Percutaneous transarticular screw fixation

C1/C2 Access System

Surgical Technique

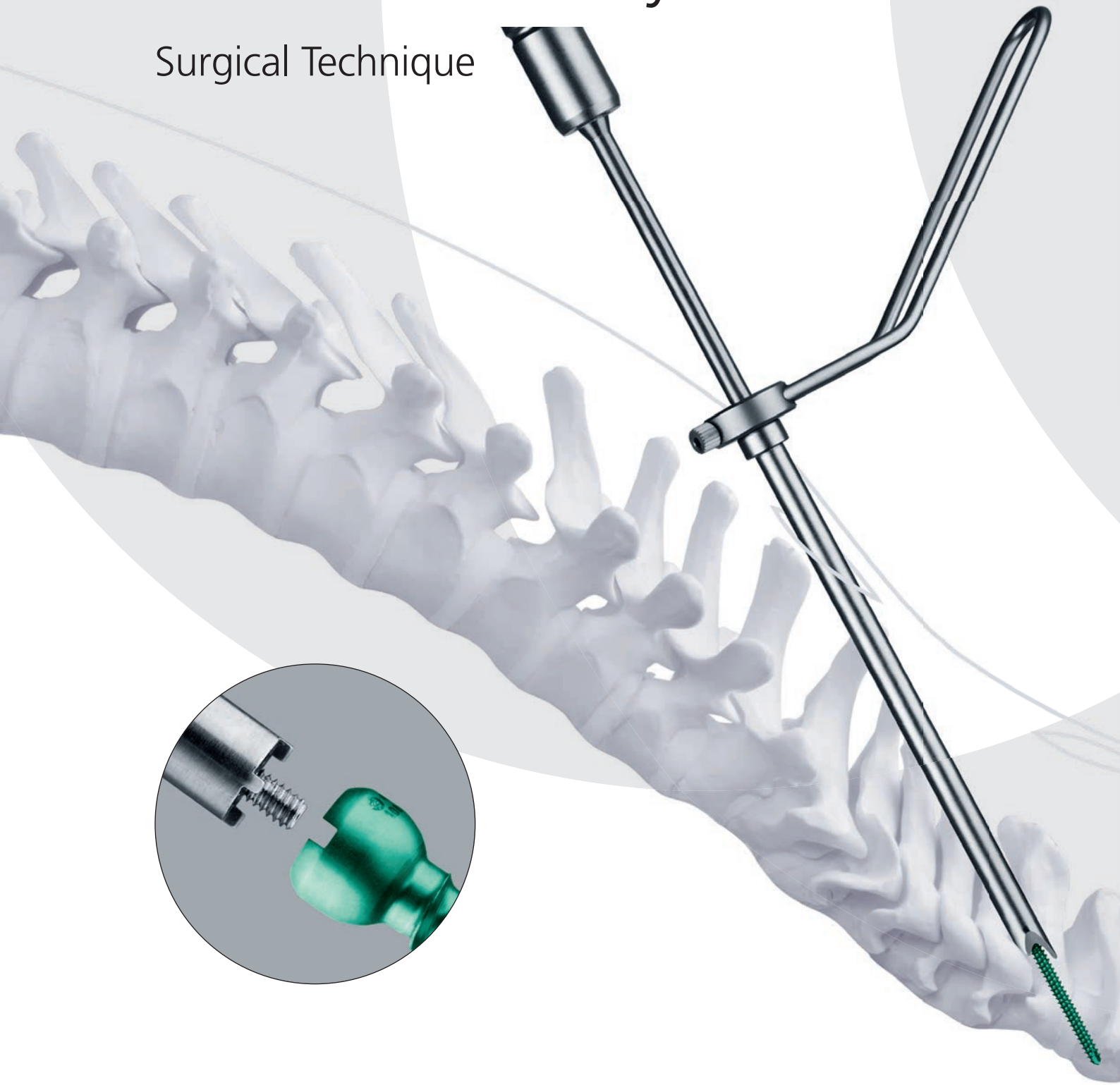

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Image intensifier control

This description alone does not provide sufficient background for direct use of DePuy Synthes products. Instruction by a surgeon experienced in handling these products is highly recommended.

