Table of Contents

The IP-XS-Compression Nail System
General 3
Pre-Operative Planning 3
Surgical Technique on Olecranon Fractures 4-6
Surgical Technique on Patella Fractures 7-9
Surgical Technique on Upper Ankle Joint Fractures 10-14
Surgical Technique on Pilon Tibial Fractures 15-17
Implants 18
Instruments 19
The IP-XS-Compression Nail System

General

Instruments

Positioning Device with fixed 11-hole IP-XS-Nail, lateral Drill Guide and Kirschner Wire with threaded tip.

The nail is screwed to the positioning device with the adapter. The webs of the adapter sleeve must fit into the nail grooves exactly. The nail can only be attached to the adapter sleeve in a certain e.g. correct rotation position.

IP-XS-Nail Tray
Adapter for IP-XS-Nail
IP-XS-Nail
Adapter for IP-XXS-Nail
IP-XXS-Nail
Lateral Drill Guide
Reduction Sleeve IP-XS-XXS-Nail
IP-XSL-Nail
Compression Screws

Kirschner Wires with threaded Tip
IP-XS-Nail Case
Positioning Device with Adapter Sleeve
Screw Driver with Holder
T-Handle with AO Adapter
Hollow Drill
Centering Wire
Hand Drill

Pre-Operative Planning
A true scale template is available for the pre-operative selection of the implant length (magnification factor 1.15). This means that the length of the nail, but also the length of the thread needed on the locking wires, can be determined pre-operatively.
Surgical Technique on Olecranon Fractures

Dislocated Multifragment Fracture
For the olecranon synthesis, we recommend that the operation is performed in the abdominal position with blood block applied and the arm abducted and flexed 90° at the elbow. A typical longitudinal incision is made with radial perimotisation of the olecranon. As with the conventional technique, we visualise the area of the joint on both sides of the olecranon fracture. In order not to damage the ulnar nerve, we visualise this in principle from proximally of the sulcus ulnaris to distally of the fracture and treat the nerve with the greatest care throughout the operation. The holder for the nerve sling is not provided with a clip in order not to risk tensile damage to the nerve through the weight of the clip or if the clip sticks.

Reduction
Since the IP-XS Nail is used to treat fractures involving the articular area as a rule, contrary to other nail osteosyntheses, a precise anatomical reduction must always be performed before the actual osteosynthesis. This applies irrespective of the anatomical location. Only in the case of subaponeurotic fractures in the patella, upper angle joint fractures and olecranon area can percutaneous treatment also be carried out. In the case of pilon and ulna shaft fractures, the treatment is percutaneous.

With olecranon fractures, too, if necessary, the exact anatomical reduction takes place with raising of the articular area fragment and padding underneath in the usual way.

Preparation for the Nail Implantation
A 2 mm Centering Wire is drilled in in the axial direction, from the proximal olecranon area through the triceps tendon and into the medullary space. It is important to guide the wire through the fragment nearest the articular area to achieve a secure fixing. It is not necessary to detach the triceps tendon; only a short split in the tendon in the direction of the fibres is required.
Drilling out of the nail site
After checking the position in both planes with the image converter, the Centering Wire is used to drill open the bone around the Centering Wire using a 4.5 mm Hollow Drill. The drill has markings that indicate the length of the 4 hole nail to 11 hole nail without compression screw. The length of the nail is selected according to the pre-operative template size, but it is also possible by checking intra-operatively with a normal screw length measuring device.

Inserting of the Compression Nail
According to the pre-operative template length, choice of nail and locking wires. The locking can be radial or ulnar. The distal locks can usually be introduced via percutaneous incisions, which shortens the skin incision.

With the aid of the image converter, the nail is introduced until the proximal locking hole finishes with the bone contour. In the case of larger fragments, the nail can also be introduced completely into the bone in order to avoid soft part irritation. The nail is introduced with slight turning movements or light axial hammer blows.

Positioning of the threaded Kirschner Wires
After drilling in a threaded wire, the sleeve is left in and a second sleeve is inserted into the next hole. This increases the stability of the target system. The first sleeve is then placed in another hole and a new threaded wire is drilled in.

To shorten the wires, a Percutaneous Forceps is used.

Apart from the metal nail adapter, the carbon positioning device can be X-rayed so that when the lateral drill guide for the threaded wires has been removed, the position of the wire can be easily seen in the transverse beam path.
Compression of fracture
In the case of olecranon fractures, the system is nearly always only compressed by the compression screw. However, in the case of additional dorsal fragment splintering, crossed or transverse wire loops can be used between the ends of the threaded locking wires.

