

AESCULAP®



Advanced
Biomechanical
Concept

AESCULAP ABC
Anterior Cervical Plating System

Surgical Technique

B | BRAUN



List of Content

Indications for Use _____	3
Introduction _____	4
Features of the ABC System _____	6
Surgical Technique _____	9
Plate Lengths Selection _____	9
Plate Contouring _____	11
Plate Positioning and Fixation _____	13
Screw Insertion _____	15
Locking Mechanism _____	28
Removal of Temporary Fixation Pins _____	32
Essential Points of the ABC Plating Technique _____	33
Clinical Examples _____	34
Additional Notes _____	35

Indications for Use

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

- degenerative disc and/or its surgical treatment
- trauma (including fractures) and
- tumors,

as well as in cases of

- cervical spondylosis
- rheumatoid instabilities
- kyphosis or other cervical spine deformities and
- re-operation for failed previous fusions.

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





Introduction

Anterior cervical plating systems are designed to augment spinal stability after trauma or surgical procedures. As such they allow the surgeon to perform the necessary surgery and then re-stabilize the spine during the period of time that bony union is being achieved. Ultimately, however, it is the bony union that confers long-term stability and any plating system, or other spinal fixation devices, will fail if such union is not achieved. Careful attention to surgical detail, including full decompression of the spinal canal and neural foramina, restoration of spinal alignment and cervical lordosis to the maximal extent possible, proper preparation of the bone graft sites, as well as selection, preparation and meticulous fitting of the bone graft are therefore necessary to optimize the outcome.

Only after all of these steps have been successfully completed is plating utilized. No plating system can compensate for inadequacies in the preceding steps.

The ABC system offers a number of advantages over previous generation anterior cervical plating systems. It has been designed to facilitate application and allows the surgeon flexibility in screw placement, angulation, and in type of screws (i.e. unicortical or bicortical or a mixture of both) as the surgeon's experience and judgment dictate. Depth and angulation of drilling can be precisely controlled as well.

A major feature of this system is in the plate-screw interface which locks the screw to the plate, preventing back-out but allows variation in screw angulation. Most importantly, the construct facilitates load sharing and avoids stress shielding of the graft.

WOLFF's law says: "Every change in the function of a bone is followed by the definitive changes in its internal architecture and secondary alterations in its external confirmation". This means that osseous tissues remodel in response to the stress placed across it.

The ABC dynamic system is designed to take advantage of this principle. By avoiding stress shielding and allowing full load sharing, earlier and more substantial graft incorporation can occur.

Unlike previous generations of anterior cervical plating devices, the ABC plate in combination with its unique locking screw, is designed to allow graft settling and to maintain axial loading on the graft. To take full advantage of this unique and very desirable feature, the surgeon must understand and use correct technique in applying the device, as detailed in this instructional brochure.



Features of the ABC System



Figure 1 ABC implant construct

The ABC system consists of anterior cervical plates in various lengths and configurations, and bone screws to affix the plate to the anterior cervical spine. All implants are made of Titanium alloy in accordance to ISO 5832-3 (Ti6Al4V),

Axial settling, which allows full load sharing capability occurs because the screws are free to settle in the plate slots (as illustrated in figure 1). The settling distance will be determined by the amount of natural bone graft resorption, rather than by being restricted by the plate screw interface.

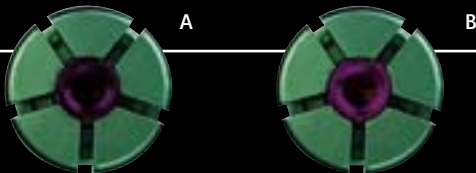


Figure 2 View onto the
fivesegmented screw head,
unlocked **A** and
locked **B** position.

The ABC screws (figure 2) have a screw head consisting of five segments ("petals") which compress (in unlocked position) on insertion so that the screw snaps into a slot on the plate. This prevents back-out, but allows for axial settling.

The design allows screw angulation of plus and minus 35 degrees in the vertical axis as well as plus and minus 8 degrees laterally and medially in the coronal axis (see figure 3).

The screws (figure 4) come three different versions

- The 4.0 mm **unicortical** versions are self-tapping and therefore pointed. For easy identification they are colored green. Unicortical screws are available in 10, 12, 14, 16 and 18 millimeter lengths.
- The 4.0 mm **bicortical** screws, which are colored blue, are also available in variable lengths in one millimeter increments from 10 to 28 millimeters. They are flat tipped to maximize thread purchase in the distal cortex without a protruding tip entering into the spinal canal.
- Additional **oversized** 4.5 mm screws are available in lengths 13, 15 and 17 mm. They serve as rescue screws in cases where one of the standard unicortical screw does not provide a firm hold (e.g. in osteoporotic bone quality) or has been over-tightened.

Please note that the detailed and latest implant range is shown on pages 8 and 9 of Aesculap's ABC brochure (to be ordered under Aesculap brochure No. 0 152 02).

The screw lengths refer to the length of the screw protruding below the plate, in other words, the actual length within the bone.

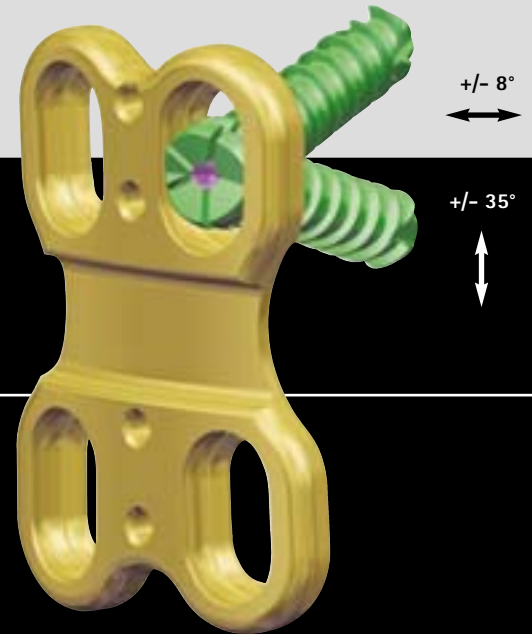
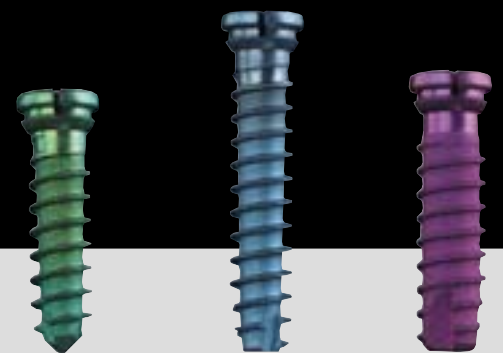


Figure 3 Range of possible screw angulation

Figure 4 The color-coding helps to distinguish the screw types



unicortical

4.0 mm

bicortical

4.0 mm

oversized

4.5 mm

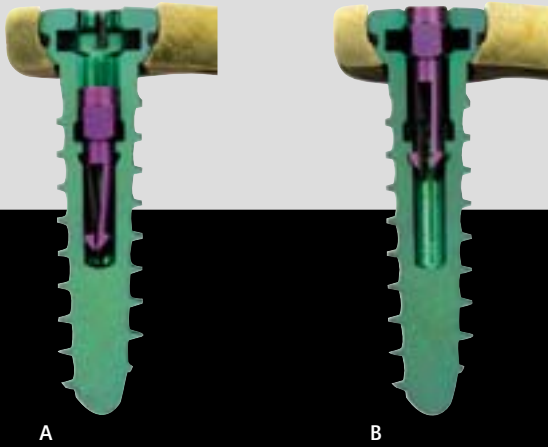


Figure 5 Cutaway views of the screw inside the plate hole in unlocked A and locked B situation of the internal locking pin.

