Arthrodesis System
2.0/2.3, 2.5

APTUS®
Wrist
Arthrodesis System 2.0/2.3, 2.5

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Arthrodesis System
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Features, Technique
Combination is the Solution

1. Bending of RSL Fusion Plate
2. Detail of Total Wrist Fusion Plate Short Bend
3. Four corner fusion plate with screws
4. Biomechanical testing of an implant
5. Detail of hand bone model with bent Total Wrist Fusion Plate
multidirectional (±15°) and angular stable fixation
- anatomic plate designs
- hexadrive interface with excellent self-holding properties

**technology**
- multidirectional (±15°) and angular stable trilock locking system
  - spherical three-point wedge-locking
  - friction locking through radial bracing of the screw head in the plate – without additional tensioning components
- trilock screws can be re-locked in the same plate hole under individual angles up to three times
- minimal screw head protrusion thanks to internal locking contour
- no cold welding between plate and screws
- intra-operative fine tuning capabilities

**plate features**
- anatomically pre-shaped implant designs for easy intra-operative application
- highly polished surface and well rounded plate edges to reduce soft tissue irritation
- specially developed plates for four corner fusions (4CF) and scaphotrapeziotrapezoidal (STT) fusions
- specially developed plates for radioscapoholunate (RSL) fusions
- total wrist fusion (TWF) plates with two compression holes to fix a bone block
- bent total wrist fusion (TWF) plates with multiple possibilities to insert screws in different carpal bones without stiffening the carpometacarpal joint

**screw features**
- hexadrive – the optimal self-retaining mechanism between screw and screwdriver for increased torque transmission
- precision cut thread profile for improved sharpness and self-tapping properties
Introduction and Indications

PRODUCT MATERIALS

All APTUS implants are made from pure titanium (ASTM F67, ISO 5832-2) or from titanium alloy (ASTM F136, ISO 5832-3). All of the titanium materials used are biocompatible, corrosion-resistant, and non-toxic in a biological environment. Instruments consist of stainless steel, PEEK, aluminum or titanium.

INDICATIONS

The APTUS Wrist Arthrodesis Plates are indicated for wrist arthrodeses e.g. for fusion of carpal bones, carporadial fusions.

CONTRAINDICATIONS

- Pre-existing or suspected infection at or near the implantation site
- Known allergies and/or hypersensitivity to foreign bodies
- Inferior or insufficient bone quality to securely anchor the implant
- Patients who are incapacitated and/or uncooperative during the treatment phase
- The treatment of at-risk groups is inadvisable

COLOR CODING

<table>
<thead>
<tr>
<th>System</th>
<th>Color code</th>
</tr>
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<tbody>
<tr>
<td>APTUS 2.0</td>
<td>blue</td>
</tr>
<tr>
<td>APTUS 2.3</td>
<td>brown</td>
</tr>
<tr>
<td>APTUS 2.5</td>
<td>violet</td>
</tr>
</tbody>
</table>

Plates and Screws

Special implant plates and screws have their own color:
- Blue implant plates: TriLock plates (locking)
- Gold implant screws: Cortical screws (fixation)
- Blue implant screws: TriLock screws (locking)
Arthrodesis Plates 2.0/2.3

Specially developed plates for four corner fusions (4CF) and scaphotrapeziotrapezoidal (STT) fusions

Plates have two different rows of screw holes:

° Inner plate holes for compression of the carpal bones, using cortical screws (optional for small 4CF and STT)
° Outer plate holes for the angular stable fixation, using TriLock screws
° In every carpal bone at least two screws can be inserted

• Concave shape of the reamers and the plates for minimal bone removal
• Easy handling without intra-operative tilting

• The 4CF plate is intended for patients with medium to large wrists
• It has 12 screw holes, including 4 for cortical screws and 8 for TriLock screws

• The small 4CF plate is intended for patients with small wrists
• It has 8 TriLock screw holes

• The STT Fusion Plate has 6 TriLock screw holes

Note:
The 4CF, 4CF small and STT Plates are compatible with the APTUS Hand 2.0/2.3 System.
Arthrodesis Plates 2.5

Specially developed anatomical plates for radiocarpal fusion and partial wrist arthrodesis.