Processing, Reprocessing, Care and Maintenance
For general guidelines, function control and dismantling of multi-part instruments, as well as processing guidelines for implants, please contact your local sales representative or refer to:
http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance
For general information about reprocessing, care and maintenance of Synthes reusable devices, instrument trays and cases, as well as processing of Synthes non-sterile implants, please consult the Important Information leaflet (SE_023827) or refer to:
http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance

Table of Contents

General Introduction

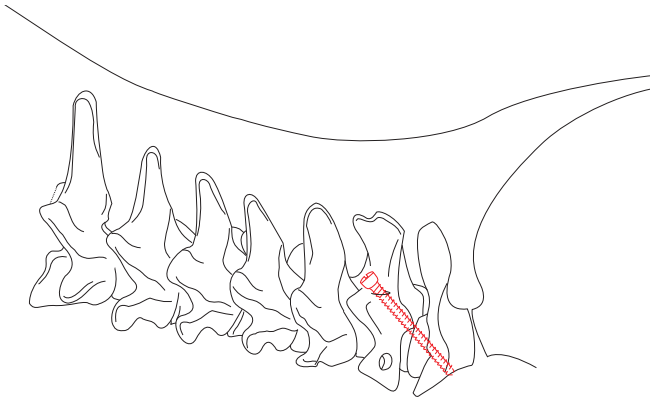
General Introduction

The instrumentation for the percutaneous transarticular screw fixation of C1/C2 is intended for transarticular screw fixation.

The C1/C2 Access System has to be used with an image intensifier. The image intensifier-assisted technique is presented on the following pages.

The self-tapping Cortex Screw ∅ 3.5 mm (497.002–008) used as a stand-alone screw (1).

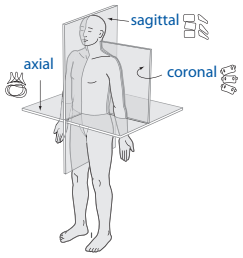
1



AO Spine Principles

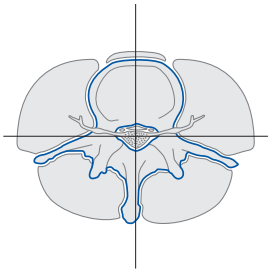
The four principles to be considered as the foundation for proper spine patient management underpin the design and delivery of the Curriculum: Stability – Alignment – Biology – Function.[1,2]

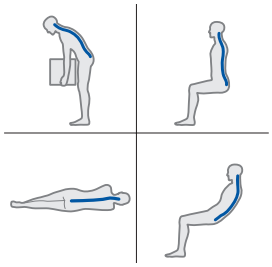
Stability
Stabilization to achieve a specific therapeutic outcome



Alignment
Balancing the spine in three dimensions

Biology
Etiology, pathogenesis, neural protection, and tissue healing





Function
Preservations and restoration of function to prevent disability

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

Indications/Contraindications

Intended Use
Minimal invasive percutaneous transarticular screw fixation of C1/C2.

Indications
- Traumatic and post-traumatic instability of C1/C2
- Pedicle screw fixation according to Judet
- Rheumatoid arthritis and degenerative arthrosis
- Congenital anomalies
- Infections/tumours

Contraindications
Screw fixation should not be performed if the anatomical situation does not permit stabilisation with screws, as in:
- Destruction of the lateral mass of C1 and/or C2
- Excessively narrow isthmus (Pars interarticularis) of C2 (< 6 mm)
- Pronounced cervicothoracic kyphosis

It is also contraindicated in cases of inadequate intraoperative reduction of C1 in relation to C2, with an atlantodental interval > 8 mm.

Image Intensifier-assisted Technique

1. Preoperative planning

A meticulous preoperative assessment of the anatomical situation using CT images is essential for determining screw position.