All screws feature ABC's **unique, internal locking mechanism** which is easily activated after the screw is in its final position (figure 6b). The internal pin located within the screw is engaged by a special locking tool which pulls it up into the head of the screw (figures 5b & 6b). In this position, it prevents compression of the screw head petals, which prevents screw back-out from the plate, while still allowing settling in the slot on the plate thereby avoiding stress shielding of the graft.

All screws both at the ends of the plate and at intermittent positions (figure 7), can be locked to prevent backing out while still allowing the settling to occur.

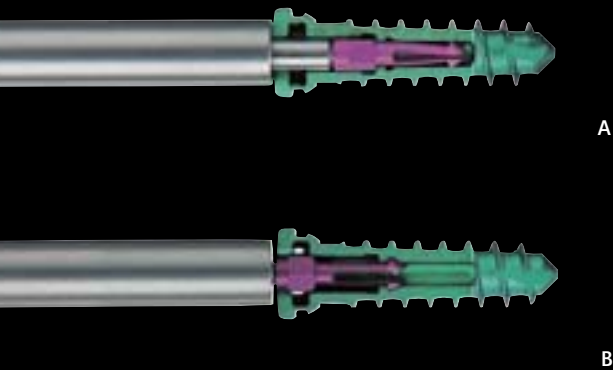


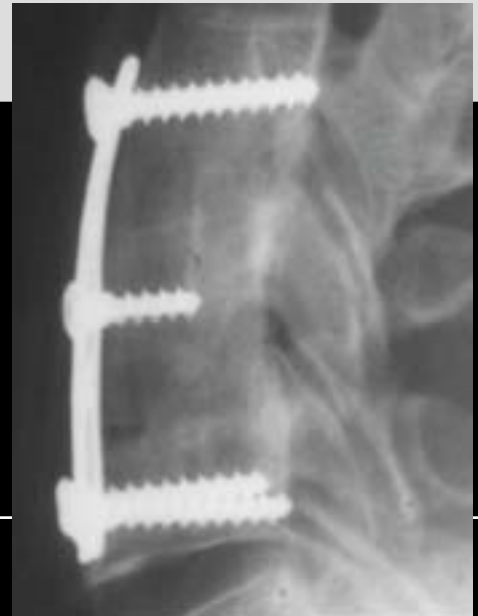
Figure 6 Cutaway view of the screw shows the internal locking pin grasped by the locking tool in unlocked A and locked B position.

Figure 7 It is possible to place screws in all effected segments. All placed screws can be locked to prevent backing out.



Surgical Technique

Patient positioning, approach, exposure, distraction, decompression and preparation of the bone graft site as well as bone graft harvesting is performed in a standard manner. The Aesculap Caspar Evolution surgical manual (Aesculap Brochure No. 015902) describes the surgical approach, distraction and bone graft harvesting procedure according to Caspar in detail.



A

Figure 8 Lateral view of two level plating cases. A first generation CASPAR plate A and an ABC plate B. **Note:** The use of a shorter ABC plate in comparable circumstances to allow for settling !



B

Practical Tip

It is suggested with the ABC system that graft height be maximized by judicious distraction because, with a dynamic plating system, several millimeters of settling will occur in response to graft loading as incorporation progresses.



Figure 9 Note: Different hole configurations in plates of the same length are available to allow for 2 and 3 level applications.

Plate Lengths Selection

Plate lengths should be chosen to encompass the area to be fixated and to allow for the aforementioned settling. **In this regard, the plate should be applied in shorter lengths than would have been utilized with previous generation systems.**

In general, use the shortest length plate possible, planning the screw entry sites in the most cephalad vertebrae near its caudal end and conversely near to the cranial end of the most caudal vertebrae (see figure 8b). This will allow for settling to occur without the plate overlapping or impinging on the adjacent (non-instrumented) interspace.

Plate lengths are available in increments of two millimeters from 20 to 34 mm and then in three millimeter increments from 34 to 103 mm to allow flexibility in their selection. The number of intervening holes also varies to allow segmental fixation when appropriate and desired.

Note that this results in some plates being available in two different hole configurations at the same lengths (for example, the 52, 55, and 58 millimeter lengths are available in both six and eight hole versions) (figure 9).

Practical Tip

In most cases, with optimal plate length selection and proper plate positioning, the upper and lower screw holes in the plate will overlap the bone graft by approximately 50 percent (see figure 8b) to allow for the dynamic settling.

Plate Contouring

The ABC plates are pre-bent to an optimal angle of cervical lordosis, but they should be further optimized to sit flush on the vertebrae without gaps and not rock when digital pressure is alternately applied to either end or side to side.

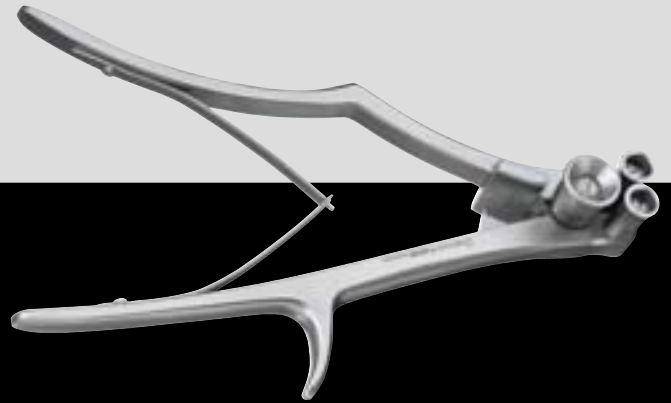


Figure 10 Bending tool FJ826R

to optimize plate configuration.

Practical Tip

To accomplish this, osteophytic ridges should be removed with rongeurs or the HiLAN high-speed drill. If necessary, a prominent bony midline keel can also be trimmed. If such bone trimming is limited in extent, it should not weaken the paramedian screw fixation sites.

