WINSTA-C

Clavicle Plating System
Clinical Advisor

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**Note:**
The surgical technique outlined below reflect the surgical procedure usually chosen by the clinical advisor. However, each surgeon must decide which surgical method and which approach is the most successful for his patient.
## Introduction

### Indication

Clavicle Plate S- and J-shaped:
- Fixation of fractures and mal-unions of the clavicle shaft

Lateral Clavicle Plate:
- Fixation of fractures and mal-unions of the lateral clavicle

### Imaging

- Radiographic diagnostic with x-ray in AP and 45° plane
- If necessary additional diagnostic with CT or MRI

### Positioning

- The patient is placed in the beach chair position
- A standard operating table with head up positioning may be used
- A longitudinal sand bag placed just medial to the affected scapula, will assist in reduction
- Before draping, check that adequate x-ray imaging is possible and that no metal is blocking the view of the clavicle
- The patient’s head is turned away from the operative site to improve access to the clavicle
- The affected arm should be towed and kept free to enable intraoperative mobilization
- The operative site is disinfected and towed

**Surgical Technique**

**Exposure**

- A transverse incision is recommended for accessing the clavicle.
- A horizontal incision is made from medial to lateral and centered over the fracture site.
- When using a lateral plate, the incision is centered over the fracture site and ending lateral to the AC joint.
- When using a minimal invasive approach, locking drill guides can be used to insert the plate from medial to lateral.

- As an alternative a vertical incision, which is placed over the fracture site and along Langer’s lines, is possible.

**Attention:**

- Branches of the Supraclavicular nerves (usually 2) should be identified and protected during subcutaneous dissection.
- During subperiosteal preparation of the platysma muscle the fiber orientation should be considered.
- Small individual bone fragments should not be removed from their periosteum to protect their blood supply.
**Implant specifications**

The Marquardt Clavicle Plating System *WINSTA-C* offers plates and screws in various shapes and lengths. According to their shape, the plates can be divided into three groups. Every plate is available as a right or left sided version. In order to facilitate identification of left and right types, the plates are color coded. Left plates are green and laser marked with “L”, right plates are blue and laser marked with “R”.

Plate holes are filled with self-tapping cortical screws. The screws are available either non-locking, locking and multiaxial locking.

**Clavicle Plate S-shaped**

- S-shaped plates are used in the middle part of the clavicle
- These plates are available in three lengths: 6, 8 and 10 holes
- In order to match different natural curvatures of the clavicle the 6 and 8 hole plates are available in three different bend types: minimum, medium and maximum
- The 10-hole plate exists in medium bend only
- The bending type is marked on the side of each plate
- Medial and lateral ends of the plate are labelled with “MED” or “LAT” to ensure correct placement of the implant

**Clavicle Plate J-shaped**

- J-shaped plates are designed for fractures involving the transition zone between the middle and the lateral part of the clavicle
- The plates have 9 holes and there are right and left versions
- The medial and lateral ends of the plate are labelled with “MED” or “LAT” to ensure correct placement of the implant

**Lateral Clavicle Plate**

- Lateral plates are used in the lateral part of the clavicle
- The plates are available in three lengths, which are defined by the number of shaft holes: 5, 7 and 9 holes
- The lateral part of the plate has five screw holes which are provided for the Ø 2.7 mm cortical screws
- The screws are available either locking or non-locking. It is also possible to use Ø 2.7 mm multiaxial locking screws in the lateral part and this offers great flexibility
1. Fracture reduction and plate positioning

- Fracture ends are exposed and the fracture is reduced
- After restoration of the anatomical position, temporary fixation can be achieved with K-wires.
- Prior to the application of the plate, lag screw fixation perpendicular to the fracture line is often helpful to stabilize and compress the main fragments
- There are Ø 3.5 mm and Ø 2.5 mm drills and a double drill guide to facilitate this
- The clavicle plate can then be placed
- K-wires can be used for temporary fixation of the plate through the provided K-wire holes

Attention:

If plate contouring is necessary, the following aspects have to be considered:

**Instruments**

REF 03.20110.035   Bending Iron for Plates 2.7 to 3.5, right  
REF 03.20110.135   Bending Iron for Plates 2.7 to 3.5, left