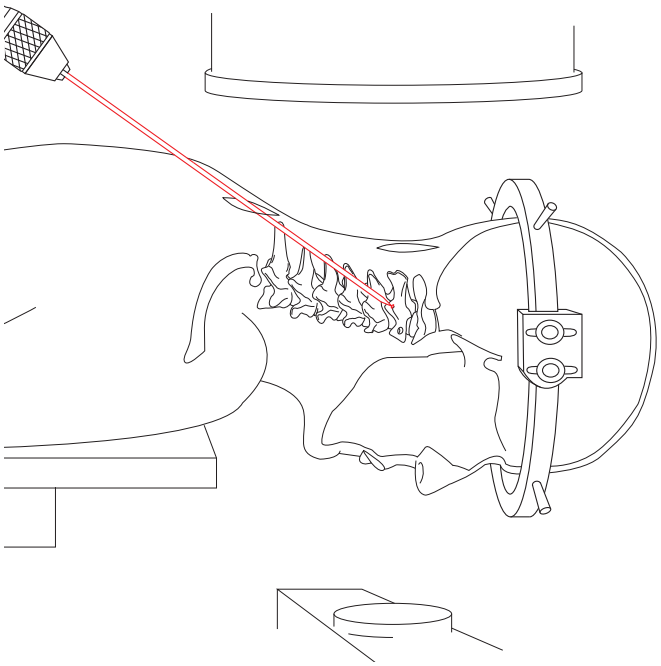
2. Reduction and access preparation

Preoperative reduction of C1/C2, using e.g. a Mayfield clamp, is recommended.

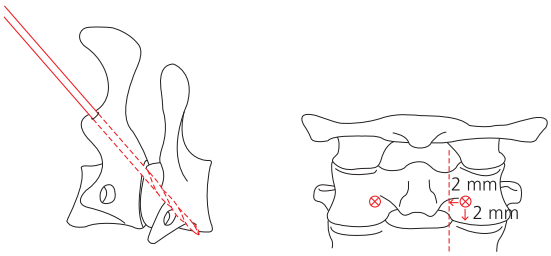
The access is designed to expose the lamina and spinous process of C2 and the posterior arch of the atlas.

3. Establish percutaneous access for transarticular C1/C2 screw fixation and screw position

Establish the percutaneous access under image intensifier using a Kirschner Wire ∅ 3.2 mm (292.451). The Kirschner Wire can be inserted manually with the universal chuck with T-handle (393.100).

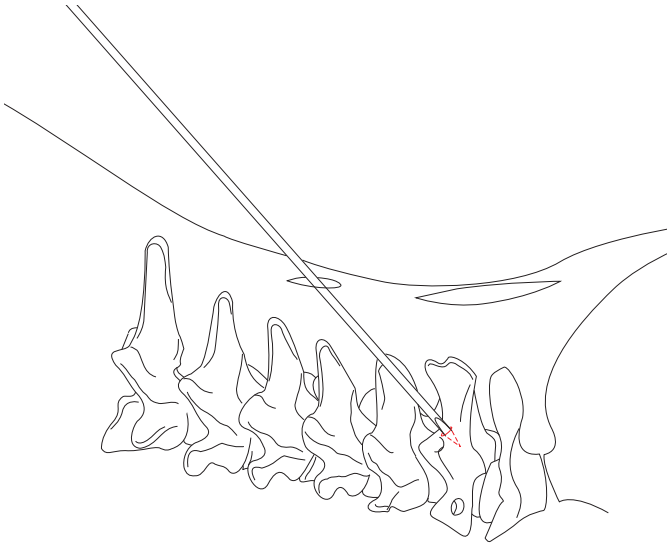


The entry point for the cortex screw is located on the straight sagittal line passing medially through the crest of the isthmus, at the lower border of the lamina of C2, approximately 2 mm cranial and lateral from the medial edge of the caudal articular process of C2. The planned screw channel is in the sagittal direction, pointing straight forwards and towards the medial section of the isthmus.[1]