A bending tool (Cat. No. FJ826R, see figure 10) is provided to increase or decrease the lordotic curvature of the plate to optimize the fit. Increased curvature is achieved by making a series of corrections along the plate in small incremental steps (see figure 12). **Bending is only allowed inside the so called bending zone of the plate** (see figure 11). A reduction of curvature can be achieved at the plate regions between the holes as indicated in figure 13.

Figure 11 Bending zones

of the plates.





Figure 12 Here bender is being used to increase lordosis of plate.

Note: Small sequential corrections should be made to avoid over-correcting since repeated bending and unbending is weakening any metallic device and therefore should be avoided.

Under no circumstances should the plate be straightened after being bent, because this would weaken the plate. **To avoid damaging the ABC plate only the special ABC bending tool should be utilized.** As already mentioned, bending is only allowed inside the so called bending zone of the plates (see figure 11).

Figure 13 Bender is being used as illustrated to reduce plate curvature.





Figure 14 Plate holder /fixation tool FJ832R applied with temporary fixation pin FJ833R

Plate Positioning and Fixation

The ABC plate fixator (see figure 14, Cat. No. FJ832R) is designed for easy manipulation of the plate and to fix it firmly in the selected position. This is accomplished without interfering with the screw placement steps by utilizing **temporary** single-use fixation pins (see figure 15, Cat. No. FJ833R) which are inserted through midline holes of the plate into the vertebrae. The "plate holder and pin applying tool" also grasps the plate allowing it to be manipulated into its final position prior to setting the pin (figure 16).



Figure 15 Temporary single-use fixation pin (Cat. No. FJ833R).



Figure 16 Plate placed onto the plate holder / fixation tool. The integrated spring mechanism enables the temporary fixation pin to be easily placed into the vertebral surface right after plate positioning through careful impacting with a small mallet. Please note to position the trapezoidal shaped plate with the smaller width towards cranial direction.



Figure 17 Single pin applying tool (Cat. No. FJ835R)

Utilizing the plate holder with the ABC fixation pin placed in the desired location, the plate is then manipulated into final position (after removing any cervical traction) and the fixation pin is set with a gentle mallet tap on the instrument. The procedure is then repeated at the opposite end of the plate. A single pin-applying tool (see figure 17, Cat. No. FJ835R) is also available and can be used in lieu of the plate positioner, particularly at the second site, if so desired. Pin site location need not be at the ends of a multilevel plate but can be placed in an intermediate position based on the anatomy and the surgeon's best judgment.

It is recommended that ABC fixation pins be used in all cases so that the plate does not move during drilling or screw insertion. This allows optimization of the screw placement as detailed below.

In most cases, with optimal plate length selection and proper plate positioning, the upper and lower screw holes in the plate will overlap the bone graft by approximately 50 percent (figure 18) to allow for the dynamic settling.

Practical Tip

It may be helpful to mark the midline above and below the plate placement site to assist in vertical alignment. This can be easily done at the time of initial spine exposure by making a small cut with the electrocautery and using a marking pen so a persistent mark remains, marking the midline when the plate is placed.

Screw Insertion

Drill Guides

Screw Placement is facilitated by the instrumentation. Both single and double barrel drill guides are available (Cat. No. FJ822R and FG823R/ figure 19). Usually the latter will be used to optimize the angle of convergence of the screws to each other. By converging them, pullout strength is greater than if a straight anterior-posterior path is chosen.



Figure 19 Single (Cat. No. FJ822R) and double barrel adjustable drill guides (Cat. No. FJ823R)



Figure 18 Note the use of a short plate (the asterisk denotes the distance between the end of the plate and the vertebral body endplate). The slots in the plate overlap the graft-vertebral body interface. The inferior end of the upper slot in the plate is marked with a long white arrow, while the graft-vertebral body interface is noted with the shorter black arrow. **Please note also that the screw are placed at the most distal ends of the plate holes.**

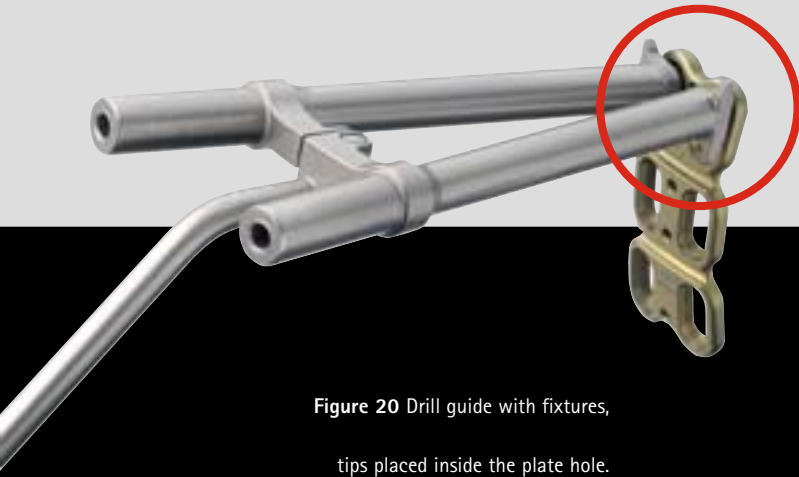


Figure 20 Drill guide with fixtures, tips placed inside the plate hole.

The drill guides have tips and fixtures on their ends which engage into the plates holes and allow placement within the full range of longitudinal angulation achievable with the system, without exceeding the range in which plate screw locking is possible (see illustrations 20 and 21).

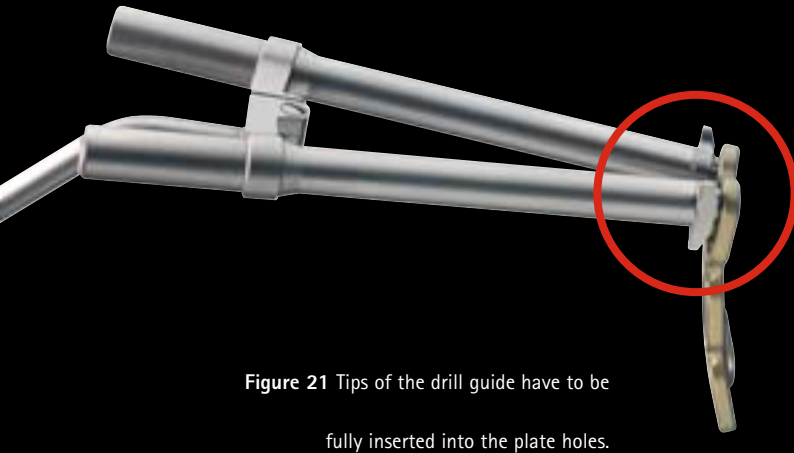


Figure 21 Tips of the drill guide have to be fully inserted into the plate holes.

Figure 22 A fixed non-adjustable drill guide (14 mm drill penetration/Cat. No. FJ834R) is also available for placement of 14 mm unicortical screws. Fourteen millimeter unicortical screws are the most used screw lengths as the average a.p. diameter of cervical vertebral bodies is about 16 - 18 mm and the screw should at least penetrate 75% of this distance to ensure a sufficient implant fixation.



