Aesculap ABC2

Anterior Cervical Plating System
Surgical technique

Aesculap Spine

B BRAUN
SHARING EXPERTISE

ABC2

Table of contents

Indications

A

Cervical Plating

Anterior cervical fusion was first performed by Bailey and Badgley, Smith and Robinson, and Cloward in the 1950s. Despite minor technical differences, poor clinical results were noticed which called for new fixation systems.
Anterior cervical plating systems were designed to augment spinal stability and to reduce graft-related surgical complications until bony fusion occurs. Ultimately, it is the bony fusion that leads to long-term stability. Pivotal to support the bony fusion and to optimize the outcome is the careful attention to surgical detail, including full decompression of the spinal canal and neural foramina, maximum restoration of spinal alignment and proper preparation of the intervertebral disc space. Furthermore, the selection of the bone graft or interbody device plays an important role in this context.
From the need for increased stability and improved clinical outcomes, different designs of plates like constrained, semi-constrained and dynamic plating systems have emerged. They coexist legitimately, but in addition to an augmented stability, technically advanced and fully dynamic plates like ABC2 show noteworthy advantages. ABC2 allows for translation and rotation at the plate-screw interface and locks the screw within the plate. Thereby preventing back-out while allowing screw angle variation and screw sliding. Most importantly, the construct facilitates load sharing and avoids stress shielding of the graft by allowing the screws to translate axially. Better graft loading, in turn results in faster fusion and consequently fewer complications.
Recently, Pitzen et al. compared the implant complications and speed of fusion in both rigid and dynamic plates and conclude that dynamic plates should be considered to be the preferred treatment option.[1]

Intended use

The ABC2 Cervical Plating System is intended for the treatment of cervical spine instability resulting from:

- Degenerative disc disease (DDD)
- Deformities
- Post-trauma instability
- Fractures
- Tumors
- Reoperations necessitated by pseudarthroses

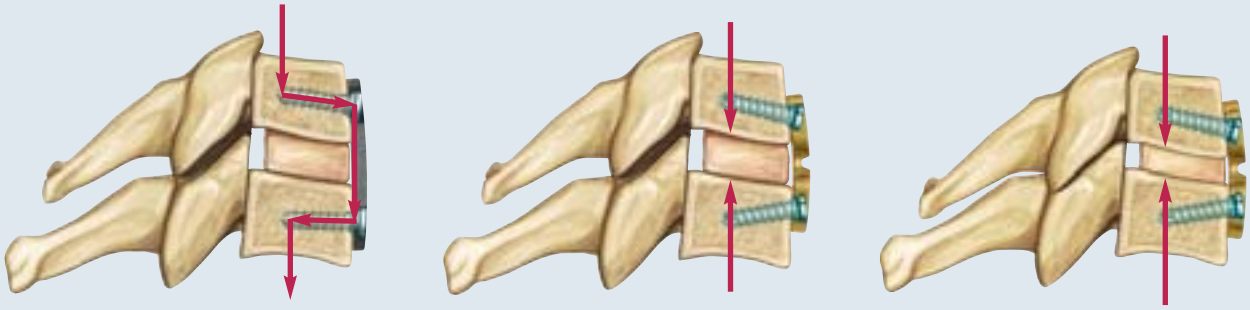
Levels of screw fixation for these indications are from C2 to T1

[1]Pitzen T, Chrobok J, Štulic J, Ruffing S, Drumm J, Sova L, Kučera R, Vyskočil, T, Steudel W. Implant complications, fusion, loss of lordosis, and outcome after anterior cervical plating with dynamic or rigid plates: two-year results of a multi-centric, randomized, controlled study. Spine 2009; 34(7), 641-646.

Principles of Dynamic Osteosynthesis

B

Stress shielding	Load sharing	
Loading forces applied with constrained (rigid) construct	*Loading forces applied with dynamic construct before settling*	*Loading forces applied with dynamic construct after settling*



Wolff's Law states that:

"Every change in the function of a bone is followed by definitive changes in its internal architecture and secondary alterations in its external confirmation."

This means that osseous tissues remodel in direct response to the stresses placed upon them. The ABC2 dynamic system is designed to take full advantage of this principle. It avoids stress shielding and allows for full load sharing, as well as a more substantial fusion. The speed of fusion is faster in the presence of a dynamic plate.[1]

[1]Pitzen T, Chrobok J, Štulic J, Ruffing S, Drumm J, Sova L, Kučera R, Vyskočil, T, Steudel W. Implant complications, fusion, loss of lordosis, and outcome after anterior cervical plating with dynamic or rigid plates: two-year results of a multi-centric, randomized, controlled study. Spine 2009; 34(7), 641-646.

In combination with its self-locking screw, ABC2 is designed to compensate for settling of the bone graft or interbody device so as to maintain continued axial loading on the graft. To take full advantage of this unique and very desirable feature, the surgeon must understand and use the correct techniques (detailed in this instructional brochure) when applying the device.