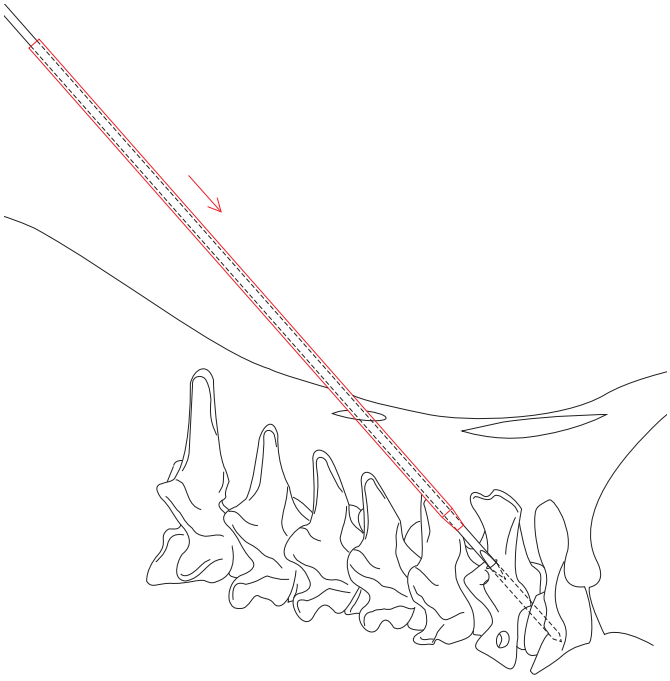
4. Prepare entry point for drill bit

Using the tip of the Kirschner Wire, prepare the entry point on the bone so as to prevent slippage of the subsequently used Drill Bit ∅ 2.5 mm (387.013) on the sloping bone surface.



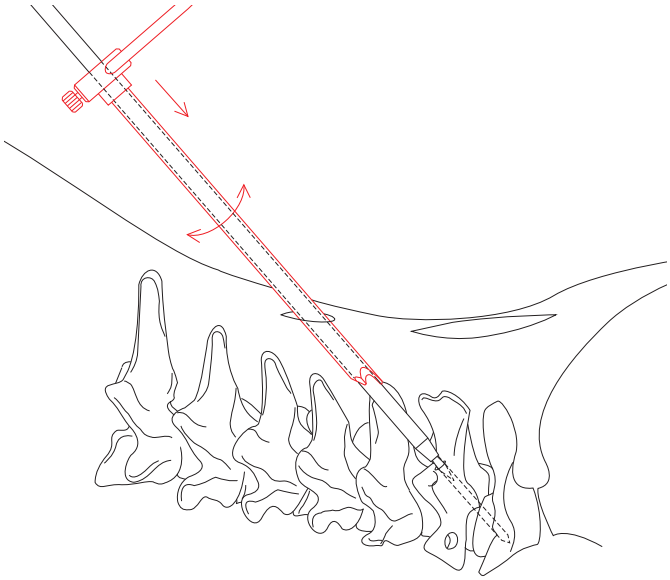
5. Widen soft tissue access and insert guide sleeve 6.0/3.2

To widen the soft tissue access and insert the Protection Sleeve 8.0/6.0 (387.017), advance the Guide Sleeve 6.0/3.2 (387.011) over the Kirschner Wire.



6. Insert protection sleeve

Slide the protection sleeve 8.0/6.0 over the guide sleeve and, with rotating movements, advance through the soft tissue as far as C2.

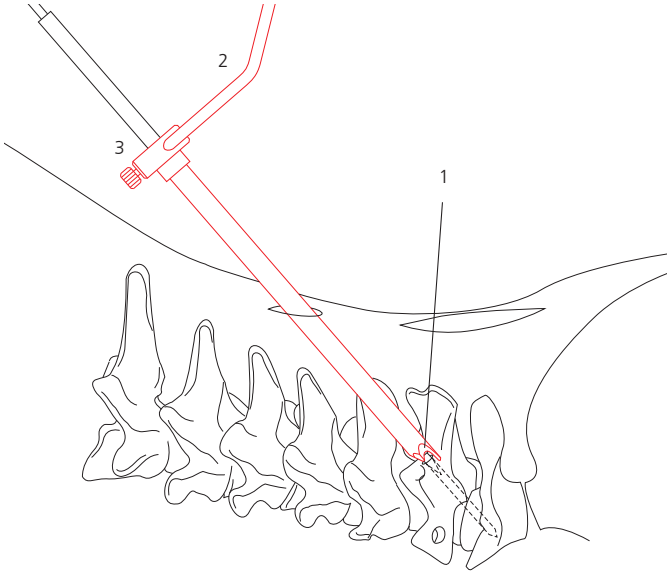


Locate the protection sleeve 8.0/6.0 with its sloping surface in the planned screw direction against the lamina of C2 (1).