For simplicity, a fixed (14 mm depth of penetration) double drill guide (see figure 22, Cat. No. FJ834R) is available for use with unicortical screws. It has a green handle to readily distinguish it from the blue handled variable drill guide. It may be used when placing screws unicortically to a depth of 12, 14, 18 or 18.4 mm, as long as the self-tapping screw remains in the central cancellous bone. If strong resistance to screw tightening is encountered, indication denser bone posteriorly, consideration should be given to drilling deeper with the adjustable depth drill guide to avoid the possibility of over torquing and breaking the screw driver.



Figure 23 The direction to turn the drill barrel to adjust for more (+) or less (-) drill penetration is clearly marked on the drill guide barrels.

For unicortical screws longer than 14 mm and bicortical screws, the drill guides have calibrated adjustable barrels (figure 23 and 24) to allow the surgeon to pre-select a drilling depth as well as to adjust depth in one-half millimeter increments as drilling proceeds. Turning the adjustable barrel counter-clockwise will increase the depth of drilling while clockwise rotation reduces it. These directions are marked on the barrel (figure 23).

Figure 24 Drill guide with calibrated adjustable barrels for depth control.

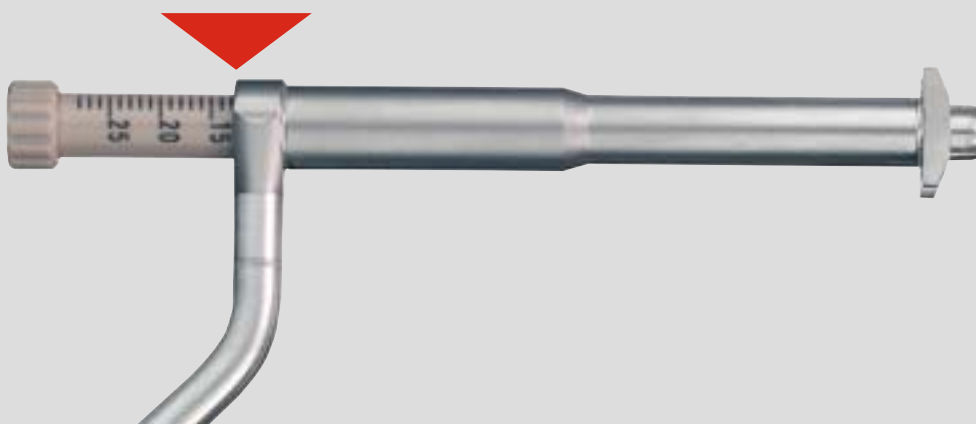




Figure 25 Correct, centric screw hole placement only achieved by using the ABC drill guides.

For safety, a reverse thread is used so that if the drill were to bind to the barrel, resulting in an altered setting, the depth of drilling would always be reduced. At each half rotation of the barrel, a click is felt and represents a one-half millimeter alteration in depth. This means one turn needs two "clicks" to adjust one millimeter. The actual depth of penetration into the vertebrae is calibrated on the barrel. This setting is used to select the screw length.

In addition, an adjustable single drill guide (Cat. No. FJ822R/figure 19) is available when only a single screw is being placed. This might be into a graft or an intervening vertebral body if the surgeon elects to use only one screw.

It is absolutely mandatory to use a drill guide!

This ensures the correct centric placement of the screw hole (respectively of the screw position) inside the plate slot (figure 25).

Through a off-centric placement of the screw the segments of the screw head get destroyed during screw insertion and the proper function of the screws is not given anymore.

Practical Tip

When utilizing two screws at any level, the double drill guide is preferable to optimize convergence screw angulation.

This correct screw hole placement is ensured by using the appropriated ABC drill guides, which have to be completely inserted into the plate hole to guaranteed the centric position (as indicated in figures 20 & 21).

Drilling

Normally, plate placement and drilling are done under fluoroscopic control to optimize selection of plate length and to optimize screw placement. Cranial and caudal screws are usually angled within the vertebrae, again increasing holding power. Their paths are carefully controlled to avoid entering the adjacent disc space (figure 28).

Please note, that the screws are placed at the most distal ends of the plate holes to enable the screw to settle inside the hole.

Drilling is performed with the ABC drill bit (Cat. No.FJ840R, diam. 2.7 mm/figure 27) driven by a micro drill hand piece (Cat. No. GD450R – with intra-connection) or manually with the ABC hand twist drill (Cat. No FJ839R/figure 26).



Figure 26 ABC hand twist drill

Figure 27 ABC drill bit, diam. 2.7, with depth stop

Driven either with a micro drill hand piece or manually with the ABC hand twist drill.



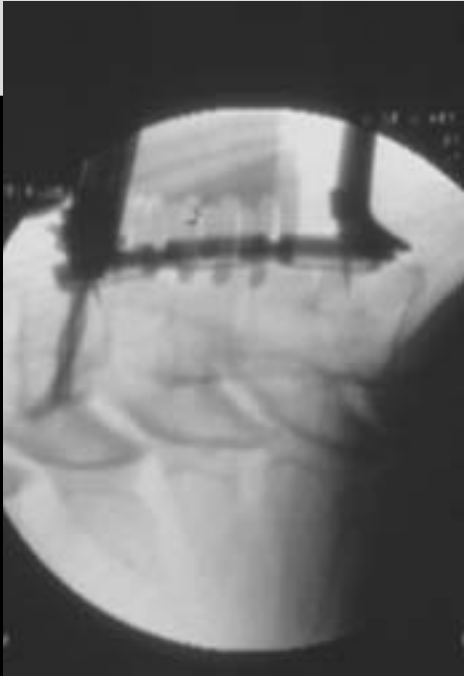


Figure 28 Fluoroscopic view of the drilling progress.

Note, the control of drill angle and depth of penetration provided by the drill guide system.

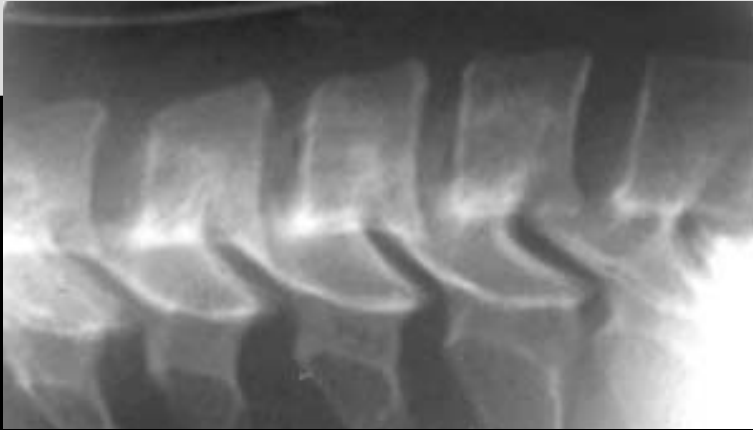
Figure 29 A/B/C Careful attention to the positioning of the fluoroscope assures the true lateral image that is necessary for accurate screw placement. The facet joints are the keys to this positioning. They should be superimposed in both an antero-posterior plane as well as a cranio-caudal one as shown in figure A. Note that in figure B they are mis-aligned in the coronal plane (rotation), while in figure C they are mis-aligned in the sagittal plane (tilt).

