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**Site preparation**

**Step 1**

**Site preparation**

- Use the square awl to perforate the cortex and create the screw entry point.

Remark: Penetration through the cortex is limited to 15mm by the awl stop.

**Step 2**

**Screw path creation and verification**

- With either the **straight pedicle probe** (using rotational moves) or the **curved pedicle probe**, create a path in the pedicle for the screw.

**Important:** Do not make any rotational moves with the curved pedicle probe that could over-enlarge the path and prevent good screw anchorage.

Remark: The pedicle probes have a graduated shaft, marked in 1 centimeter increments (up to 5cm), in order to control insertion depth and make selection of the best adapted screw length easier.
Use the straight sounder or the curved sounder to check pedicle wall integrity.

Remark: The sounders also have a graduated shaft, marked in 1 centimeter increments (up to 6cm), in order to control insertion depth and to make selection of the best adapted screw length easier.

Place the pedicle markers in the pilot holes in order to verify the screw paths under fluoroscopy.

Remark: The markers can remain inserted pending screw insertion in order to help visualize the entry point and ensure proper trajectory of the screw paths.
Step 3

Polyaxial or monoaxial screw selection

The polyaxial and monoaxial screws can be used on the same construct based on the surgeon preference and patient anatomical needs.

The polyaxial screws provide ±30° of angulation, making rod insertion easier, while the monoaxial screws rigidity can assist in other constructs (such as scoliosis, trauma).

Remark: The polyaxial screw heads are colour coded to help identify screw diameter. The colour code is used on the labels of the implant boxes, making screw selection easier per-operatively.

Select a type (monoaxial or polyaxial) and size (diameter x length) of the screw to be inserted.

<table>
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<tr>
<th>Colour code</th>
<th>Monoaxial screws</th>
<th>Polyaxial screws</th>
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<tr>
<td>Ø 4.5 mm</td>
<td></td>
<td>Ø 4.5 mm</td>
</tr>
<tr>
<td>Ø 5.5 mm</td>
<td></td>
<td>Ø 5.5 mm</td>
</tr>
<tr>
<td>Ø 6.5 mm</td>
<td></td>
<td>Ø 7.0 mm</td>
</tr>
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Sterilisation indicator

Size (diameter x length)

Colour code
**Step 4**

**Screw / screwdriver assembly**

- Select the *screwdriver* according to the kind of screw to be inserted (monoaxial – Option A – or polyaxial – Option B-).

Two handles are available: a straight *ratcheting handle*, or a *cannulated ratcheting T-handle*.

- 3 screwdriver options:
Option A - Monoaxial screw: Mono screwdriver

Important: The mono screwdriver can only be used with monoaxial screws.

- Assemble the selected handle to the mono screwdriver

- Completely place the end of the screwdriver into the saddle of the screw.

- Push down the ridged knob to engage the threads of the screwdriver within the head of the screw.

- Turn the ridged knob to secure the screw onto the screwdriver.
**Option B - Polyaxial screw**

1st Choice: poly screwdriver

- Assemble the selected handle to the **poly screwdriver**.

- Place the hex end of the screwdriver into the hex hole in the saddle of the screw.

**Remark:** Adjust the screw thread to ensure the two footprints square together (screw/screwdriver).

- Push down the ridged knob to engage the threads of the screwdriver within the head of the screw.

- Turn the ridged knob to secure the screw onto the screwdriver.

**Important:** The poly screwdriver can only be used with polyaxial screws (standard or reduction screws). Its use is recommended when it is necessary to apply a specific force on the screw, such as in a screw path correction case.
2nd Choice: poly screwdriver - quick connect

Important: The poly screwdriver – quick connect can only be used with polyaxial screws (standard or reduction screws).

- Assemble the selected handle to the poly screwdriver – quick connect.

- Place the hex end of the screwdriver into the hex hole in the saddle of the screw. The poly screwdriver – quick connect is self-retaining.

Remark: Adjust the screw thread to ensure the two footprints square together (screw/screwdriver).
**Screw insertion**

Insert the screws in the pedicular paths previously prepared (step 1 & 2).

**Important:** The screws conical core and cylindrical thread enable an adjustment in height, without anchorage loosening.

**Remark:** The polyaxial screws have to be inserted in such a way that the screw head keeps its mobility, making rod insertion easier.

In the case a polyaxial screw (standard or reduction screw) is inserted too deep, or not enough, screw height can be adjusted with the **screw adjuster**.
Rod insertion

Step 6

Rod selection

- When all the pedicle screws are inserted, determine the rod length using the malleable rod gauge (60, 120 or 250 mm).

Remark: Rods of 80 mm or less are curved. The ones over 80 mm are straight.

If rod bending is necessary, use the rod bender to create the desired curve.

Important: The laser marked line on the rod is used to visually check that the curve is maintained during the bending step.

Remark: The rod bender is adjustable to provide 3 bending possibilities (small, medium or large) to the rods.
**SURGICAL TECHNIQUE**

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**Step 7**

**Rod insertion**

- After rod length is determined and bending (if needed) completed, insert the rod into the saddle of the screws with the **rod holder**.