After positioning the protection sleeve, remove the Kirschner Wire and guide sleeve.

Note: **When advancing the guide sleeve and the protection sleeve, take care to ensure that the Kirschner Wire does not become dislocated and penetrate the spinal canal.**

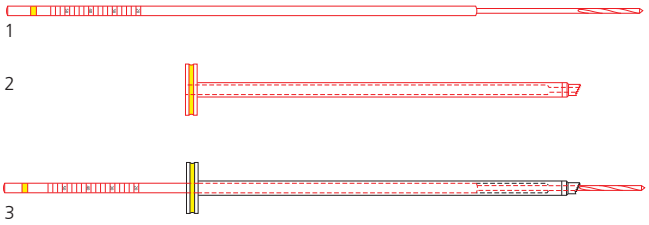
For better handling, the handle (2) of the protection sleeve can be readjusted by loosening the screw (3).



7. Create screw channel

To create the screw channel, use the drill bit ∅ 2.5 mm (387.013S) (1) with Guide Sleeve 6.0/2.5 (387.014) (2) (both marked yellow), since the latter guides the cutting part of the drill (3) and ensures close contact with the bone. This reduces the risk of bending at the transition between bone and guide sleeve (4).

Note: **If the drill bit cannot be held in straight alignment with its axis, significant leverage can be exerted on the long bit by the drill unit and the drag of the air-hose. This potentially causes the bit to bend, particularly at the transition between the bone and the protection/guide sleeve.**



The drill bit can break if

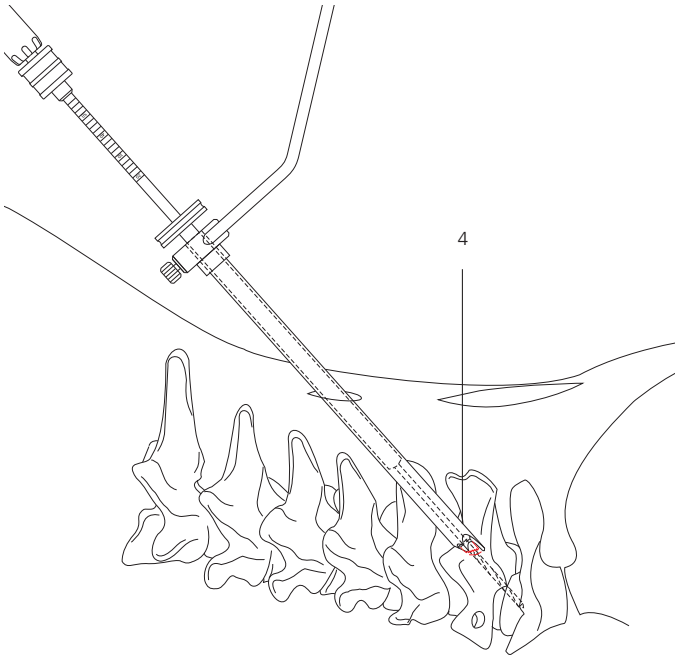
- it is bent excessively or repeatedly and/or
- it is bent and, simultaneously, a high torque is applied to the bit via the drill unit.

Consequently, the drill bit is to be used only with a drill unit with a continuously variable and manually adjustable rotational speed. Synthes recommends the Electric Pen Drive 60 000 rpm (05.001.010) or the Air Pen Drive 60 000 rpm (05.001.080). Optional, the Colibri II (532.101) or the Compact Air Drive II (511.701) can be used.

For reasons of safety and accuracy during drilling, and given the risk of fracture through possible repeated bending stresses, the drill bit is designed for single use only.

Once the drill bit is already in the bone, it is no longer possible to change the direction of drilling. An attempt to realign the drill will lead to bending of the free portion of the bit and excessive mechanical loading.