Practical Tip

By carefully aligning the fluoroscopic images of the facet joints of each vertebrae (figure 29 A, B & C), the surgeon can be assured that he has a true lateral image and precisely place bicortical screws by drilling the posterior cortex fully. Unwanted penetration into the canal is precluded by slowly increasing the depth of drilling on the drill guide barrel until the desired depth is achieved on the true lateral fluoroscopic image.

ABC

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A



B



C

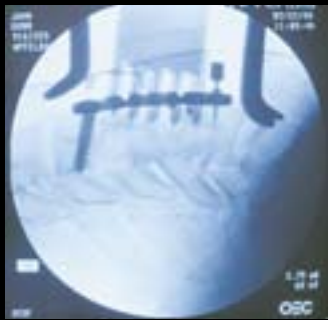
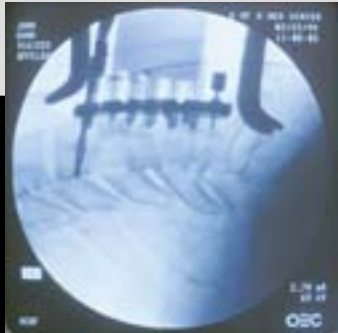


Figure 30 The storage capability of the most modern fluoroscopic unit allows ready comparison of the drilling path (top screen) and the screw insertion (bottom screen; live action) and improves precision.

Tapping

If the surgeon prefers unicortical screws, tapping is not required as the screws are self-tapping. It is often desirable, however, to tap the outer cortex for a short depth to facilitate screw insertion.

In case of bicortical screws, the holes should be tapped after they are drilled. The tap (Cat. No. FJ825R/figure 31) has a depth stop calibrated in two millimeter increments which can be set to minimize the risk of inadvertent placement of the instrument into the spinal canal. The author recommends tapping fully (including the posterior cortex) to assure firm screw engagement of the posterior cortex and avoid the screw possibly fracturing the bone in that location. This must be done under fluoroscopic control as tactile feedback when tapping is inadequate to determine the depth safely. Again, care must be taken that one has true lateral images.

Practical Tip

Storing the fluoroscopic images as each hole is drilled allows matching the trajectory of the subsequent tapping and screw placement by comparing the live image with the stored one (figure 30).

Screw Placement

The correct screw length is selected based on the depth information obtained during drilling. For unicortical screws, it is recommended that the selected length traverse at least 75 percent of vertebral body depth.

The tip of the ABC screw driver (Cat. No. FJ838R/figure 32) is a pentagonal design to account for the ABC screws' five screw head segments (petals). Unlike some screw drivers, the device fits inside of the shaft of the screws to allow turning the screw without placing stress on these screw head petals.

It is important, that the screw driver's tip be fully inserted into the screw, prior to placing it in the bone and kept fully inserted as the screw advances (figure 33). Failure to do so can result in breakage of one or more screw petals and necessitate replacing the screw.



Figure 31 Views of the ABC tap (Cat. No. FJ825R) showing the depth stop mechanism. It is preset based on the depth of drilling. Fluoroscopic guidance is used as well as to assure its safe implementation.

Figure 32 ABC screw driver (Cat. No. FJ838R) with tungsten carbide working tip.

Another useful technique is to leave the first drill in place when drilling the second hole. This reduces bleeding from the hole and provides an aiming path for the second drill placement both visually and fluoroscopically.



Figure 33 Correct placement of the screw driver into the screw.

Figure 34 Incorrect placement of the screw driver into the screw.

Figure 33/34 The screw driver needs to be fully inserted into the screw head to firmly engage with the pentagonal socket inside of the screw and to avoid breaking of the petal of the screw.

Figure 35 Screw grasping and holding sheath (Cat. No. FJ821R) to be used in conjunction with the ABC screw driver (Cat. No. FJ838R).

By insertion of the screw driver onto the screw head, the locking mechanism is automatically released by pushing down of the locking pin. Please note, all screws are supplied in locked position with the internal pin in full up position. This ensures that the locking pin is not in a compressed state and preserves the original function of the mechanism. If a screw is unlocked by inserting the screw driver and not implanted immediately, please ensure it is locked before storing.

A screw grasping sleeve (Cat. No. FJ821R/figure 35) on the screw driver helps to hold the screw. Once the screw begins to engage the bone, this can be retracted. Holding this sleeve with one hand while rotation and advancing the screw with the other, helps stabilising the screw driver as the screw is being placed (as illustrated in figure 36). This ensures to avoid levering movements during screw insertion, which could unnecessarily bent the screw driver tip.

Screw should be tightened firmly but not to excess. If inadequate screw torque is achieved with a unicortical screw and subsequently the screw is freely spinning, consider using the next longer size if feasible (additional





drilling will usually not be required) or converting to a bicortical construct (in which case additional drilling may be required). Oversized 4.5 mm screws are also available in 13, 15, and 17 millimeter lengths if needed.

It is recommended that each screw be fully or nearly fully tightened on insertion prior to placing the next screw. This will assure that the petals of the screw head are well within the plate. Resistance in disengaging the screw driver from the screw head could occur when the petals are just entering the plate can leave them in a compressed position. This can make reinserting the screw driver also difficult. **Indeed, resistance to removal of the screw driver may be felt if the screw is not fully seated due to this compression effect. Thus, if difficulty removing the screw driver is encountered, tightening the screw an additional small amount often will seat it deeper and facilitate screw driver removal** (see illustrations in figure 37). After the screws are inserted at each end, the locking mechanism is engaged and the procedure repeated at the opposite end of the plate. Finally, intervening levels are also fixated in a similar manner. Alternatively, all screws can be placed and then subsequently locked.

Figure 36 Guiding and stabilising the screw driver by fixing the screw holding sheath avoids levering movements during screw insertion. Levering movements with the screw driver could bent the instrument, which could unnecessarily bent the screw or break the screw driver's tip.