- Plates are equipped with offset screw alignment in the shaft area
- Low overall profile height

- Specially developed plates for radioscapholunate (RSL) fusions

- Anatomically contoured Total Wrist Fusion (TWF) plates with numerous distal plate holes to fixate various carpal bones
- The carpometacarpal joint is not stiffened, therefore maintaining physiological motion in this joint
- Two pre-angled screw holes facilitate bone graft fixation
- The long bend plate is intended for patients with medium to large wrists
- The short bend plate is intended for patients with small wrists and for fusion following proximal row carpectomy
- The proximal bars can be bent up for the radius

- Total Wrist Fusion (TWF) plates with two pre-angled screw holes to facilitate bone graft fixation
- Preferred for patients with severely deviant anatomical conditions, such as rheumatic patients

Note:
The RSL and TWF Plates can also be used in conjunction with the systems APTUS Distal Radius 2.5 and APTUS ADAPTIVE Distal Radius 2.5.

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General Instrument Application

**BENDING**

If required, the TriLock RSL and bent TWF plates can be bent with the plate bending pliers A-2047.

**Note:**
The bent TWF plates may be bent only in the shaft area.

Plate bending pliers have two different pins to protect the locking holes of flat and curved plates during the bending process.

When inserting the plate into the bending pliers, the labeled side of the plate must always face up. When bending the arthrodesis plate, the plate bending pliers must be held so that the letters “F – FLAT PLATE THIS SIDE UP” are legible from above.

The plate must always be held at 2 adjacent holes to prevent (refer to figures) contour deformation of the intermediate plate hole while bending.

Do not bend the plate by more than 30°. Bending the plate further may deform the plate holes and may cause the plate to break postoperatively.

**Note:**
Avoid repeatedly bending the plate in opposite directions, as this may cause the plate to break postoperatively.

Always use the provided plate bending pliers to avoid damaging the plate holes. Damaged plate holes prevent correct and secure seating of the screw in the plate and increase the risk of system failure.
REAMING

Specially designed reamers are available for each arthrodesis plate 2.0/2.3.

Note:

• The reamer is very sharp! The reamer edge can serve to determine the reaming depth

• The reamer has no guide/sheath and therefore provides no soft tissue protection

• If a power drill is used, we recommend low speed reaming for better control
DRILLING

All APTUS twist drills are color-coded. All twist drills are color-coded via a ring system.

System size 2.0 = blue
System size 2.5 = violet

Note:
The twist drills must always be guided by the drill guides (A-2020, A-2722) to prevent damaging the plate hole and to protect surrounding tissue from direct contact with the drill. The drill guides (A-2020, A-2722) also serve to limit the drilling angle.

This symbol marks the side used for centric drilling with the drill guide A-2020. This side is used for all 2.0/2.3 arthrodesis plates.

After positioning the plate, insert the drill guide and the twist drill into the plate hole. In the APTUS system, the drill is guided by the drill shaft and not the drill flute.
You can read the required screw length at the scale of drill guide A-2722 in connection with the black markings on the drill shaft of twist drills A-3713, A-3723 and A-3733.

**Note:**
For TriLock plates ensure that the screw holes are pre-drilled with a pivoting angle of no more than ±15°. For this purpose the drill guides show a limit stop of ±15°. A pre-drilled pivoting angle of >15° prevents the TriLock screws from correctly locking into the plate.
DETERMINATION OF DEPTH

Depth gauges A-2032 and A-2930 are used to determine the optimal screw length for monocortical or bicortical screw fixation.

To determine the depth, place the tip of the depth gauge on the implant plate.

The depth gauge caliper has a hooked tip that is either inserted to the bottom of the hole or is used to catch the far cortex of the bone. When measuring, the caliper stays static, only the slider is adjusted.

A scale on the depth gauge shows the ideal screw length for the measured drill hole.
SCREW PICK-UP

The screwdriver features the patented HexaDrive self-holding system.

To remove the screws from the implant container, vertically insert the screwdriver into the screw head of the desired screw and pick up the screw with axial pressure.

**Note:**
The screw will not hold without axial pressure! Vertically extract the screw from the compartment. The screw is held securely by the blade. If self-retention between screwdriver and screw cannot be achieved despite being picked up correctly, usually the screw has already been picked up before. This often leads to a permanent deformation of the self-retaining area of the HexaDrive inside the screw head.

Check the screw length and diameter at the scale of the measuring module. The screw is measured at its head.
4CF Plates

Verify the 4CF plate and the small 4CF plate to the patient’s wrist, and determine which plate to use for the fusion. The 4CF plate is intended for patients with medium to large wrists. The small 4CF plate is intended for patients with small wrists.

Instructions for creating a recess

- Expose and reduce the capitate, hamate, triquetrum and lunate from the dorsal side – special attention should be given to the reduction of the lunate.
- If necessary, completely or partially remove the scaphoid.
- Stabilize the carpal bones to be fused temporarily with K-wires.
- The cartilage and hard subchondral cortical surfaces between the 4 carpal bones being fused should be removed and the gaps must be filled with bone graft.
- Position the reamer in the centre of the carpal bones to be fused.
- Holding the reamer perpendicularly, create the recess for the plate by carefully applying axial pressure.
- Ream downward until the plate can be inserted slightly beneath the dorsal bone surface (otherwise a risk of impingement between the plate and the dorsal radiolunar edge of the radius exists).