Features of the ABC2 System

ABC2 Implant Design

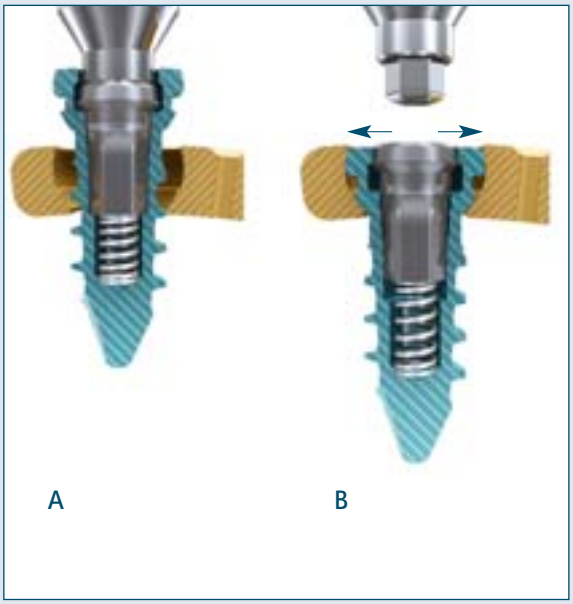
The ABC2 system consists of a variety of plate sizes as well as unicortical and oversized screws. All implants are manufactured from a titanium alloy (Ti6Al4V) complying with ISO 5832-3 and phynox according to ISO 5832-7. Axial settling, which allows full load sharing capability, occurs because the screws are free to move in the plate slots.
The settling distance is determined by the amount of graft resorption or interbody fusion device settling but not the restriction of the plate screw interface.
The design allows screw angulation of plus or minus 35 degrees in the vertical axis as well as plus or minus 8 degrees medial or lateral to the coronal axis.

ABC2 Plate marking

- Plate marking should be aligned with the endplates to give orientation for the plate size
- Distance between the markers represents the size of the interbody device or bone graft
- Pre-lordosed plates respect the cervical anatomy
- Plate contouring possible for an exact implant fit

Features of the ABC2 System

View of the five-segmented screw head in the unlocked **A** and locked **B** positions.



Unique internal self-locking mechanism

All screws feature ABC2's unique internal "zero step" locking mechanism which is automatically activated. During screw insertion the screwdriver automatically unlocks the screw by pushing down on the locking pin. Removal of the driver from the screw automatically engages the internal spring mechanism to push the pin into the locked position.

The ABC2 screw head consists of five segments or "petals", which compress (in the unlocked position) as the screw head enters the plate slot and then re-expand as the screw reaches its final position. In the locked position the petals are blocked from compressing but are not expanded. Therefore the system allows unrestricted axial settling while preventing screw back-out.

Surgical Technique

D.1

Fig. 1

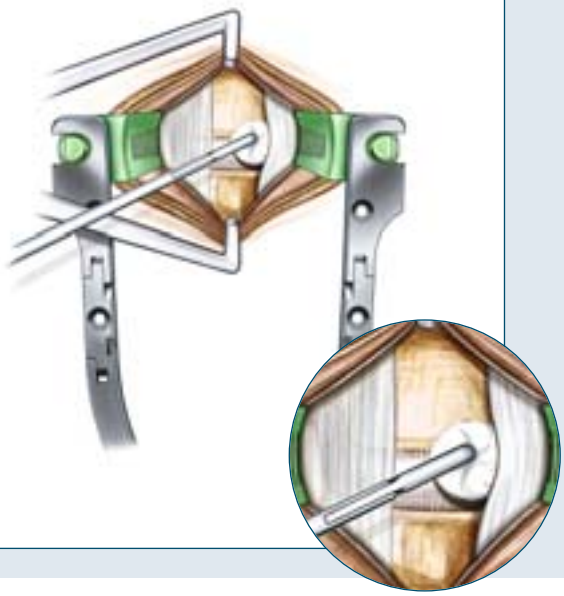


Fig. 2

Patient Positioning

- The patient is placed in the supine position with the head slightly reclined and resting in a head trough or ring.
  Once the lordotic cervical spine has been supported, the thorax may be placed on a pillow to emphasize the reclination of the cervical spine (Fig. 1).
- The arms are fixed along the sides of the body. Using the arm fixations, draw the shoulders down far enough to remove them from the radiation path of the segment to be fused.

Exposure of the Intervertebral Space

- After the skin incision and preparation, the CASPAR Cervical Retractor is applied. The blades are available in PEEK and Titanium. A counter retractor can be used (Fig. 2). The subcutaneous tissue is separated from the platysma cranially, caudally and medially, and the platysma is also separated following the direction of its fibres. The margins of the platysma can be held apart with the retractor or with two surgical forceps.
- Now the medial edge of the sternocleidomastoid muscle is located and prepared with the index finger in the connective tissue space over the ventral surface of the cervical spine and under lateralization of the vascular nerve bundle and medialization of the trachea, esophagus and thyroid gland.
- After the Langenbeck hooks have been inserted, the ventral surface of the cervical spine, still covered by a thin prevertebral layer of connective tissue, is revealed. This layer can now be exposed by either a blunt scissor or alternatively through bipolar coagulation in order to expand the tissue cranially and caudally using a swab. A wire is set under x-ray monitoring to mark the intervertebral disc space.

