl ∅ 3.3 mm, length 325 mm	
319.090	Depth Gauge for Long Screws ∅ 3.5 mm, measuring range up to 110 mm	
388.656	Pedicle Awl ∅ 4.0 mm with Silicone Handle, length 255 mm, for Pedicle Screws ∅ 5.0 to 7.0 mm	
324.078	Compression Forceps	
496.779	Schanz Screw ∅ 6.2 mm, length 180/35 mm, for temporary use	
389.812	Tap for Cancellous Bone Screws ∅ 5.5 mm, length 248 mm	

389.808	Drill Bit ∅ 3.3 mm, length 248 mm, for Quick Coupling	
389.826	Drill Bit ∅ 3.3 mm with Stop, 2-flute, length 322/40 mm	
388.652	Ratchet Wrench with T-Handle, with Hexagonal Quick-Coupling 6.0 mm	
389.829	Screwdriver Shaft, hexagonal 3.5, with Hexagonal Coupling	
389.814	Holding Sleeve, length 193 mm	
321.133	Torque-limiting T-Handle, 7 Nm	

Bibliography

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