The top edge of the reamer indicates the ideal reaming depth (see figure).
Instructions for aligning the 4CF Plates

- The 4CF plate provides 3 holes (1 fixation hole, 2 locking holes) per bone to be fused

- The small 4CF plate provides 2 holes per bone to be fused

**Note:**
In practice, at least 2 holes per carpal bone should be filled with screws – this should be observed during plate alignment

- The figures show the 4CF plate respectively the small 4CF plate positioned so that both rows of holes can be filled with screws (examples show a left hand)
Instructions for screw insertion

• Drill a fixation hole through one of the inner plate holes using the drill guide A-2020 and the APTUS twist drill for core diameter 1.6 mm (A-3410, A-3420, A-3430)

• Measure the screw length with the depth gauge A-2032

• Insert the first gold cortical screw Ø 2.0 mm; the screw functions as a lag screw

• Repeat this step with the remaining 3 inner plate holes to draw the carpal bones against the plate while tightening the screws

• Remove the K-wires

• To lock the plate and to create a solid bone block with the capitate, hamate, triquetrum and lunate, the blue TriLock screws Ø 2.0 mm are inserted through the outer plate holes (for each screw drill a hole, measure the screw length, insert a blue TriLock screw Ø 2.0 mm)

Note:
• Insert 1 cortical screw and at least 1 TriLock screw per carpal bone

• The drill must always be guided by the drill guide A-2020, as this permits multidirectional use of the full ±15° multidirectional locking range and provides soft tissue protection. A pre-drilled pivoting angle of >15° prevents the TriLock screws from correctly locking into the plate

• In the 4 CF small, the cortical screws inserted first can be replaced with TriLock screws, if required
STT Fusion Plate

Instructions for creating a recess

• Expose and reduce the scaphoid, trapezium and trapezoid from the dorsal side

• Temporarily stabilize the carpal bones to be fused with K-wires

• The cartilage and hard subchondral cortical surfaces between the 3 carpal bones being fused should be removed and the gaps must be filled with bone graft

• Holding the reamer perpendicularly, create the recess for the plate by carefully applying axial pressure

• Ream downward until the plate can be inserted a little beneath the dorsal bone surface

The top edge of the reamer indicates the ideal reaming depth (see figure)
Information on aligning the STT Fusion Plate

- The STT fusion plate provides 2 holes per bone to be fused
- In practice, 2 holes per carpal bone should be filled with screws. If two screws cannot be placed in all three bones, the trapezoid, which is the most stable, may be secured with only one TriLock screw Ø 2.0 mm
- In the image the STT Fusion Plate is positioned in such a way that both rows of holes can be filled

Information on inserting the screws

- Drill a fixation hole through one of the inner plate holes using the drill guide A-2020 and the APTUS twist drill for core diameter 1.6 mm (A-3410, A-3420, A-3430)
- Measure the screw length with the depth gauge A-2032
- Insert the first gold cortical screw Ø 2.0 mm; the screw functions as a lag screw
- Repeat this step with the remaining 2 inner plate holes to draw the carpal bones against the plate while tightening the screws
- Remove the K-wires
- To lock the plate afterwards angular stable and to create a solid bone block with the scaphoid, trapezium and trapezoid, the blue TriLock screws Ø 2.0 mm are inserted through the outer plate holes

Note:
- We recommend the use of the drill guide A-2020 while drilling. Doing so ensures that you can make use of the full ±15° multidirectional locking range. For angles > 15° locking is no longer guaranteed
- Insert at least 1 TriLock screw per carpal bone
Total Wrist Fusion Plates

Total Wrist Fusion Plates long bend (A-4760.01) and short bend (A-4760.02)

Verify the long bend and short bend plates to the patient’s wrist, and determine which plate to use for the fusion. The Total Wrist Fusion Plate long bend is intended for patients with medium to large wrists. The Total Wrist Fusion Plate short bend is intended for patients with small wrists and for fusion following proximal row carpectomy.

Expose and remove the cartilage and hard subchondral cortical surfaces between the bones being fused from the dorsal side. For optimal plate placement, remove Lister’s tubercle and if necessary, the dorsal distal aspect of the radius.

Position the hand in the angle to be fused i.e. 10° extension. Position the plate onto the bone. Fix the plate temporarily with K-wires.

