Surgical Technique

HCP - Hofer Clavícula Pin

HCPd & HCPs - Hofer Clavícula Pin dynamic & static
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Warning
This description is not sufficient for immediate use of implants and instruments. An instruction into handling these instruments by a surgeon experienced with them is strongly recommended.
This document provides information about the handling of Hofer implants and instruments.

This operation manual's intention shall be considered as an addition and under no circumstances as a substitute to existing literature about surgical methods within orthopaedics and traumatology.

The content shall be regarded as a recommendation for a standardized procedure of how to apply the products without addressing the issues of any further necessary tasks, additional operative actions and possible extensions of the surgical technique. The actual selection of the most suitable implant and its implantation method has to happen exclusively by the surgeon based on his education and the individual diagnostic findings.

Please also consider that all illustrations printed here have a purely symbolic character to support the description of the surgical technique and can vary.

Furthermore, these operation instructions don't contain any details on the use of the instruments. Corresponding documents are available in the form of:

- Instruction manual for instruments: intra and post-operative handling
- Instruction manual for implants (enclosed to each implant)

Note that it is in the surgeons function to identify and characterize the respective injury and its subsequent treatment.

For a safe handling and for the various surgical techniques Hofer-medical is pleased to offer detailed training.

Please contact our 24/7 service hotline:
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Fractures of the collarbone are one of the most common injuries of the upper extremity.

To this day most collarbone fractures are treated conservatively.

Together with the conservative treatment exist the disadvantages of a hardly controllable pain symptomatology and uncontrollable fragment dislocations, which often lead to bothersome bulge-like formation or shortening of the shoulder girdle in secondary.

Plate osteosynthesis often leads to from a cosmetic point of view undesired cicatrice formation. This factor explains the upward trend to intra-medullary osteosynthesis of the collarbone.

Since the clavicle bone resulting from desmal bone formation does not contain a medullary canal in the classical sense, the insertion of an elastic nail is often very difficult especially in case of delicately built women.

Based on those facts the HCP was developed.

**Advantages of the HCP:**
- Minimally invasive implantation and removal of implant
- Available in dynamic and static with double thread design
- Elastic material properties
- Tip-design with self-tapping thread including smooth self-guiding nose
- Special thread design for easier insertion and less pin migration
- Spiral drill at rear pin tip

An additional benefit of this HCP is that it allows length restoration of simple or comminuted fractures by applying the double-threaded pin.

For an easier material removal a special HCP extraction instrument was developed.
Implant Specific Information

Indications - HCPd dynamic design
- Fractures of the clavicular shaft (in the area of the middle third of the clavicle)
- Mal-unions and pseudarthroses of the clavicular shaft
- Simple, short transverse or oblique fractures, where shortening may not occur

Indications - HCPs static design
- Fractures of the clavicular shaft (in the middle third of the clavicle)
- Mal-unions and pseudarthroses of the clavicular shaft
- More complex multi-fragment or comminuted fractures which require length restoration

Contra Indications
- Hard and narrow clavicle showing significant resistance while drilling and/or pin insertion (relative)

Position of patient and approaches
Patient positioning:
- Standard (half sitting position with shoulder being freely moveable)

Approach:
- Standard, depending on position of fracture zone

Implant specific Details
- Minimally invasive implantation and removal of implant
- Available in dynamic and static with double-thread design
- Elastic material properties
- Tip-design with self-tapping thread and smooth self-guiding nose
- Special thread design for easier insertion and less pin migration
- Spiral drill at rear pin tip: Easier handling for indirect insertion
Nomenclature

Clavicle

lateral          medial

Fracture zone

Fracture outside of zone

Fracture outside of zone

not suitable    suitable    not suitable

Point of entrance

Antegrade direction (in distal direction)

Retrograde direction (in proximal direction)
Classification of possible Surgical Techniques:

**Standard Procedure**
4.1 Indirect insertion through the fracture / open reduction even for closed fracture
4.1.1 Indirect insertion antegrade - retrograde
4.1.2 Indirect insertion retrograde - antegrade

**Expert Procedure**
4.2 Direct insertion / closed reduction
4.2.1 Direct insertion antegrade from medial
4.2.2 Direct insertion retrograde from lateral
HCP-4.1.1 Indirect Insertion of the HCP antegrade - retrograde

Use spiral drill with diameter of 3.2 mm

Drilling of both fragments of the clavicle using the spiral drill
1) Retrograde drilling medial

Screwing in the HCP with drill tip ahead until tip is located completely within the bone
Swinging in the lateral clavicle

Careful screwing in until reaching significant resistance with rounded HCP tip ahead

When reaching the final position of the pin, shortening the HCPd or HCPs to 5 - 10 mm excessive length so that the extraction instrument can take hold of the HCPd or HCPs