- For contouring of the plates the bending irons may be used
- To avoid weakening of the implant material the plates should be bent only once and only in one direction
- Bending of the implant across a screw hole should be avoided
- To protect the threads of the plate during bending, drill sleeves should be inserted into the threads
**Clavicle Plate S-shaped**

**Instruments**

*REF 14.40060.006 WINSTA-C Template*

- The plate is placed on the middle part of the clavicle with its center located over the fracture site
- In order to evaluate which bend type may be appropriate for the patient’s anatomy, the clavicle template can be used. This template has the same curvature as the 6-hole plate medium bend and by turning it over or around it can be used for right or left clavicles. By using the template it is possible to check if the medium bending type fits or if a plate with minimum or maximum bend should be used instead.

**Clavicle Plate J-shaped**

- The J-shaped clavicle plate is placed in the transition zone between the middle and lateral parts of the clavicle
- The plate should be placed so that the strengthened part of the plate is located over the fracture site

**Lateral Clavicle Plate**

- The fracture is reduced and the AC joint is identified. It may be helpful to mark this with a needle
- The plate is placed medial but close to the AC joint so as to gain maximum purchase in the lateral fragment. Ideally the part which is between the oval hole and the lateral holes is located over the fracture site.
- The final plate position should be checked with x-ray control. Guide wires which can be placed in the lateral K-wire holes of the plate can help to verify that the lateral screws do not penetrate into the AC joint.
- Multiaxial screws are very useful here, to help the surgeon to avoid the joint space
2. Fixation with Clavicle Plates S-shaped and J-shaped

**Instruments**

*REF 14.40060.025*  
Drill Bit Ø 2.5 mm, 2-flute,  
AO Coupling, L 110 / 85 mm

*REF 03.20060.025*  
Double Drill Guide 3.5 / 2.5

- It is recommended to place a non-locking Ø 3.5 mm compression screw into the oval hole as a first step. Minor adjustment of the plate position is possible by loosening that screw and moving the plate around the oval hole.
- The pilot hole for Ø 3.5 mm screws is drilled with a Ø 2.5 mm drill bit and the double drill guide

**Instruments**

*REF 03.20100.040*  
Depth Gauge for Screws, measuring range 40 mm

- The screw length is measured with the depth gauge
- The hook of the measuring device is hooked into the far cortex and the appropriate screw length is given by the scale
- The screws must be placed through both cortices in order to achieve bicortical fixation

**Instruments**

*REF 03.20040.030*  
Screwdriver hexagonal, with Groove, ball handle, hex 2.5 mm

- An appropriate screw can be inserted by using the screwdriver
- If the value of the measured screw is between sizes, the longer screw option should be chosen but its length and position must be checked with the image intensifier and further adjustment made if necessary
- After placing screws into the oval holes medial and lateral to the fracture site, the remaining screw holes can be filled with either locking or non-locking screws
- If the insertion of a non-locking lag screw through the plate is planned, it is important to remember that the non-locking screw(s) should always be placed prior to any locking screws
Instruments
REF 14.40060.047  Drill Guide 2.5, calibrated

- In order to place Ø 3.5 mm locking screws into the circular holes, the scaled drill guide is screwed into the thread of the hole
- Subsequently the pilot hole can be drilled and the screw length can be measured as described above
- When using a scaled drill guide it is possible to read off the required screw length directly from the drill guide

Instruments
REF 03.20040.325  Torque-Limiting Screwdriver 1.5 Nm, short, hex 2.5 mm

- Final tightening of the locking screws should be done by hand using the torque-limiting screwdriver
- As soon as all desired screws are placed into the corresponding screw holes, an intraoperative radiograph is recommended to check the implant positions and the anatomical reduction of the fracture and the lengths of the screws

Instruments
REF 14.40060.010  Clavicle Retractor

Tips:
- To avoid trauma to the Subclavian Artery and the Brachial Plexus, drilling should always be done with caution
- The clavicle retractor (neurovascular protector) should be placed under the inferior cortex of the clavicle, to prevent over-penetration
3. Fixation with Lateral Clavicle Plates