■ CASPAR Cervical Retractor System

Surgical Technique

D.2

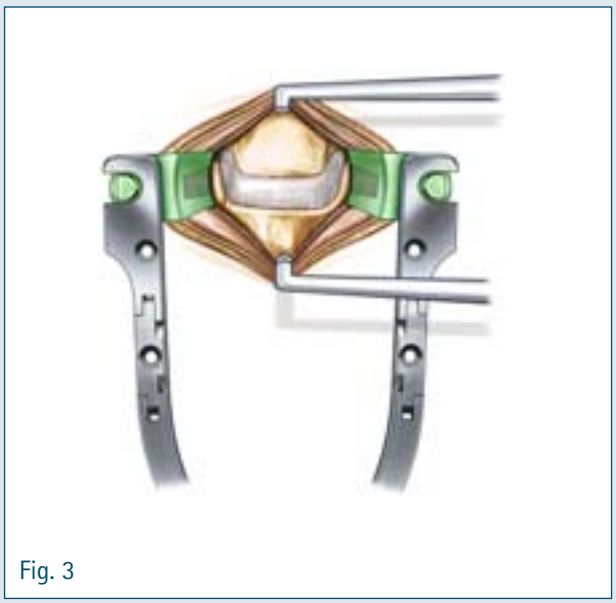


Fig. 3

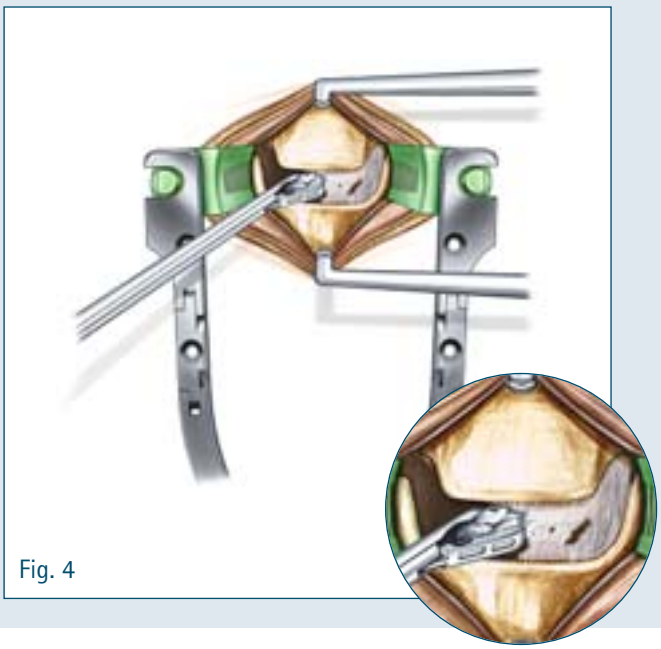


Fig. 4

Distraction / Discectomy / Preparation of the Endplates

- The distraction screws are placed in position and the CASPAR distractor is applied following the CASPAR technique (Fig. 3).
- Complete discectomy is performed using various rongeurs, rectangular curettes and bone curettes (Fig. 4). While using a high speed drill to remove the posterior rim and/or dorsal osteophytes, care must be taken to avoid damaging the vertebral body endplates.

Note:
Excessive preparation of the endplates may weaken the construct and cause subsidence of the interbody device.

- CASPAR Vertebral Body Distractor
- CASPAR Distraction Screws

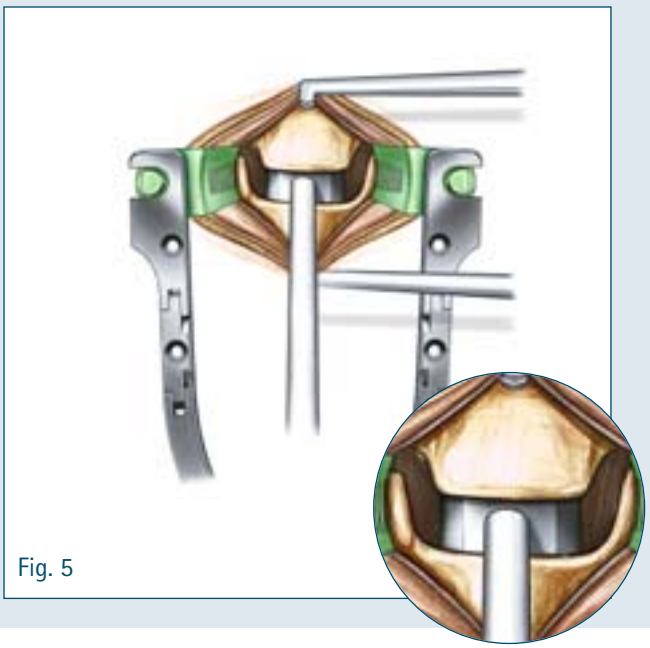


Fig. 5

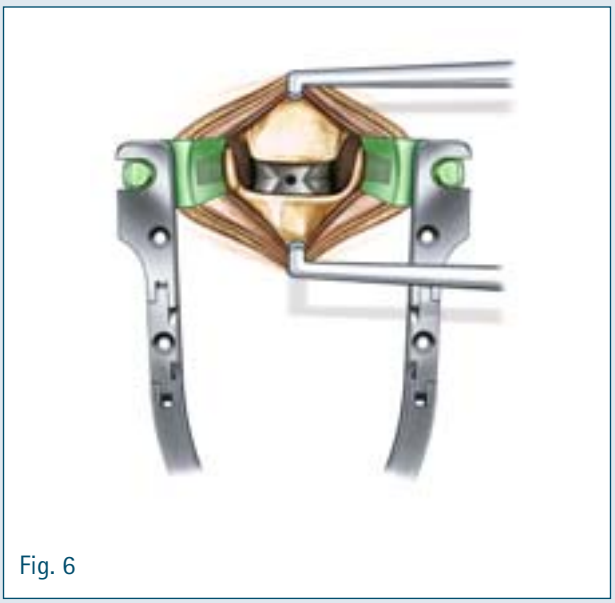


Fig. 6

Insertion of interbody device

- Bone graft or alternative means of interbody device can be used like Titanium or PEEK Spacer, e.g. CeSpace®.
- The correct size of CeSpace® can be determined using the trial implants (Fig. 5).
- CeSpace® PEEK and CeSpace® Titanium have a different implant shape. Therefore different trials are available for the respective system. Laser markings on the handle as well as the trial itself indicate the cranial and caudal side of the trial.

Determination of implant size of CeSpace® Titanium

The height of the CeSpace® Titanium trials corresponds exactly with the height of the final implant and is inclusive of the fixation crown.