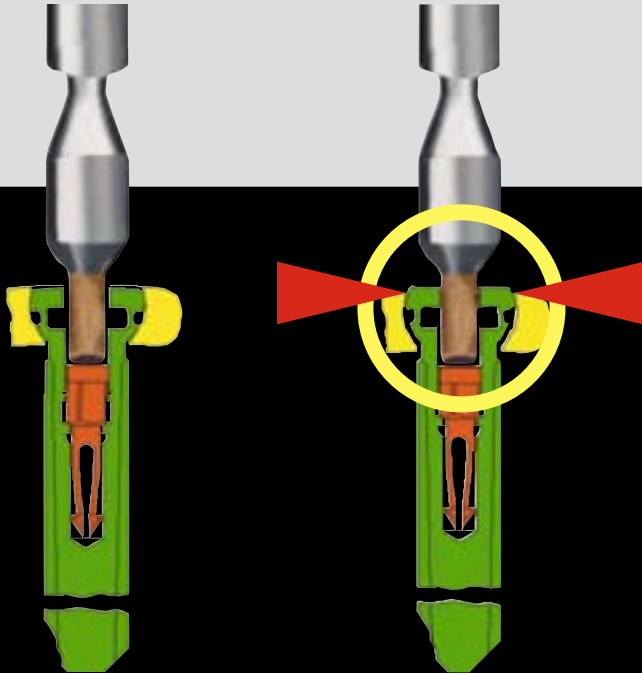


Figure 37 Left: Fully inserted screws Right: Not completely inserted screws. This leaves the petal of the screw head in compressed position and makes it difficult to remove the screw driver. Thus, if difficulties removing the screw driver is encountered, tightening the screw an additional small amount, often will seat it deeper and facilitate screw driver removal.

Screw Removal

Should it be necessary to remove a screw, the screw driver will normally suffice. Even if the locking pin is already engaged, the screw driver will re-position it and function normally.

However, if a screw is stripped and is spinning with the bone and not developing significant friction to be propelled out of the plate, a special removal tool (Cat. No. FJ829R/figure 38) is available.

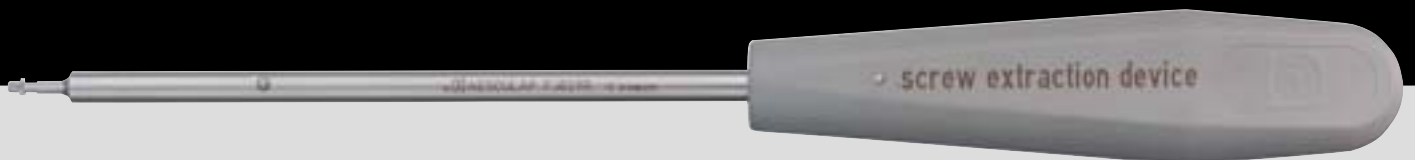


Figure 38 Screw extraction instrument
(Cat. No. FJ829R) – for removal of free
spinning screws only!

Caution

This device visibly resembles the screw driver, however it has a different color handle (gray) to distinguish it and will not accept the screw holding sheath. It should not be used as a screw driver as it may break if subjected to too much torque. It has five small protrusions (tabs) at the distal end (see figure 39) which will fit under the screw head petals and allow traction to be applied on the screw as the screw is unthreaded and withdrawn from the plate.



Figure 39 Tip of the screw removal tool that is only used in the circumstances of a screw that is spinning and can't be backed out of the plate.

To be used effectively, it must be seated within the screw and counter-rotated while blocking the screw's rotation to set the tabs before exerting counter-traction (figure 40). To release it from the screw, rotate it a small distance while restraining the screw to allow the tabs to disengage before pulling the instrument out of the screw.

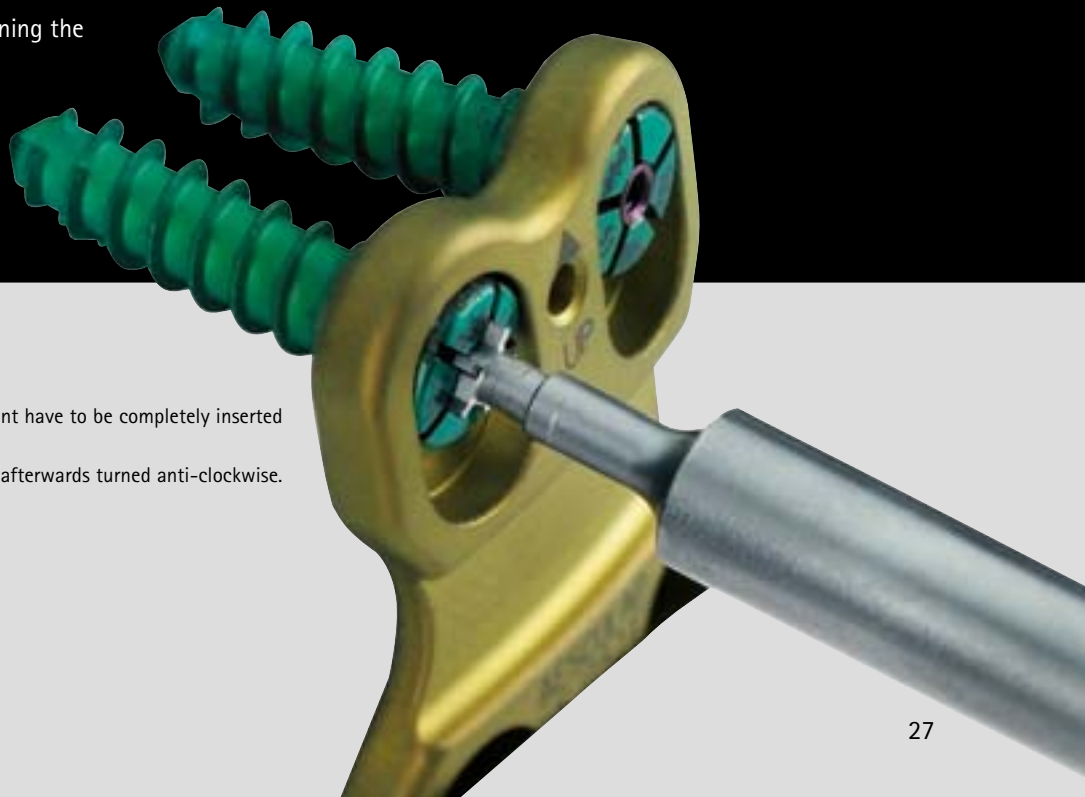


Figure 40 The 5 "tabs" of the screw removal instrument have to be completely inserted through the "grooves" of the screws head and afterwards turned anti-clockwise.

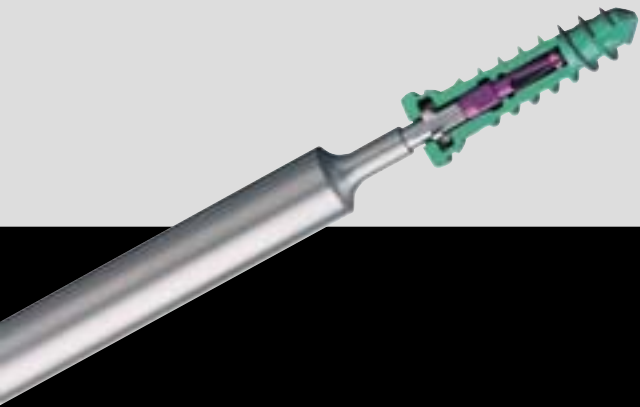


Figure 41 The tabs are positioned below the petals of the screw head allowing the screw to be turned counter-clockwise while exerting firm extraction pressure. This will allow the screw to be gently pulled out of the plate.