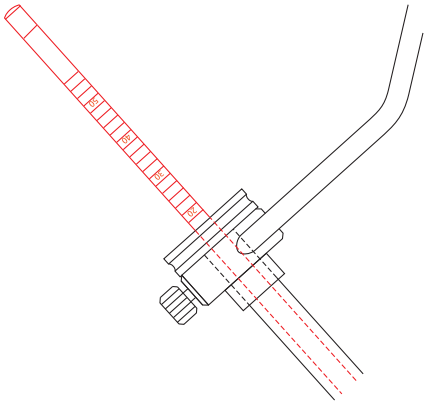
The direction of drill can therefore be changed only if the drill bit is repositioned.



8. Determine screw length

The drill bit is provided with markings, allowing comparison of the required screw length with the drill depth determined using the image intensifier. To avoid any misinterpretation, the guide sleeve 6.0/2.5 of the drill bit must rest against the bone.

Note: **The length stated in the article description for Cortex Screws (497.002–008) and marked on the drill bit and tap covers the whole screw length (shaft and head).**

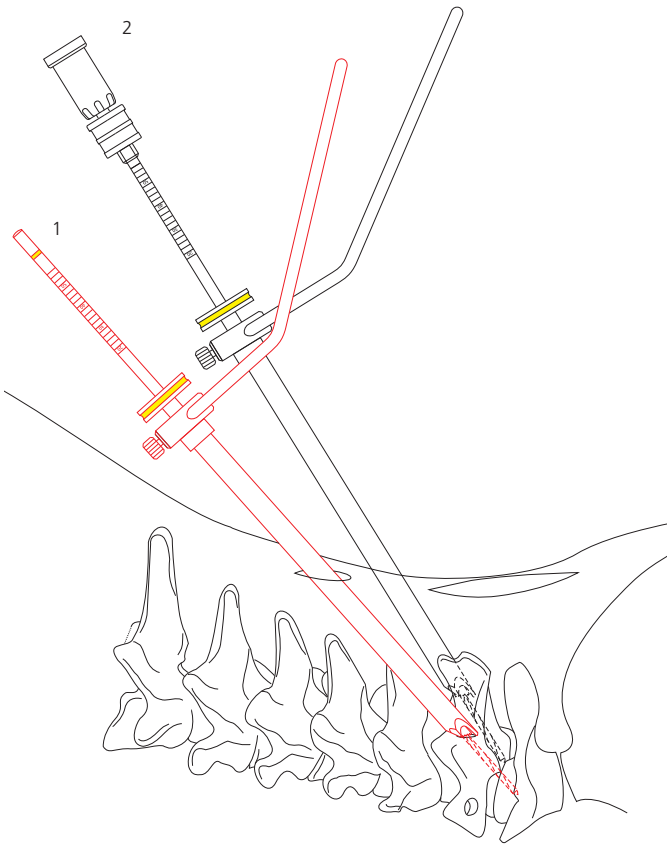


Option

Secure reduction

To secure the reduction according to the technique of Jeanneret and Magerl[3], the drill bit and the protection sleeve can be left in position (1) until the transarticular screw fixation has been completed on the contralateral side (2).

In this case, repeat steps 3 to 8 on the contralateral side of C1/C2 and perform the stabilisation as described in sections 9 to 11.