Determination of implant size of CeSpace® PEEK

The CeSpace® PEEK trials regard the anatomical shape and serrated profile of the CeSpace® PEEK implant.

- The CeSpace® implant should be inserted centrally in AP and with a distance of approximately 1-2 mm to both the anterior and posterior rim (Fig. 6).

Surgical Technique

D.4

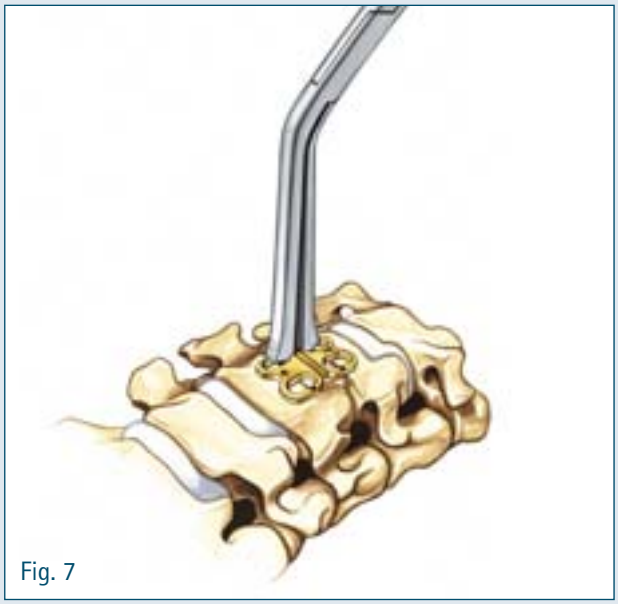


Fig. 7

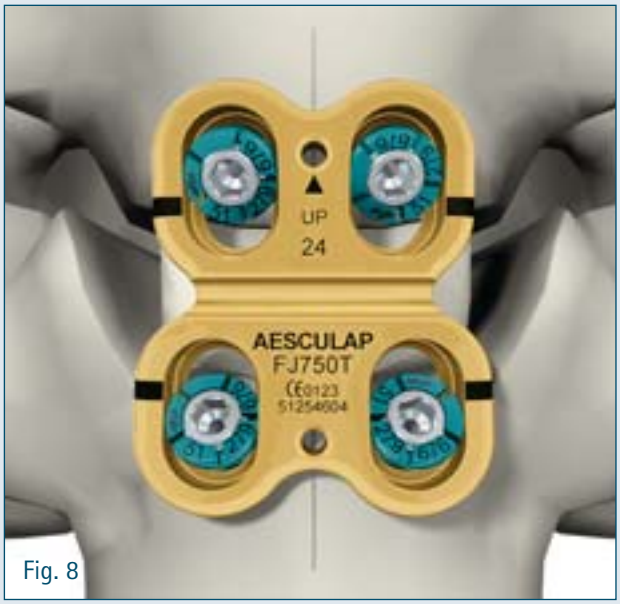


Fig. 8

Plate Length Selection

- In general, use the shortest plate length possible, planning the screw entry points at the most distal end of the plate slots. This will allow for settling to occur so that the plate does not overlap over the adjacent (non-instrumented) interspaces.
- Match the etch marks on the plates with the caudal endplate of the cranial vertebrae and the cranial endplate of the caudal vertebrae. Using the etch marks on the plate as a guide will help to ensure proper plate placement and plate length selection (Fig. 8).
- To allow maximum flexibility of selection, plate lengths are available in 2 mm increments from 20 to 34 mm and in 3 mm increments from 34 to 115 mm. The number of intervening holes also vary to allow for segmental fixation when appropriate and desired.

Note:
Some plate lengths may be available with two different hole configurations. For example, the 52, 55, and 58 millimeter lengths are available in both six and eight hole versions.

Fig. 9

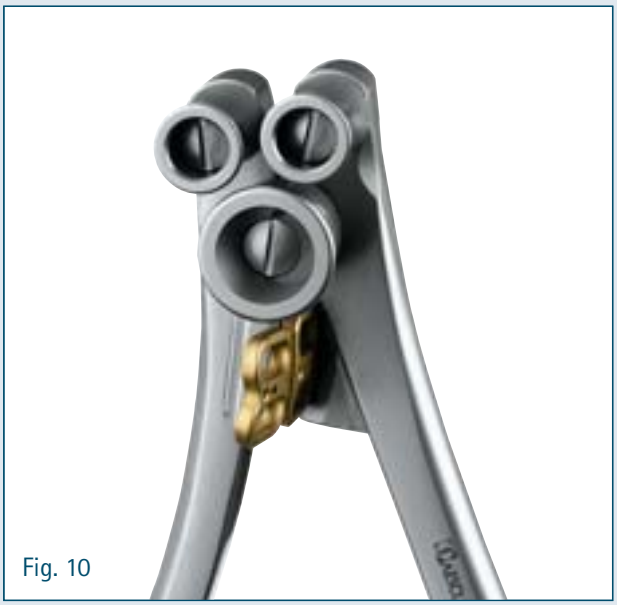


Fig. 10

Plate Contouring

- The ABC2 plates are pre-bent to an optimal angle of cervical lordosis. If needed, they should be further optimized to sit flush on the vertebrae without gaps or without rocking as pressure is alternately applied to either end or from side to side.
- To optimize the plate curvature, a bending tool is provided. Increased lordotic curvature is achieved through a series of small incremental corrections along the plate (Fig. 9). Bending will only occur within the bending zones of the plate (Fig. 11). A reduction of lordotic curvature can also be achieved within these regions as indicated in Fig. 10.
- To accomplish optimal plate fit, osteophytic ridges should be removed with rongeurs or with the Micro-speed high-speed drill. If necessary, a prominent bony midline keel can also be trimmed. Care must be taken during bone trimming not to weaken the paramedian screw fixation sites.