End of osteosynthesis, final check by image converter
Surgical Technique on Patella Fractures

Approach
We recommend that patella fracture osteosynthesis is carried out in the dorsal position with blood block applied and with the knee joint bent to approximately 20° using a suitable roller support and with an image converter with sterile cover permanently installed in the transverse beam path. We use a longitudinal incision via the knee-cap of a length that extends slightly beyond the upper and lower patella pole. The bursa praepatellaris is usually injured as well and should be resected. We recommend a short medial parapatellar longitudinal arthrotomy to check the reduction result. This can only be omitted with the co-rupture of the retinacula. The fracture should be reduced and held with reduction forceps in the usual way.

X-ray pre-operative
Articular surface fragments or small intermediary fragments are usually fixed to the neighbouring main fragments with Ethipin pins. Peripheral fragments can be fixed with thin Kirschner wires, also only temporarily. When introduced, Kirschner wires must not cross the path of the future nail bearing.

Reduction
Since the IP-XS Nail is used to treat fractures involving the articular area as a rule, contrary to other nail osteosyntheses, a precise anatomical reduction must always be performed before the actual osteosynthesis. This applies irrespective of the anatomical location. Only in the case of subaponeurotic fractures in the patella, can percutaneous treatment also be carried out.
Centering wire and a temporary assistant wire are drilled in
The nail itself is positioned after drilling in a non-threaded 2 mm Kirschner guide wire.

Drilling open with a 4.5mm drill
After checking the position in both planes with the image converter, the Kirschner wire is used to drill open the bone around the guide wire using a 4.5 mm drill. The drill has markings that indicate the length of the 4 hole nail to 11 hole nail without compression screw. The length of the nail is selected according to the pre-operative template size, but it is also possible by checking intra-operatively with a normal screw length measuring device.

Introduction of the IP-XS-nail
With the aid of the image converter, the nail is introduced until the proximal locking hole finishes with the bone contour. In the case of larger fragments, the nail can also be introduced completely into the bone in order to avoid soft tissue irritation. The nail is introduced with slight turning movements or light axial hammer blows. The nail can be introduced proximally or distally and also in transverse directions in the case of longitudinal fractures.
Locking
Depending on the fragment length, locking of the fragment near the perforation point is done with at least one threaded wire, or 2 if possible. Locking in the fragment away from the perforation point is also done with at least one wire, but again with 2 if possible. In the case of multiple fragment fractures, it is better to use all the positions.

Fixation of ventral fragments with crossed wire tension banding loops
Depending on whether it is intended to apply additional medial or lateral or even crossed wire tension banding loops, the threaded wires on the opposite side only have to be introduced as far as the surface of the bone, or approximately 2 to 3 mm beyond this if it is intended to apply loops. Perforation of the opposite side of the patella must be checked with the finger or an instrument. There is no risk of injury if the drilling is done slowly, because the wire can already be felt before perforation of the connective tissue parts. If no additional wire loops are fitted, we usually omit metal removal, so the Kirschner wires should be shortened directly, 1 mm above the surface of the bone.

Compression of the fracture
The Kirschner wires are also shortened as required on insertion end of the locking wires. Side cutting pliers or the special percutaneous wire cutter should be used to remove surplus threaded wire. The latter must also be used with percutaneous wire introduction in order to shorten the wire sufficiently (3 mm projection) with a small skin incision.
After checking the position of the locking wires, the positioning device is removed and a compression screw is screwed into the proximal nail end. This screw compresses the proximal threaded wire and therefore the proximal fragment in the direction of the fracture and produces a uniform compression. It serves as a locking screw at the same time. Metal removal is not necessary with a fully countersunk implant and threaded wire length. However, if additional wire loops are introduced and the wire ends cause irritation of the soft tissue, the metal is removed. It is best to use a strong Hegar needle holder to remove the threaded wires. The nails are extracted with small flat pliers or by inserting the adapter into the nail after removing the compression screw.
Surgical Technique on Upper Ankle Joint Fractures
Pre-operative X-ray A/P and lateral

Drilling in of centering wire
In the case of outer malleolus fractures, the wire should be introduced from the fibular tip if possible. To do this, the peroneal tendons have to be raised with a Langenbeck's hook. Lateral access without raising the tendons can only be used for far distal fractures and therefore with the use of a nail with up to 6 holes.