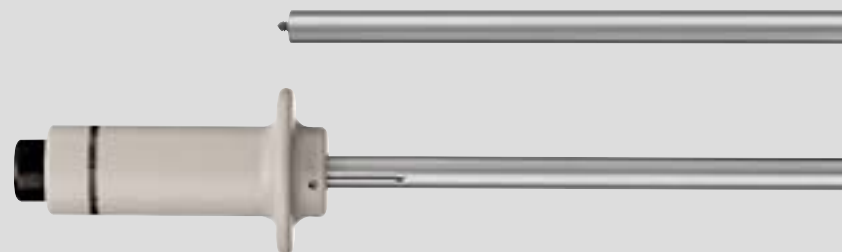
Again, two points should be emphasized

- 1 The removal tool is for the special circumstance of extracting a freely spinning screw. The regular screw driver should be used to remove most screws and will function well in this regard in most situations.
- 2 Both the removal tool and the screw driver need to be fully inserted into the screw to avoid break-off of the petal from the screw.

Locking Mechanism

The locking mechanism is activated in each screw with the screw locking instrument (Cat. No. FJ828R/figure 42).

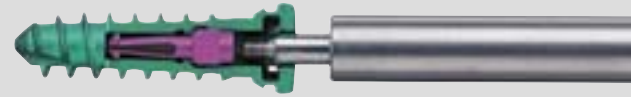
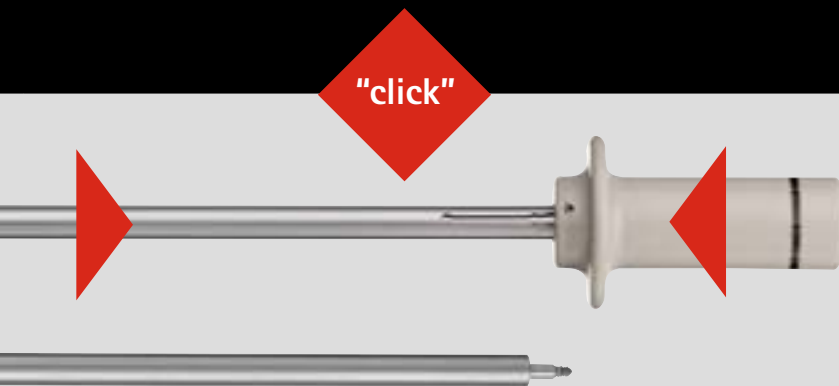
Figure 42 ABC locking tool (Cat. No. FJ828R)
with fully extended internal shaft.



The internal shaft of the device is extended by grasping the instrument below the grey collar and pushing the grey collar toward the tip until a snap or click is felt. This fully extends the internal shaft, which is threaded at its tip (figure 43). Later this tip goes into the inner thread of the internal locking pin inside the screw.

The device should then be **inserted fully into** each screw head and rotated until the threaded tip engages the internal locking pin (figures 44 A & B).

It takes about three or four turns, until the mechanism is fully engaged. Failure to engage the pin is usually due to either a failure to fully extend the internal shaft of the device or not being coaxial within the screw (see figure 45). Pressing firmly on the gray collar of the device, not the black top, while aligning the shaft as precisely as possible with the long axis of the screw facilitates engagement of the pin.



A



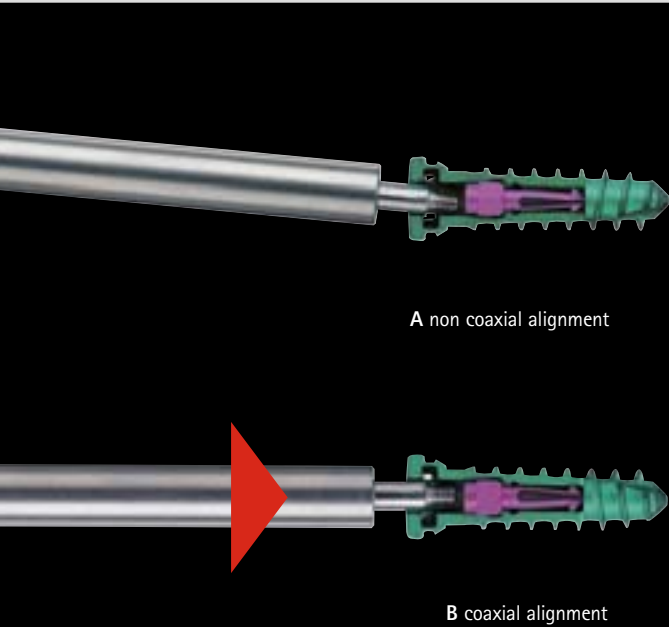
B



C

Figure 44 Cutaway view of the screw shows the internal locking pin and the locking tool in not yet grasped **A**, grasped by the locking tool in unlocked **B** and locked **C** position.

Figure 43 To extend the inner shaft of the instrument by grasping the instrument at the grey collar and below the grey collar at the outer shaft and pushing the grey collar toward the tip until a snap or click is felt.



A non coaxial alignment

B coaxial alignment

Because locking is accomplished coaxial with the screw, the same angle of screw insertion is replicated in the locking procedure and this is easily done even at the extreme portions of the plate. As it is inserted fully into the screw, the shaft length helps align the threaded tip with the threads in the internal locking pin.

This is a unique mechanism which may take a bit of practice to become familiar with and adept at using. A common technical problem can be difficulty engaging the locking tool in the internal locking pin. This may be caused by not fully extending the internal shaft until a click is heard, or by grasping the tool by the top cap and thereby inadvertently partially retracting the shaft when attempting to insert it.

Figure 45 Holding by collar only and push tool firmly into screw head align it **coaxial B** with the screw until seated.

Once the device is engaged into the pin, pushing on the top black cap while pulling up on the collar (place thumb on top – two fingers under collar) quickly sets the pin (figure 46).

Figure 46 Compression between thumb and fingers sets the internal locking part of the locking instrument FJ828R.



Practical Tip

It is best to hold it by the gray handle to position and then rotate the collar while pushing down slightly to set the threads. Gentleness allows feeling the threads engage. It is not necessary to excessively tighten the device. Stop turning once it is fully threaded and resistance to turning occurs. With a little practice, it becomes second nature and is easily and reliably accomplished. As the locking tool enters the locking pin with the screw, a snap may be felt if pressure is applied firmly on the collar of the locking tool. This indicates proper alignment.



Figure 47 Plate in position with the screws locked. The purple internal locking pin is now flush with the top of the screw and provides a visual confirmation of successful positioning of the locking pin.