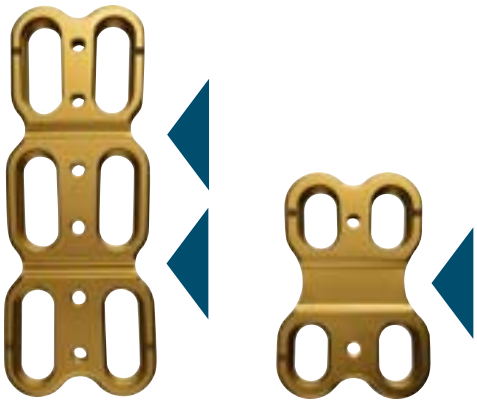


Fig. 11

Note:
To avoid damaging the ABC2 plate, only use the special ABC2 bending tool. Under no circumstances should the plate be straightened once it has been bent. Small sequential corrections are preferred since repeated bending and unbending will weaken any metallic device.

- FJ826R – ABC2 Plate Bender

Surgical Technique

D.6

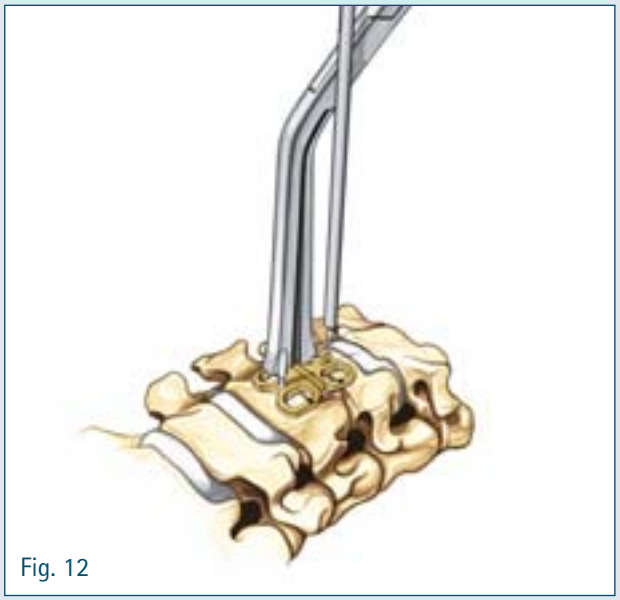


Fig. 12

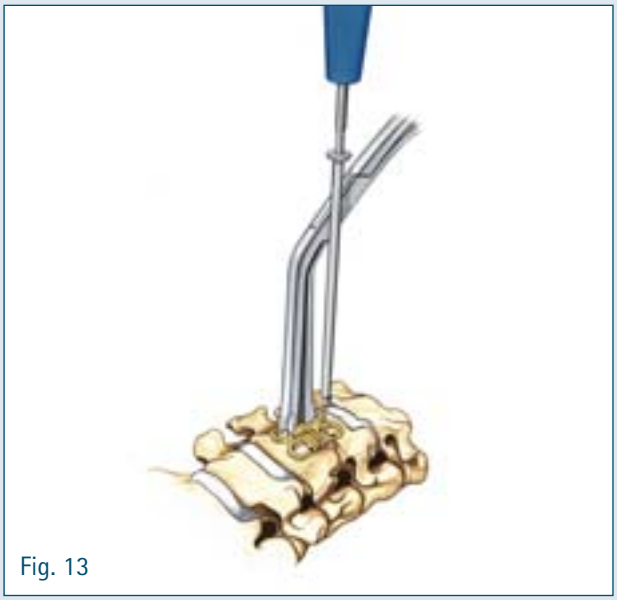


Fig. 13

Plate Positioning and Fixation

- The plate holder is used to position the plate with the endplates aligned at the marks of the plate.
- Once the plate is in its final position, set the fixation pin with a gentle mallet tap on the single pin applying tool. Repeat the process at the opposite end for the second fixation pin.
- Using the fixation pin allows optimization of screw placement because the drill guides can be angled and firmly pressed against the slots without the plate migrating during drilling.

Note:
It is strongly recommended that temporary ABC2 fixation pins are used in all cases.

Note:
To assist in vertical alignment, it may be helpful to mark the midline above and below the plate placement site.

