

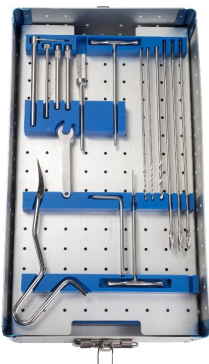
Intramedullary locked Nailing With Screws for
Humerus Fractures
Solid/Cannulated



Surgical Technique



Humeral Interlocking Nail



Approved by



Intramedullary Nail System
Humerus Nail Kit
Code 08050001



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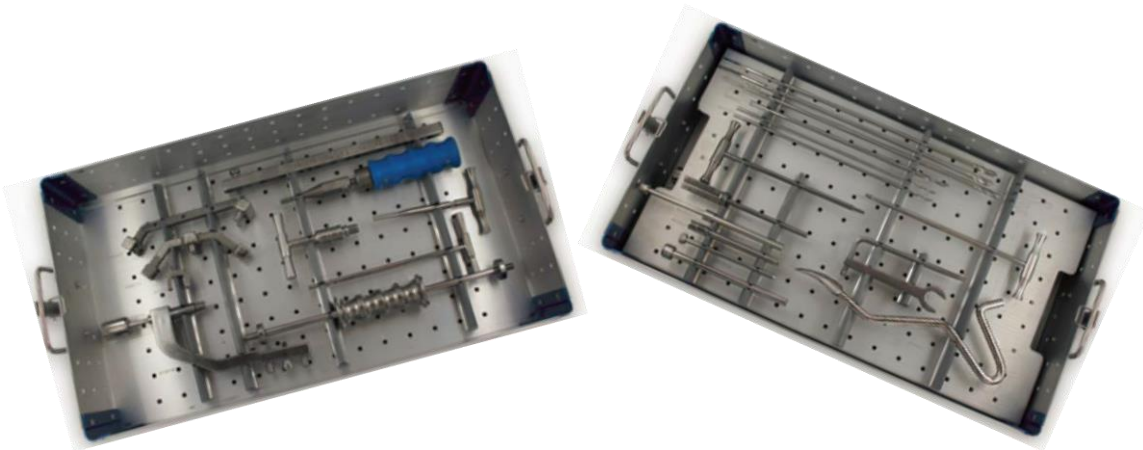
Intramedullary locked Nailing With
Screws for Humerus Fractures
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This guide is designed to demonstrate the techniques that can be applied to the utilization of the **ARZZT** locked intramedullary nail for the humerus, and it is recommended for use by orthopedic traumatologists in the treatment of humerus fractures.

The recommendations for their use do not presume to interfere with the surgeon's experience, nor the particular needs of each patient, and follow the biomechanical principles of internal splints with treatment of diaphyseal and proximal fractures of the humerus.





Introduction

Conservative treatment does not always lead to favorable results, and is linked to long periods of immobilization, as well as trophic and functional problems in the upper part of the affected extremity.

The fracture line can extend from the metaphyseal area to the superior and inferior diaphyseal thirds (diaphyseal lesions or fractures).

The management of these lesions caused by high-energy trauma, which are increasingly more frequent, has led to the development of implants like the ARZZT intramedullary nailing system for the humerus, which can be used to treat various types of fractures.



Implant Design

The ARZZT solid and cannulated intramedullary nails for the humerus have the particular feature of being able to block the proximal part in three ways and on three planes, allowing for excellent fixation and stability with respect to both fracture lines and tuberosities (including diaphysis).



The ARZZT intramedullary nails for the humerus are available in solid and cannulated versions, are made from a titanium 6Al4V alloy, and can be used at the discretion of the orthopedic surgeon, who must evaluate the risk, benefits, and convenience.

The solid nail can be drilled manually or not, creating a diameter 1 mm greater than that of the nail.