Centering wire, clinical picture
Both fibula and inner malleolus fractures can occur as strain fractures. It has also been found that the IP-XS nail is a favourable alternative treatment for normal Weber-B and C fractures, even with additional syndesmosis fragment injuries. Therefore, the IP-XS Nail has also been used for Weber A, B and C fractures. In this case, the main advantage lies in not introducing a plate under the thin soft tissue cover and thereby reducing the risk of wound healing, particularly in patients with poor circulation. The reduction is done in the conventional way. In the case of a very thin fibula, the IP-XXS nail, not the IP-XS nail, and a correspondingly smaller 3.5 mm hole is adequate. Transverse fractures are compressed with a Maden screw.
Drilling of the seat for nail implantation
Diagonal fractures - as is the rule with Weber B & C fractures - are compressed with wide-armed reduction forceps to avoid breaking into the bone and threaded wires are used for the pressure fixing in the area of the fracture.

Positioning of the compression nail
Drilling in a 2 mm Kirschner wire in the direction of the medullary space of the fibula or in the area of the inner malleolus and, in the case of Weber A fractures, as vertical to the fracture line as possible, is followed by tapping and introduction of the nail. The nail is fixed in the carbon positioning device and twisted in or hammered in. The strap should be turned with a ventro-dorsal alignment. The locking wires are positioned from ventral to dorsal, parallel to the path of the articular area. The threaded wires are introduced dorsally only as far as the surface of the bone in order to avoid irritation of the peroneal and tibialis posterior and flexor tendon (checked with a clamp). Compression is provided by the axial screw. Inner malleolus fractures are treated in a similar way with an IP-XS or IP-XXS nail, depending on fragment size.

Drilling in of the first threaded wire through a drill guide
First Kirschner wire distal. After drilling in a threaded wire, the sleeve should have been left and a second sleeve should have been inserted into the next hole. This increases the stability of the target system. The first sleeve is then placed in another hole and a new threaded wire is drilled in.
Drilling in of the second threaded wire
Second Kirschner wire distal. After drilling in a threaded wire, the sleeve should have been left and a second sleeve should have been inserted into the next hole. This increases the stability of the target system. The first sleeve is then placed in another hole and a new threaded wire is drilled in.

After distal and proximal introduction of the threaded wires, the fracture is stabilised by the first Kirschner wire.

Next step, the fracture is stabilised by a second Kirschner wire.

Checking of the wire positions A/P
Checking of the threaded wires length

Correction of the threaded wires length by drilling the wires back.

Correction of the threaded wires length. Clinical picture. Stability check of the syndesmosis using a single prawn hook.

End of the fixation
Shortening of threaded wires by either percutaneous forceps or side cutting pliers.

End of osteosynthesis

X-ray A/P post op
Surgical Technique on Pilon Tibial Fracture

Medical evidence of soft tissue

X-ray accident diagnosis

Treatment with IP-XS Nail Fibula and external fixator
X-ray diagnosis after removal of external fixator and IP-XS-Nail osteosynthesis of the Tibia and Fibula

In the case of a Pilon tibial fracture, a covered procedure with stitch incision at the fibular tip is indicated. This will protect the committed skin. After introducing the nail and locking near the perforation point, the length of the fibula can be adjusted by pulling on the strap. In this case, the tibial articular area is more or less vertical to the tibial longitudinal axis. Proximal locking is done in this position. A standard nail (up to 11 holes) is sufficient as a rule. Otherwise, a special length nail (IP-XSL) and proximal free hand locking is necessary.
Soft tissue situation medial 10 weeks after accident with full weight bearing

Soft tissue situation lateral 10 weeks after accident with full weight bearing
## Implants