- FJ890R – Plate holding forceps
- FJ833RS – ABC2 Plate fixation pin

Fig. 14

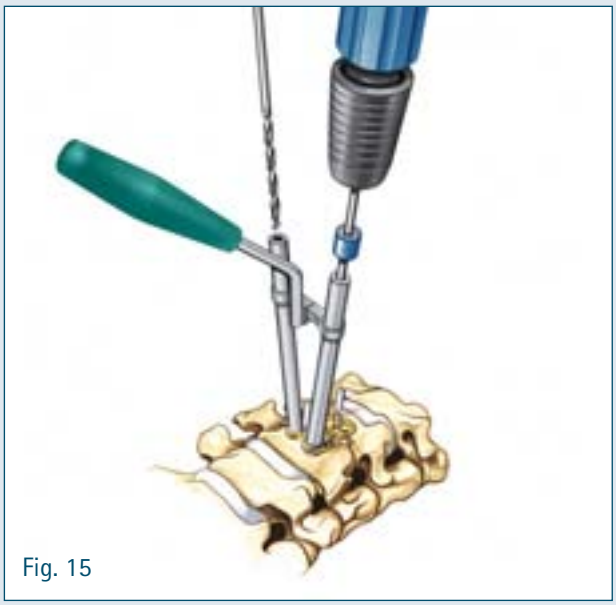


Fig. 15

Screw Hole Preparation

- The surgeon has the option to drill or to use the Awl to puncture the cortical bone.
- The adjustable drill/awl guides have calibrated barrels that allow for 1/2 mm incremental adjustments during drilling.
- The drill guides have tips and fixtures at their ends that engage the plate slots. This ensures that maximum range of longitudinal angulation is achieved without exceeding the range of which plate screw locking is possible.
- It is essential to use a drill guide. This ensures the correct centric placement of the screw holes within the plate slots and helps to ensure the activation of the self-locking mechanism. If the screw is placed off center, the segments or petals of the screw head may be deformed during screw insertion. In such a case, the locking mechanism may fail.
- In cases of hard or sclerotic bone a screw tap is available for preparing the screw hole.

Fig. 16

- Drill guide with calibrated adjustable barrel for depth control.

Fig. 17

- The direction to turn the drill barrel to adjust for more (+) or less (-) drill penetration is clearly marked on the drill guide barrels.

- FJ913R – ABC2 Bone awl
- FJ834R – ABC2 Double drill guide, fixed 14 mm

- FJ840R – ABC2 Drill bit 2.7 mm
- FJ839R – ABC2 Twist drill handle
- FJ822R – ABC2 Single drill guide, variable
- FJ823R – ABC2 Double drill guide, variable

Surgical Technique

D.8

Fig. 18

Fig. 19

Screw Placement

- The ABC2 screwdriver tip has a hexagonal shape to account for the shape of the internal locking pin. The tip fits inside the shaft of the locking pin, which drives the screw without compressing the screw head petals.
- The screw holding sleeve is used to hold the screw during initial placement. Once the screw begins to engage the bone, the sleeve should be retracted. To help stabilize the screwdriver as the screw is being placed, grasp the sleeve with one hand while rotating the screwdriver with the other.
- The screw should be placed at the most distal end of the plate slots to allow for settling and medial in central holes of multilevel plates (Fig. 19).
- During screw insertion it is important that the tip of the screwdriver remain fully inserted within and pushing down upon the locking pin. Once the screw is implanted, removal of the driver from the screw will automatically engage the internal spring to push the pin into the locked position. At this time, the surgeon should verify that the screw is locked by checking that the internal pin sits flush with the top of the screw head.
- All screws should be tightened firmly but not to excess. If inadequate screw torque is achieved with a unicortical screw, or the screw is free spinning, consider using the next longer size or rescue screw. Overtightening may result in a deformation of the screw head, which may prevent the locking mechanism from engaging.

Note:
It is recommended that each screw is fully or nearly fully tightened on insertion prior to placing the next screw. This will ensure that the screw head petals are well within the plate slot as well as easy removal of the screwdriver.
Resistance in disengaging the screwdriver from the screw head can occur when the petals have not fully entered the plate slot because they are placed in a compressed state. If resistance is encountered, tighten the screw an additional small amount to properly seat the screw within the slot. This should facilitate screwdriver removal.

- FJ910R – ABC2 Screw driver
- FJ812R – ABC2 Screw holding sheath

D.9

Fig. 20

Final Construct

Preoperative

Discharge

6 Months Postoperative

Surgical Technique

D.10

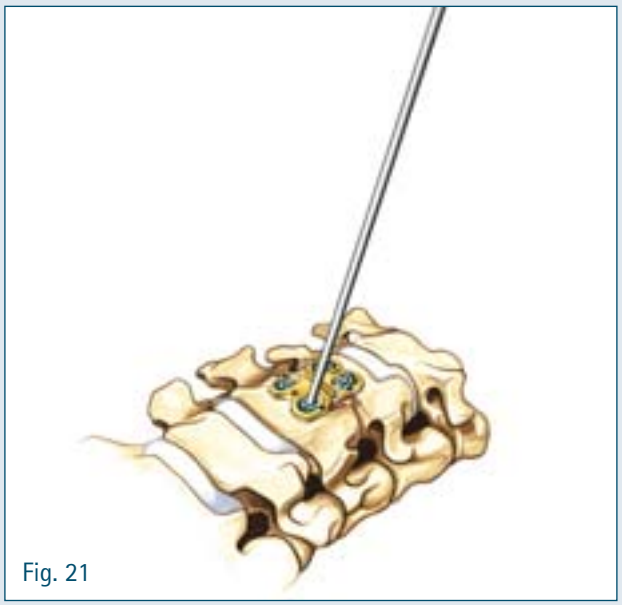


Fig. 21

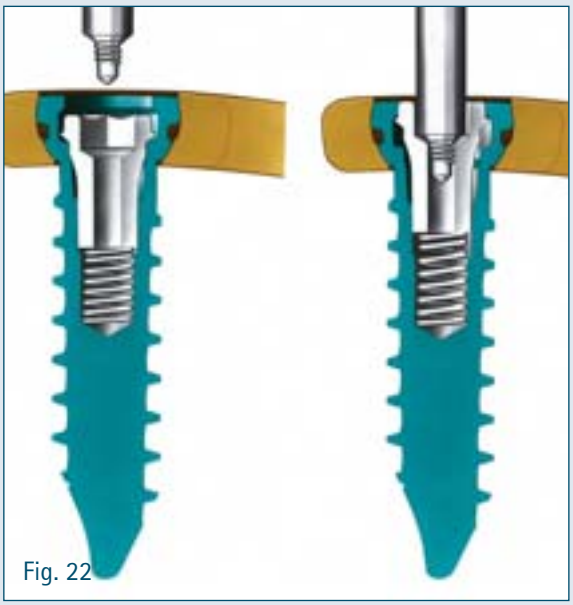


Fig. 22

Locking Assistance

If the self-locking mechanism does not engage for any reason, the ABC2 locking assistance tool can be threaded into the locking pin to manually pull the pin into the locked position.