- To achieve initial stabilization it is recommended to place first two screws, one medial and one lateral to the fracture site
- As described above, a Ø 3.5 mm non-locking cortical screw is placed into the oval hole of the plate
- Locking or non-locking screws can be used in the other holes of the plate according to the procedure described before

- There are three choices of self-tapping Ø 2.7 mm screws available to be used within the lateral screw holes:
  - Yellow: Non-locking cortical screws
  - Blue: Locking cortical screws
  - Green: Multiaxial locking cortical screws

Instruments

<table>
<thead>
<tr>
<th>REF</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03.20060.025</td>
<td>Double Drill Guide 3.5 / 2.5</td>
</tr>
<tr>
<td>10.20010.020</td>
<td>Drill Bit Ø 2.0 mm, 2-flute, AO Coupling, L 112 / 84 mm</td>
</tr>
<tr>
<td>10.20060.047</td>
<td>Drill Guide 2.0, calibrated</td>
</tr>
<tr>
<td>14.40060.030</td>
<td>Drill Sleeve Insert 3.5 / 2.0</td>
</tr>
</tbody>
</table>

- To drill the hole for a locking Ø 2.7 mm cortical screw the locking drill sleeve is placed into the desired hole and screwed into the thread of the plate (left)
- A Ø 2.0 mm drill bit is used and precautions should be taken to avoid over-penetration of the inferior cortex of the clavicle
- For non-locking Ø 2.7 mm cortical screws it is also possible to use the locking drill sleeve (left). Alternatively the reduction drill sleeve Insert for Ø 2.0 mm drills can be placed into the double drill guide (right).
• Multiaxial Ø 2.7 mm screws can be used in order to reach certain bone fragments, if the defined screw axis is not sufficient
• When using multiaxial locking screws, it is possible to place and lock the screw within a cone of 20° around the original screw axis

Instruments
REF 10.20010.020 Drill Bit Ø 2.0 mm, 2-flute, AO Coupling, L 112 / 84 mm
REF 10.20050.025 ML Drill Guide 2.0

• To ensure a proper and safe locking of the screw into the plate, the angulation of the screw should not be more than 20°
• Drilling of the Ø 2.7 mm multiaxial screw holes is performed with the specific ML drill guide which is screwed into the desired plate hole
• With the coned sleeve in place, it is possible to drill using the drill bit Ø 2.0 mm within 20° of the original screw axis
• When using the ML drill guide it is necessary to ensure that the axis of drilling is chosen correctly and that the AC joint is not penetrated with the drill

Instruments
REF 03.20040.030 Screwdriver hexagonal, with Groove, ball handle, hex 2.5 mm
REF 03.20040.325 Torque-Limiting Screwdriver 1.5 Nm, short, hex 2.5 mm

• The ML drill guide is removed and a proper length screw is inserted as described above using the depth gauge
• When screws are close to the AC joint and the measured value is between sizes, the shorter length should be chosen
• The insertion of the Ø 2.7 mm screws is done using the hexagonal screwdriver
• Final tightening of the locking screws should be done by hand using the torque-limiting screwdriver
4. Post-OP protocol

- Postoperative management will be determined by various factors such as fracture type, bone quality or age of the patient
- Generally, passive movement only is recommended during the first four weeks
- Heavy lifting, pushing or pulling must be avoided by the patient
- Depending on the healing process the patient can start with supported active exercises from four to six weeks postoperatively
- Increased load bearing is allowed from the 8th week postoperatively provided there is radiological healing at the fracture site

5. Implant removal

**Instruments**

**REF 03.20040.030**  Screwdriver hexagonal, with Groove, ball handle, hex 2.5 mm

- Removal of the implant is done through the same incision
- For midshaft plates, try to avoid the cutaneous nerves
- After loosening and removal of all screws with the hexagonal screwdriver, the plate can be removed
**Product Information**

**Implants**

**Clavicle Plate S-shaped**

6 and 8 hole plates:
- Bend Types: minimum, medium and maximum

10 hole plates:
- Bend type: medium
- Material: Ti6Al4V (ISO 5832-3)

<table>
<thead>
<tr>
<th>Article Number left</th>
<th>Article Number right</th>
<th>Holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.15100.106</td>
<td>14.15100.006</td>
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<tr>
<td>14.15100.108</td>
<td>14.15100.008</td>
<td>8</td>
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<td>14.15101.110</td>
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**Clavicle Plate J-shaped**