Symbolic, exemplary presentation of the final position of the HCPd or HCPs: straight shaft, curved tip
Use spiral drill with diameter of 3.2 mm

Drilling of both fragments of the clavicle using the spiral drill

1) Antegrade drilling lateral
2) Retrograde drilling medial

Screwing in the HCP with drill tip ahead.
Swinging in lateral clavicle

Careful screwing in until reaching significant resistance with rounded HCP tip ahead

When reaching the final position of the pin, shortening of the HCPd or HCPs to 5 - 7 mm excessive length so that the extraction instrument can take hold of the HCPd or HCPs

Symbolic, exemplary presentation of the final position of the HCPd or HCPs: straight shaft, curved tip
Direct Insertion of the HCP antegrade from medial

Use spiral drill with diameter of 3.2 mm

Drill the cortical bone with the spiral drill from medial.
- drill the first cortical bone, then
- immediately turn the spiral drill in axial direction

After drilling pull back the spiral drill from the clavicle.
Correct side = for screwing in use rounded threaded tip of the HCPd or HCPs!

Screwing in until reaching significant resistance with rounded HCP tip ahead

When reaching the final position of the pin, shortening the HCPd or HCPs to 5 - 7 mm excessive length so that the extraction instrument can take hold of the HCPd or HCPs.

Symbolic, exemplary presentation of the final position of the HCPd or HCPs: straight shaft, curved tip
Use spiral drill with diameter of 3.2 mm

Drill the cortical bone with the spiral drill from lateral.
- drill the first cortical bone, then
- immediately turn the spiral drill in axial direction

After drilling pull back the spiral drill from the clavicle.
Correct side = for screwing in use rounded threaded tip of the HCPd or HCPs!

Screwing in until reaching significant resistance with rounded HCP tip ahead

When reaching the final position of the pin, shortening the HCPd or HCPs to 5 - 10 mm excessive length so that the extraction instrument can take hold of the HCPd or HCPs.

Symbolic, exemplary presentation of the final position of the HCPd or HCPs: straight shaft, curved tip
4.3 Insertion of Implant - Detailed Explanations

4.3.1 Indirect Insertion of the Implant
If, from the very beginning on, an open technique is planned the antegrade - retrograde or the retrograde - antegrade insertion of the HCP via the fracture may be the method of choice. In doing so, if required first a transverse skin incision right next to the fracture is set.

First a spiral drill with a diameter of 3.2 mm is inserted into the medial or lateral clavicle fragment intra-medullarily through the fracture surface to anteromedial or posterolateral.

Recommendations for intra-medullar drilling:

- While drilling always pull out the drill in short intervals to clean the drill tip.
- Shortly before reaching the cortical bone reduce rotational speed of the drilling machine and stop drilling before reaching and therefore damaging soft tissue. Perform drilling of soft tissue only by using the implant tip and open it from the outside by using a scalpel!
- It should be drilled approx. 15 mm beyond the fracture line into the other fragment.

Then the HCP, in „backwards direction“ is connected to the chuck of the drilling machine, inserted through the drilled canal and finally led through the cortical bone and a small skin incision (fig. 1 and 2). Next, connect the chuck of the drilling machine to the end of the pin and turn it back further until the threaded tip enters the medial or lateral fragment completely.

IMPORTANT:
When inserting the pin into a drilling machine DO NOT clamp it at its threaded tip.

Fig. 1: Open reduction - Displaying the fracture

Fig. 2: Open reduction - retrograde drilling; HCP drill tip pointing medially
Then the fracture is reduced open and the HCP inserted further under fluroscopic control into the lateral or medial fragment (fig. 3). The fluroscopic control has to be performed in two planes (ap and axial) to prevent HCP dislocation and therefore the danger of lesions along the vessel-nerve bundle. The orientation of the pin in the bone should be as straight as possible - only the tip is (slightly) bent.

Fig. 3: Open fracture reduction and HCP insertion into the lateral fragment

Ideally the HCP needs to be inserted until its thread-less area is located within the fracture zone.
4.3.2 - Direct Insertion of the Implant

Open via a small transverse skin incision in a very flat angle with a 3.2 mm drill either the ventral cortical bone of the medial clavicle, coming from the front, or the dorsal cortical bone of the lateral clavicle, coming from the back (fig. 4). The medial or lateral location of the entry point depends on the condition of the opposite cortical bone which has to be intact.

IMPORTANT:
For drilling a corresponding drill sleeve may be used for guiding.

For drilling the cortical bone hold the drill perpendicular first. As soon as the drill tip can not slip off anymore align the drill as flat as possible with respect to the clavicle and drill through the cortical bone. Special care has to be taken on not to drill the opposite cortical bone!