Should it be necessary during the initial procedure to remove a screw, the screwdriver will normally suffice. If the screw has self-locked, reinsertion of the screw driver and pushing down into the pin will deactivate the locking mechanism and allow the screw to be removed.

■ FJ911R – ABC2 Locking assistance

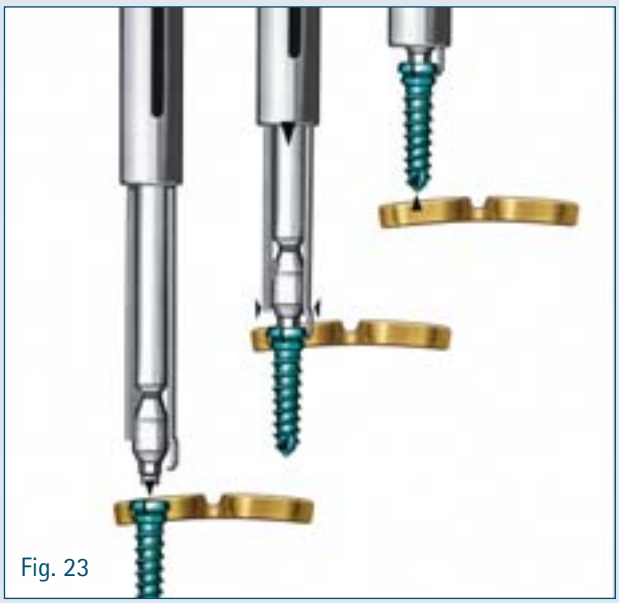


Fig. 23

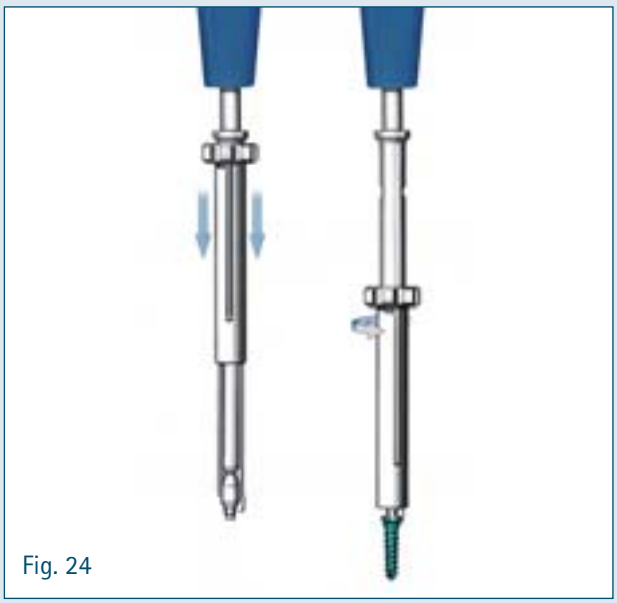


Fig. 24

Screw Removal

- If a screw is stripped and spinning within the bone, a special removal tool is available.
- The ABC2 free spinning screw removal instrument resembles the screw holding sheath and is to be used with driver FJ910R.
- First step is to pull inner and outer sheath to a retracted position, then the tip of the inner sheath is pushed toward the screw head until the sheath is grasping the screw head.
- The outer sheath should be pushed onto the inner sheath to lock onto the screw head (Fig. 24).
- The screw can be taken out by screwing counter clockwise and pulling simultaneously.
- The free spinning screw shoud be replaced with a rescue screw.

- FJ912R – ABC2 Screw-out sleeve for free spinning screw

Essential Points of the ABC2 Plating Technique

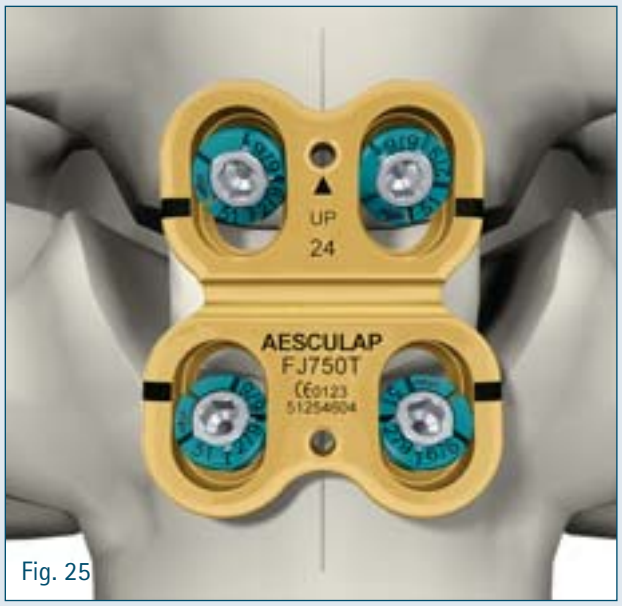


Fig. 25

- Always select the shortest possible plate. This avoids overlap over the adjacent disc spaces and allows for axial settling.
- If plate contouring is necessary, always bend in the appropriate bending zones with the supplied ABC2 bending tool. Avoid bending and unbending the plate.
- To avoid slippage of the plate during drilling and screw insertion, always use the ABC2 temporary fixation pins.
- Place awl/drill holes at the most distal ends of the outer screw slots and medial in central holes of multi-level plates.
- Use the ABC2 awl/drill guides to properly align the entry hole in a centered position within the plate slot.
- Tighten each screw fully before removing the screw-driver, avoiding overtightening.
- Ensure that the locking pin is flush with the petals.
- Remove temporary fixation pins once all the screws have been inserted.