**Remark:** If needed, use the poly screw head holder to properly adjust the screw heads and to ease rod insertion.

**Step 8**

**Screws pre-tightening**

**Set screw insertion**

- Assemble the set screw to the self-retaining **set screw starter**.

**Remark:** Laser lines indicate the top of the set screws.

- Place the set screw on the screw head and turn to engage the threads.

**Remark:** The counter torque wrench can be used as an alignment guide to facilitate set screw insertion into the screw head.
If the rod is not properly positioned in the bottom of the screw head saddle, the set screw can be hard to insert. In this case, two options are possible:

Option A – Rod pusher

- Use the rod pusher to press on the rod and position it in the bottom of the screw head.
- Insert the set screw.

Option B – Rocker

- Place the rocker prongs in the slots located on the external sides of the screw head.
- Rotate the rocker toward the rod to introduce it into the saddle of the screw head.
- Insert the set screw.

Important: Do not use the set screw starter to final tighten the set screws.
Correction maneuvers

Step 9a  Derotation

- If needed, the derotator can be used before final tightening to help restore an appropriate curve in the sagittal plan by rotating the rod.

Step 9b  Compression or distraction

If needed, compression and/or distraction can be performed before final tightening with the compression forceps or the distraction forceps.

- Lock one of the screws in the segment to be translated (distraction or compression) and place the chosen forceps against the screw heads.

- Compress or distract by pressing on the locked screw.

Remark: The forceps teeth maintain the space until final locking of the construct.
Final tightening

Step 10

Final tightening of set screws

- When all the set screws are inserted, place the **counter torque wrench** on the screw to be tightened.

Remark: Use of the counter torque wrench permits reduction of the pressure applied on the pedicles during final tightening. It can be oriented in different ways on the construct according to the surgeon’s needs.

- Insert the **T-handle torque wrench** through the counter torque wrench until it engages with the set screw. Then proceed with final tightening.

**Important:**
- Tighten only until the laser marked arrow on the wrench aligns with the bold line, ensuring a final lock of 12 ± 1Nm.
- Ensure the rod is not in contact with bone and sits perfectly in the bottom of the screw head before proceeding with the final tightening.

- Repeat this action on all screws in the construct.
Surgical Technique

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Options

**Spondylolisthesis reduction**

The following surgical technique is of a case of spondylolisthesis reduction at L5-S1 using polyaxial reduction screws.

**Important:** When reducing a spondylolisthesis, the tension applied on the nervous roots must be checked.

- Prepare the pedicle screw paths in the vertebra subjacent to the spondylolisthesis and the vertebra to be treated with the awl and the pedicle probe.

**Remark:** Two screw paths are possible in S1, one parallel to the vertebral endplate and the other one where the entry points are in the lowest part of the pedicle and directed toward the promontory.

- Insert two polyaxial screws in S1 and two reduction screws in L5 in the pedicular screw paths previously created.
Remark: Screw length must be adapted to the vertebral dimensions (at least 2/3 of the thread into the pedicle) in order to resist pull-out forces.

- Insert the rods into the screws in S1 with the rod holder.

Remark: 80mm rods and smaller are curved. If necessary, use the rod bender to obtain the desired curve.

- Insert the set screws with the set screw starter (step 8).

- Then, carry out final tightening of the set screws with the T-handle torque wrench.

Important: The spondylolisthesis reduction capacity depends on the screw insertion depth in L5. The more the screw is inserted, the more the spondylolisthesis will be reduced.
Insert the set screws in the L5 screw heads with the set screw starter (step 8).

Assemble the set screwdriver-quick connect with the selected ratcheting handle (straight or T shaped).

Screw the set screws alternately with the set screwdriver to accomplish the spondylolisthesis reduction.

Important: Do not use the T-handle torque wrench for the reduction.

Screwing the set screws into the reduction screws heads results in pulling up the L5 vertebra toward the rod and thus allowing the lumbar vertebrae to be reduced on S1 as well as pushing down the sacrum.
Remark: The counter torque wrench or the poly screw head holder can be used in addition to the set screwdriver to stabilize the L5 screw head.

- Carry out final tightening of the set screws into the reduction screws with the T-handle torque wrench.
The extended tabs of the reduction screws are broken off with the reduction screw tab remover.

Conduct a final A/P and lateral control under fluoroscopy.
Cross connector

In order to improve construct stability, a cross connector can be used.

- Use the reduction screw tab remover to hold the chosen cross connector.

Remark: The reduction screw tab remover can hold the cross connector only by its thinnest part.

- Place the cross connector at the selected level and position the cross connector hooks on the rods.

- Use the cross connector torque wrench to press on the hooks and insert them onto the rods.
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- Place the cross connector in the desired position and tighten one hook until half-torqued with the cross connector torque wrench.

- Final tighten the other hook with full torque, then final tighten the first hook with full torque.

**Important:** For half torque tightening, the laser marked arrow on the wrench must align with the middle line.

For final tightening, the wrench's laser marked arrow must align with the bold line, ensuring a tightening torque of 8 ± 1Nm.

- Complete cross connector positioning by final tightening the middle nut with full torque.
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