Fig. 4: Closed reduction
As next step the HCP, connected to a drilling machine, is inserted into the intramedullary canal laterally or medially under fluoroscopy control (fig. 5 and 6) till the tip reaches the fracture zone and reduce the fracture. Perform this step slowly to prevent heat built up. Successful closed reduction can be obtained frequently by pulling the lateral fragment cranio-ventrally and pushing the medial fragment dorso-caudally by using the HCP (fig. 4). If closed reduction can not be performed an additional small incision for direct open reduction has to be taken into account.

IMPORTANT:
For pin insertion the angle between HCP and clavicle has to remain small (< 15° relative to medial course of the clavicle). If the angle is too large the HCP may perforate the dorsal cortical bone, may not enter the clavicle at all since the necessary deflection is too small or due to a too small deflection bending radius the tip may even break off! The insertion using drilling machine should be performed slowly and constantly to prevent heat built up. The orientation of the pin in the bone should be as straight as possible - only the tip is (slightly) bent.

Ideally the HCP needs to be inserted until its thread-less area is located within the fracture zone.
4.4 - Removal of Excessive Material Length
The final step for the implantation is to remove the excessive length of the pin. For its possible removal later on with the HCP extraction instrument an excessive length of not less than 5 mm is required. After pin shortening remove possible burrs or sharp edges.

4.5 - Wound Closure

Fig. 7: Skin closure after open reduction

4.6 - Post-Operative Treatment
An immobilization for six weeks is recommended. The activity shall be limited based upon the level of pain and arm elevation shall be kept restricted for not more than 90° within about the first six weeks.
4.7 – Material Removal

After radiologic fracture healing (recommendations see table) the HCP can be removed.

<table>
<thead>
<tr>
<th>Female</th>
<th>Male</th>
<th>Recommended point of removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25 years</td>
<td>&lt; 25 years</td>
<td>after 2 - 4 months depending on x-ray</td>
</tr>
<tr>
<td>25 - 35 years</td>
<td>25 -35 years</td>
<td>after 4 - 6 months depending on x-ray</td>
</tr>
<tr>
<td>35 - 50 years</td>
<td>35 -60 years</td>
<td>after 5 - 8 months depending on x-ray</td>
</tr>
<tr>
<td>&gt; 50 years</td>
<td>&gt; 60 years</td>
<td>after 7 - 9 months depending on x-ray</td>
</tr>
<tr>
<td>&gt; 70 years</td>
<td>&gt; 75 years</td>
<td>if no complications occur, removal may not be necessary</td>
</tr>
</tbody>
</table>

Attention: The recommendations are based on experiences. Each patient has to be considered individually and if necessary the suggested point of removal has to be adjusted depending on the x-ray.

A special HCP extraction instrument for the material removal is available. The instrument gets connected to the wire's excessive length and is applied for unscrewing the pin with a T-handle.

Information about the handling of this instrument is available in the instruction manual for HCP extraction instrument.

IMPORTANT:
Make first turns always by hand and with caution till the HCP can be turned smoothly.

When the HCP shows little resistance and can be connected to the chuck, a drilling machine may be used. On doing so, the removal of the pin shall be done constantly and not too fast to prevent unnecessary heat built-up and overstress of the implant.
Clinical Cases - Case 01, male, 46 years

Fig. 1a: Pre-op, x-ray ap

Fig. 1b: Intra-op, situs at open reduction

Fig. 1c: Intra-op, x-ray check ac

Fig. 1d: Intra-op, x-ray check ap

Fig. 1e: Post-op, x-ray check ap
Clinical Cases - Case 02, male, 20 years

Fig. 2a: Pre-op, x-ray ap

Fig. 2b: Intra-op, x-ray check ac

Fig. 2c: Intra-op, x-ray check ap

Fig. 2d: Post-op, x-ray check ap
Revision after plate osteosynthesis with screw pull out

Fig. 3a: Pre-op, x-ray ap

Fig. 3b: Post-op, x-ray check ap

Fig. 3c: 1 year post-op, x-ray check ap
Clinical Cases - Case 04, male, 56 years

Fig. 4a: Pre-op, x-ray ap

Fig. 4b: Intra-op, x-ray check ap, posterolateral insertion

Fig. 4c: Intra-op, x-ray check ac, posterolateral insertion

Fig. 4d: Post-op, x-ray check ap
Fig. 5a: Pre-op, x-ray ap

Fig. 5b: Post-op, x-ray check ap, posterolateral insertion

Fig. 5c: 2 months post-op, x-ray check ap

Clinical Cases - Case 05, male, 36 years

Clinical Cases - Case 06, male, 49 years

Fig. 6a: Pre-op, x-ray ap

Fig. 6b: Post-op, x-ray check ap
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