**Note:**
Plate must not project beyond the carpometacarpal joint.

Drill a fixation hole through one of the distal holes using the drill guide A-2722 and the APTUS twist drill (A-3713, A-3723, A-3733) for core diameter 2.0 mm (one purple ring).

Initially, a golden cortical screw Ø 2.5 mm can be placed to achieve a contact between plate and bone. (We recommend to insert the first screw into the trapezoid)

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Insert a blue TriLock screw Ø 2.5 mm in the distal plate hole. Remove the distal K-wire.

For initial fixation insert a gold cortical screw Ø 2.5 mm in the oblong hole. Remove the K-wire.

Insert two gold cortical screws Ø 2.5 mm into the two pre-angled screw holes to fix a bone block to the plate.

Note:
Do not insert blue TriLock Ø 2.5 mm screws into the pre-angled plate holes!

Insert at least 1 TriLock screw Ø 2.5 mm in each carpal bone being fused; 2 TriLock screws Ø 2.5 mm would be recommended. Complete the fixation of the plate shaft with blue TriLock screws Ø 2.5 mm.
Total Wrist Fusion Plate, straight, (A-4760.03)
The straight plate is intended for wrist fusion when the long and short bend plates do not fit the patient’s anatomy. Expose and remove the cartilage and hard subchondral cortical surfaces between the bones being fused from the dorsal side. For optimal plate placement, remove Lister’s tubercle and if necessary, the dorsal distal aspect of the radius.

Place the plate on the bone. Ensure that the capitate can be reached through the plate’s intended pre-angled locking hole. Use K-wires to temporarily fixate the plate distally in the capitate and proximally in the radial bone.

Fix the plate with two blue TriLock screws Ø 2.5 mm to the 3rd metacarpal bone.

Remove the distal K-wire.

For initial fixation insert a gold cortical screw Ø 2.5 mm in the oblong hole.
Remove the K-wire.

Insert a blue TriLock screw Ø 2.5 mm into the most proximal plate hole.
Insert a blue TriLock screw Ø 2.5 mm into the capitate through the pre-angled plate hole.

Insert blue TriLock screws Ø 2.5 mm into the remaining plate holes in the 3rd metacarpal bone.

Optional: The two pre-angled screw holes can be used to fix a bone block to the plate with two gold cortical screws Ø 2.5 mm.

**Note:**
Do not insert blue TriLock Ø 2.5 mm screws into the pre-angled plate holes!

Insert blue TriLock screws Ø 2.5 mm into the remaining plate holes in the radius.
RSL Fusion Plates

Expose and remove the cartilage and hard subchondral cortical surfaces between the bones being fused from the dorsal side. For optimal plate placement remove Lister’s tubercle.

If necessary, bend the plate with the bending pliers A-2047 in order to fit the anatomy of the patient’s wrist.

After positioning the plate, drill a hole by using the drill guide A-2722 and the twist drill (A-3713, A-3723, A-3733) in the oblong hole. Screw length is determined using the depth gauge A-2730.

For initial fixation insert a gold cortical screw Ø 2.5 mm in the oblong hole. It is possible to readjust the position of the plate via the slot.

Insert two blue TriLock screws Ø 2.5 mm in the lunate and in the scaphoid.

Complete the fixation of the plate shaft with blue TriLock screws Ø 2.5 mm.
CORRECT APPLICATION OF THE TRILOCK LOCKING TECHNOLOGY

The screw is inserted through the plate hole into a pre-drilled canal in the bone. An increase of the tightening torque will be felt as soon as the screw head gets in contact with the plate surface.

This indicates the start of the “Insertion Phase” as the screw head starts entering the locking zone of the plate (section “A” in the diagram). Afterwards, a drop of the tightening torque occurs (section “B” in the diagram). Finally the actual locking is initiated (section “C” in the diagram) as a friction connection is established between screw and plate when tightening firmly.

The torque applied during fastening of the screw is decisive for the quality of the locking as described in section “C” of the diagram.
CORRECT LOCKING OF THE TRILOCK LOCKING SCREWS IN THE PLATE

Visual inspection of the screw head projection provides an additional indicator of correct locking. Correct locking has occurred only when the screw head has locked flush with the plate surface (figures 1 + 3).

However, if the screw head can still be seen or felt (figures 2 + 4), the screw head has not completely entered the plate and reached the locking position. In this case, the screw has to be retightened to obtain full penetration and proper locking. Due to the system characteristics, a screw head protrusion of 0.2 mm exists when using plates with 1.0 mm thickness.

Do not overtighten the screw, otherwise the locking function cannot be guaranteed anymore.

Correct: LOCKED

Incorrect: UNLOCKED

Correct: LOCKED

Incorrect: UNLOCKED

Figure 1

Figure 2

Figure 3

Figure 4