### Implants IP-XS- and IP-XSL-Nail

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Hole</th>
<th>Diameter</th>
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<tbody>
<tr>
<td>0132350</td>
<td>IP-XS Nail</td>
<td>4 hole</td>
<td>Ø 4.5 x 38 mm</td>
</tr>
<tr>
<td>0132351</td>
<td>IP-XS Nail</td>
<td>5 hole</td>
<td>Ø 4.5 x 47 mm</td>
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<tr>
<td>0132352</td>
<td>IP-XS Nail</td>
<td>6 hole</td>
<td>Ø 4.5 x 55 mm</td>
</tr>
<tr>
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<td>IP-XS Nail</td>
<td>7 hole</td>
<td>Ø 4.5 x 64 mm</td>
</tr>
<tr>
<td>0132354</td>
<td>IP-XS Nail</td>
<td>8 hole</td>
<td>Ø 4.5 x 72 mm</td>
</tr>
<tr>
<td>0132355</td>
<td>IP-XS Nail</td>
<td>9 hole</td>
<td>Ø 4.5 x 81 mm</td>
</tr>
<tr>
<td>0132356</td>
<td>IP-XS Nail</td>
<td>11 hole</td>
<td>Ø 4.5 x 99 mm</td>
</tr>
<tr>
<td>0132370</td>
<td>IP-XSL Nail</td>
<td>8 hole</td>
<td>Ø 4.5 x 196 mm</td>
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<tr>
<td>0132372</td>
<td>IP-XSL Nail</td>
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<td>Ø 4.5 x 222 mm</td>
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<td>0132373</td>
<td>IP-XSL Nail</td>
<td>8 hole</td>
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<tr>
<td>0132371</td>
<td>IP-XSL Nail</td>
<td>8 hole</td>
<td>Ø 4.5 x 272 mm</td>
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<td>0132361</td>
<td>Compression Screw M3 x 10 mm</td>
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0132382 | Kirschner Wire Ø 2.0 x 150 mm, Threadlength 20 mm |
0132384 | Kirschner Wire Ø 2.0 x 150 mm, Threadlength 60 mm |

### Implants IP-XXS-Nail

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Hole</th>
<th>Diameter</th>
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<tbody>
<tr>
<td>0132390</td>
<td>IP-XXS Nail</td>
<td>3 Hole</td>
<td>Ø 3.5 x 29 mm</td>
</tr>
<tr>
<td>0132391</td>
<td>IP-XXS Nail</td>
<td>4 Hole</td>
<td>Ø 3.5 x 38 mm</td>
</tr>
<tr>
<td>0132393</td>
<td>IP-XXS Nail</td>
<td>6 Hole</td>
<td>Ø 3.5 x 55 mm</td>
</tr>
<tr>
<td>0132394</td>
<td>IP-XXS Nail</td>
<td>8 Hole</td>
<td>Ø 3.5 x 72 mm</td>
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<tr>
<td>0132392</td>
<td>IP-XXS Nail</td>
<td>10 Hole</td>
<td>Ø 3.5 x 90 mm</td>
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<tr>
<td>0132395</td>
<td>IP-XXS Nail</td>
<td>8 Hole</td>
<td>Ø 3.5 x 143 mm</td>
</tr>
<tr>
<td>0132396</td>
<td>IP-XXS Nail</td>
<td>8 Hole</td>
<td>Ø 3.5 x 178 mm</td>
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</tbody>
</table>

0132362 | Compression Screw M2.5 x 10 mm |

0132381 | Kirschner Wire Ø 1.6 x 130 mm, Threadlength 15 mm |
Instruments and their Care

Instruments for IP-XS- and IP-XSL-Nail

1133300       Container Cover
1133312       Case
1133313       Tray
1133302       Adapter M3
1133303       Screw Driver with Holder M3
1133304       Lateral Drill Guide Ø5.0/2.0 mm (2 pieces)
1133309       Hollow Drill Ø4.5/2.0 mm
1133310       Positioning Device with Adapter Sleeve
1133320       T-Handle with AO Adapter
1133322       Centering Wire Ø2.0x250 mm
1133361       Hand Drill XSL Ø4.5x320 mm

Additional necessary Instruments IP-XXS-Nail

1133342       Adapter M2.5
1133343       Screw Driver with Holder M2.5
1133344       Lateral Drill Guide Ø5.0/1.6 mm (2 pieces)
1133346       Reduction Sleeve XS-XXS
1133349       Hollow Drill Ø3.5/1.6 mm
1133321       Centering Wire Ø 1.6x150 mm
1133361       Hand Drill XXS Ø3.5x240mm

Special Instruments IP-XS Nail

1133315       Sterilisation Container Basic
1133317       Percutaneous Forceps

Important Note
The instruments are handled in the usual manner. The perforated drills, centering wires and sleeves should be thoroughly rinsed and all blood residue removed.

Drills and centering wires become less sharp with use, potentially resulting in axial deviations or deformation of these instruments. Ensure that only sharp drills and centering wires are used. Blunt instruments should be re-sharpened or replaced. The system elements and instruments are supplied in unsterile condition. Before use they must be sterilised in an autoclave by conventional methods and in accordance with internal hospital guidelines. The autoclave manufacturer's directions for use should be consulted for the correct settings of sterilisation temperature and cycle time. The instrument manufacturers and dealers accept no responsibility of any kind for sterilisation of the products by the purchaser.