ABC E-Plate

Fig. 26

ABC E-Plate

The ABC E-Plate works according to the same dynamic principles of the ABC2 cervical plating system. The main difference between the ABC E-Plate and the existing ABC2 plate is the adaptation flute located at the cranial and caudal end of the respective ABC E-Plates.

This flute is used to attach the E-Plate to the existing ABC2 construct. In addition, there is also a middle screw hole in the caudal plates which can be used as an extra fixation point to already fused cranial vertebra.

Ordering Information

G.1

Implants

Unicortical screws, ø 4.0 mm, blue-colored		
Art. No.	Thread length	Recommended
FJ930T	10 mm	10 pcs.
FJ931T	12 mm	10 pcs.
FJ932T	14 mm	14 pcs.
FJ933T	16 mm	14 pcs.
FJ934T	18 mm	10 pcs.

Rescue screws, ø 4.5 mm, purple-colored		
Art. No.	Thread length	Recommended
FJ941T	13 mm	6 pcs.
FJ942T	15 mm	6 pcs.
FJ943T	17 mm	6 pcs.

1-level, 4-hole		
Art. No.	Length	Recommended
FJ748T	20 mm	1 pc.
FJ749T	22 mm	1 pc.
FJ750T	24 mm	2 pcs.
FJ751T	26 mm	2 pcs.
FJ752T	28 mm	2 pcs.
FJ753T	30 mm	1 pc.
FJ754T	32 mm	1 pc.

2-level, 6-hole		
Art. No.	Length	Recommended
FJ755T	34 mm	1 pc.
FJ758T	37 mm	1 pc.
FJ759T	40 mm	2 pcs.
FJ760T	43 mm	2 pcs.
FJ761T	46 mm	2 pcs.
FJ762T	49 mm	1 pc.
FJ763T	52 mm	1 pc.
FJ764T	55 mm	1 pc.
FJ765T	58 mm	1 pc.

3-level, 8-hole		
Art. No.	Length	Recommended
FJ768T	49 mm	1 pc.
FJ769T	52 mm	1 pc.
FJ770T	55 mm	1 pc.
FJ771T	58 mm	1 pc.
FJ772T	61 mm	1 pc.
FJ773T	64 mm	1 pc.
FJ774T	67 mm	1 pc.

4-level, 10-hole		
Art. No.	Length	Optional
FJ776T	67 mm	1 pc.
FJ777T	70 mm	1 pc.
FJ778T	73 mm	1 pc.
FJ779T	76 mm	1 pc.
FJ780T	79 mm	1 pc.
FJ781T	82 mm	1 pc.
FJ782T	85 mm	1 pc.

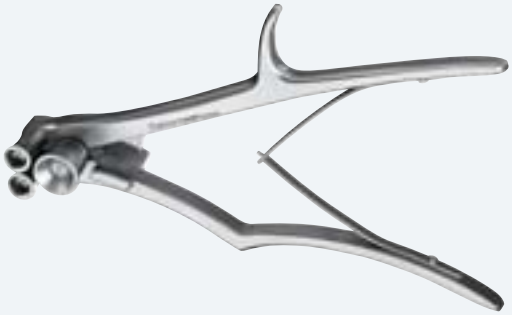
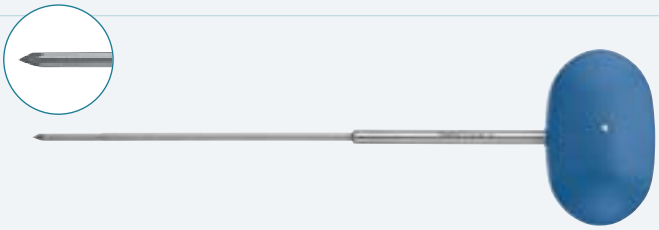
5-level, 12-hole		
Art. No.	Length	Optional
FJ783T	82 mm	1 pc.
FJ784T	85 mm	1 pc.
FJ785T	88 mm	1 pc.
FJ786T	91 mm	1 pc.
FJ787T	94 mm	1 pc.
FJ788T	97 mm	1 pc.
FJ789T	100 mm	1 pc.
FJ740T	103 mm	1 pc.

Corpectomy, 12-hole		
Art. No.	Length	Optional
FJ741T	106 mm	1 pc.
FJ742T	109 mm	1 pc.
FJ743T	112 mm	1 pc.
FJ744T	115 mm	1 pc.

Ordering Information

G.2

Instruments

		Recommended
	FJ890R ABC Plate holding forceps	1
	FJ833RS ABC2 Plate fixation pin (single sterile)	6
	FJ835R ABC2 Pin extractor	1
	FJ826R ABC2 Plate bender	1
	FJ913R ABC2 Bone awl	1
	FJ840R ABC2 Drill bit, ø 2.7 mm	1
	FJ839R ABC2 Twist drill handle	1

		Recommended
	FJ822R ABC2 Single drill guide (variable)	1
	FJ823R ABC2 Double drill guide (variable)	1
	FJ834R ABC2 Double drill guide (fixed 14 mm)	1
	FJ910R ABC2 Screw driver for selflocking screws	2
	FJ821R ABC2 Screw holding sheath	2
	FJ911R ABC2 Locking assistance	1
	FJ912R ABC2 Screw-out sleeve for free spinning screw	1
	FJ841P ABC2 Tray for implants and instruments	1

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Brochure No. 029602 0110/2/1