The device should then be unscrewed from the pin. Confirmation of proper locking is obtained visually by noting the purple top of the locking pin flush within the screw head (see figure 47).

With a little practice, locking of each screw can be easily and reliably accomplished and requires only a brief period of time (usually about 10 to 15 seconds) per screw.

Should screw removal or re-positioning be necessary, inserting the screw driver into the screw will depress the pin to the unlocked position. The screws are shipped with the internal locking pin in the up or locked position. Insertion of the screw driver automatically pushes the pin down to the unlocked position.

Removal of Temporary Fixation Pins

After completing the bone screw placement at the end of the plate and any desired intermediate levels, as well as into any strut grafts if desired, the temporary fixation pins are removed with the single pin-applying tool (Cat. No. FJ835R).

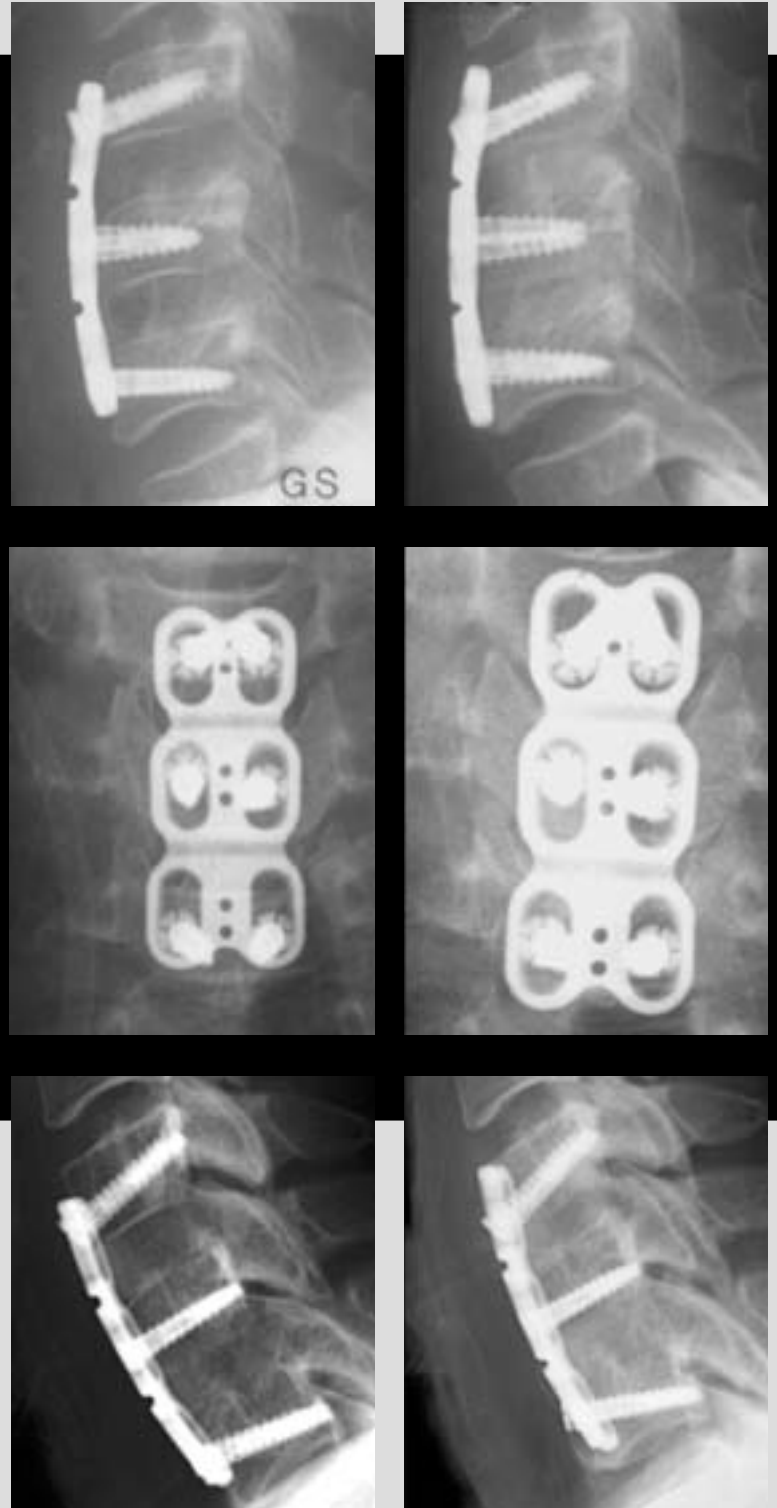
Essential Points of the ABC Plating Technique

- ◆ Select a shorter plate than with other systems to allow for settling avoiding impingement towards the adjacent segments.
- ◆ When it is necessary to change the contour of the plate, always use the supplied ABC bending tool and avoid bending and then unbending the plate. Bending is only performed through the appropriated bending zone
- ◆ Use ABC temporary fixation pins to hold plate in position while drilling and insertion screws to avoid slippage of the plate.
- ◆ Place drill holes at the most distal ends of the screw slot.
- ◆ Use ABC drill guides to place the drill hole in centric position inside the plate hole.
- ◆ Tighten each screw fully or near fully in place before removing screw driver in order to avoid crimping of the head and possible screw damage.
- ◆ Engage internal locking pins after screw tightening to lock screw head with plate slot
- ◆ Before engaging the locking pin with the appropriated locking instrument, extend the internal shaft of the device by grasping the instrument below the gray collar and pushing the gray collar toward the tip until a snap or click is felt.
- ◆ Remove temporary fixation pins.
- ◆ **Attention** should be paid to screws stored in the system tray; they should always be stored in locked position to ensure that they will function properly.



Clinical Example

Figure 48 Examples of unicortical and bicortical plating with the ABC system. Note the amount of settling allowed by the plate over the initial first three post-operative months as evidence by the shift in position of the screws from the distal ends of the plate slots. Associated with this is migration of the plates closer to the ends of the vertebral bodies. Also note the very mature appearing fusions, even at this early interval, which occurs due to load sharing capability of the ABC system. Both patients were grafted with allograft iliac crest bone.



Important Additional Notes

The ABC screws and the corresponding screw driver have a unique five-sided (pentagonal) configuration.

A patient information card is available to give to patients, should they require future surgery that might include removal of the ABC plate and screws. This card advises their surgeon how to contact Aesculap to obtain a screw driver and removal tool, if they were to need such surgery at a facility that did not have the ABC system. In such a case, Aesculap will quickly make these tools available to their surgeon.

Warning

This device System is not approved for screw attachment or fixation to the posterior element (pedicles) of the cervical, thoracic or lumbar spine. This device system has labeling limitations. See package insert for further information.

Caution

Federal Law (USA) restricts this device System for sale by or on the order of a physician.

B | BRAUN

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