9 hole plates:
- Material: Ti6Al4V (ISO 5832-3)

<table>
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<tr>
<th>Article Number left</th>
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<tbody>
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<td>14.15100.109</td>
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</tbody>
</table>

**Lateral Clavicle Plate**

5, 7 and 9 hole plates:
- Material: Ti6Al4V (ISO 5832-3)

<table>
<thead>
<tr>
<th>Article Number left</th>
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<th>Holes</th>
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### Cortical Screws, self-tapping

<table>
<thead>
<tr>
<th>Article Number 3.5 mm</th>
<th>Article Number 2.7 mm</th>
<th>Length</th>
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<tbody>
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<td>03.03612.010</td>
<td>03.03527.010</td>
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</tr>
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<td>03.03527.012</td>
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<tr>
<td>03.03612.016</td>
<td>03.03527.016</td>
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<tr>
<td>03.03612.018</td>
<td>03.03527.018</td>
<td>18 mm</td>
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<tr>
<td>03.03612.020</td>
<td>03.03527.020</td>
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<tr>
<td>03.03612.022</td>
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<td>22 mm</td>
</tr>
<tr>
<td>03.03612.024</td>
<td></td>
<td>24 mm</td>
</tr>
</tbody>
</table>

- Thread diameter: 3.5 mm | 2.7 mm
- Core diameter: 2.4 mm | 1.9 mm
- Head diameter: 6.0 mm | 5.0 mm
- Hexagon socket: 2.5 mm | 2.5 mm
- Material: Ti6Al4V (ISO 5832-3)

### Locking Cortical Screws, self-tapping

<table>
<thead>
<tr>
<th>Article Number 3.5 mm</th>
<th>Article Number 2.7 mm</th>
<th>Length</th>
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<tbody>
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<td>03.05527.010</td>
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<td>22 mm</td>
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<tr>
<td>03.05612.024</td>
<td></td>
<td>24 mm</td>
</tr>
</tbody>
</table>

- Thread diameter: 3.5 mm | 2.7 mm
- Core diameter: 2.4 mm | 1.9 mm
- Head diameter: 4.75 mm | 4.75 mm
- Hexagon socket: 2.5 mm | 2.5 mm
- Material: Ti6Al4V (ISO 5832-3)

### ML Locking Cortical Screws, self-tapping

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<tr>
<td>03.03540.010</td>
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<td>03.03540.020</td>
<td>20 mm</td>
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</table>

- Thread diameter: 2.7 mm
- Core diameter: 1.9 mm
- Head diameter: 4.75 mm
- Hexagon socket: 2.5 mm
- Material: Ti6Al4V (ISO 5832-3)
## Instruments

<table>
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<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>10.20010.020</td>
<td>Drill Bit Ø 2.0 mm, 2-flute, AO Coupling, L 112 / 84 mm</td>
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<tr>
<td>14.40060.025</td>
<td>Drill Bit Ø 2.5 mm, 2-flute, AO Coupling, L 110 / 85 mm</td>
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<tr>
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<tr>
<td>03.20040.030</td>
<td>Screwdriver hexagonal, with Groove, ball handle, hex 2.5 mm</td>
</tr>
<tr>
<td>03.20040.325</td>
<td>Torque-Limiting Screwdriver 1.5 Nm, short, hex 2.5 mm</td>
</tr>
<tr>
<td>03.20080.006</td>
<td>Periosteal Elevator, curved blade, round edge, width 6 mm</td>
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<tr>
<td>14.40060.006</td>
<td>WINSTA-C Template</td>
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<tr>
<td>14.40060.025</td>
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<td>14.40060.047</td>
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<td>Drill Sleeve Insert 3.5 / 2.0</td>
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<td>Screw Forceps, self-holding</td>
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<td>03.20110.135</td>
<td>Bending Iron for Plates 2.7 to 3.5, left</td>
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<tr>
<td>14.40060.010</td>
<td>Clavicle Retractor</td>
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<tr>
<td>14.40060.006</td>
<td>WINSTA-C Template</td>
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Instrument Tray