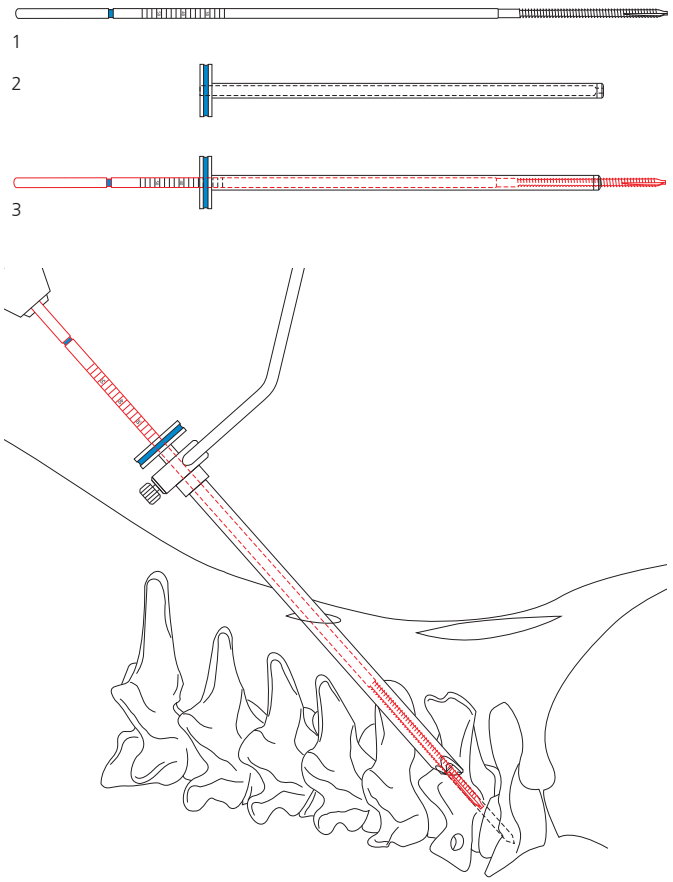


9. Tap thread

If the bone is sclerotic, the thread should be tapped beforehand. Use the Tap ∅ 3.5 mm (387.015) (1) with Guide Sleeve 6.0/3.5 (387.016) (2) (both marked blue) and connect to the universal chuck with T-handle (393.100). This sleeve guides the tap in the protection sleeve and provides additional stability in the tapped section (3).

Check the position of the tap during tapping under the image intensifier.

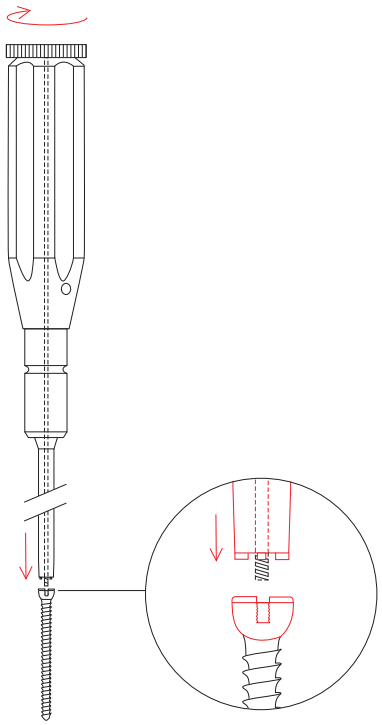
Note: **Any taps that have become bent should be replaced since, owing to their length, any additional mechanical loading increases the risk of breakage.**



10. Pick up cortex screw with self-holding screwdriver

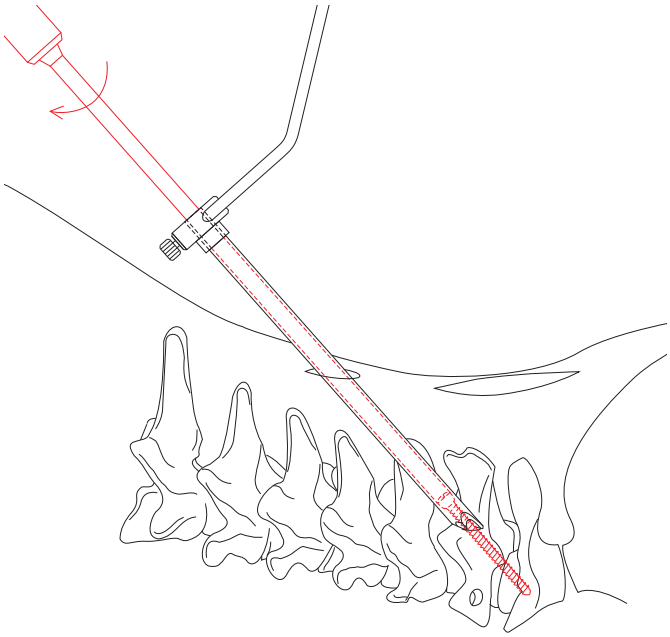
Since the Cortex Screw ∅ 3.5 mm (497.002–008) has a special head, it can be used only in conjunction with the self-holding Screwdriver (387.018).

To pick up the cortex screw, locate the screwdriver on the cross-recessed head of the cortex screw. Turn the connecting screw of the screwdriver to connect the screw firmly to the screwdriver. Ensure that the cross of the screwdriver is fully inserted in the cruciform recess of the screw head.



11. Insert cortex screw with self-holding screwdriver

Check the position of the cortex screw during insertion under the image intensifier.



12. Transarticular screw fixation of C1/C2 on the contralateral side

The definitive stabilisation of C1/C2 is completed by performing the same procedure (steps 3 to 11) on the contralateral side.

13. Postoperative management

Biomechanical studies have confirmed that adequate stability of transarticular screw fixation can be achieved only if it is combined with a structural bone graft between C1 and C2.[4] Additional fixation of the graft with cerclage wiring or a cable is advisable.

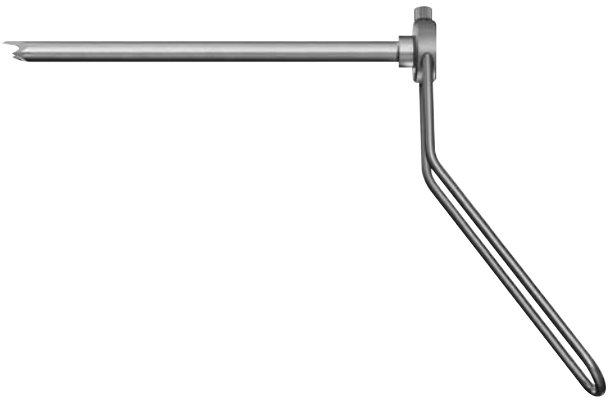
The wearing of a soft cervical collar for 12 weeks is recommended.

Implants

Cortex Screw ∅ 3.5 mm, self-tapping, Titanium Alloy (TAN), self-holding with No. 387.018

Art No.	length
497.002	38 mm
497.003	40 mm
497.004	42 mm
497.005	44 mm
497.006	46 mm
497.007	48 mm
497.008	50 mm

Instruments

292.451	Kirschner Wire ∅ 3.2 mm with trocar tip, length 300 mm, Stainless Steel	
387.011	Guide Sleeve 6.0/3.2, for Kirschner Wire No. 292.451	
387.013S	Drill Bit ∅ 2.5 mm with Stop, length 270/70 mm, 3-flute, for Jacobs Chuck, sterile	
387.014	Guide Sleeve 6.0/2.5, for Drill Bits No. 387.013	
387.015	Tap for Cortex Screws ∅ 3.5 mm, with Stop, length 270/70 mm, for Jacobs Chuck	
387.016	Guide Sleeve 6.0/3.5, for No. 387.015	
387.017	Protection Sleeve 8.0/6.0	

387.018	Screwdriver, self-holding, for Nos. 497.002 to 497.008	
532.101	Colibri II Handpiece	
393.100	Universal Chuck with T-Handle	
05.001.010	Electric Pen Drive 60 000 rpm	
05.001.080	Air Pen Drive 60 000 rpm	
511.701	Compact Air Drive II	

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1. Aebi M, Thalgott J S and Webb J (1998) AO ASIF Principles in Spinal Surgery, c. 5.2 Transarticular Screw Fixation, Springer, Berlin

2. Aebi M, Arlet V, Webb JK, (2007): AOSPINE Manual (2 vols), Stuttgart, New York: Thieme.

3. Jeanneret B and Magerl F (1992) Primary Posterior Fusion C1/2 in Odontoid Fractures: Indications, Technique, and Results of Transarticular Screw Fixation. J Spinal Disord (United States), Dec, 5 (4): 464–75

4. Henriques T, Cunningham BW, Olerud C et al. (2000) Biomechanical Comparison of Five Different Atlanto-axial Posterior Fixation Techniques. Spine, 25 (22): 2877–83

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