It is available in the following measurements:

- Diameter Ø 7 mm / longitude of 180 to 320 mm
- Diameter Ø 8 mm / longitude of 180 to 320 mm

The cannulated nail is best used with drilling, and is available in the following measurements:

- Diameter 6.7 mm / longitude of 140 to 340 mm
- Diameter Ø 7 mm / longitude of 180 to 320 mm
- Diameter Ø 8 mm / longitude of 180 to 320 mm

Diameter of cannulated orifice: 3.00 mm

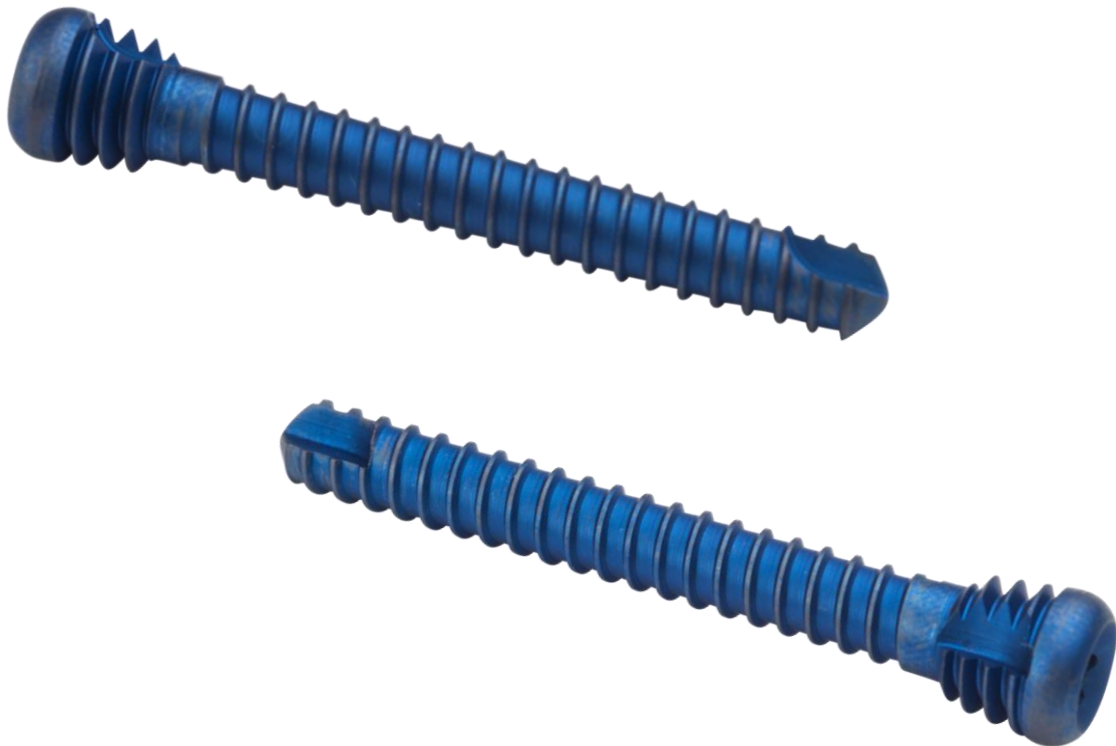




Implant Design

Diameter of the guide rod: 2.0 mm; longitude of 800 mm
Both nails are available in increments of 20 mm between each of their lengths.

Titanium locking screws: diameter of 3.85 mm, measurements of 20 to 50 mm with increments of 5 mm between measurements, made from titanium 6Al4V





Indications

Ins Hilden Arzzt Nail Systems, consisting of intramedullary solid and cannulated nails, end cap and locking screws, are intended for fixation of fractures of different types: of the shaft, open and closed shaft fractures; and malunion and non-unions of the Femur, Tibia, and Humerus.

Pre-operative Planning

The diameter and longitude of the nail can be established by way of X-rays of—if possible—the healthy extremity, which are to be used as templates, taking into account the magnification, which varies between 10 and 15%.

Some surgeons make use of the image intensifier, superimposing the nail onto the affected extremity to establish the diameter and obtain a safe distance from the joint, as well as the insertion point of the nail.

The longitude of the nail can be determined prior to the surgery by measuring the healthy humerus from the point of the humeral head to the upper part of the olecranon fossa, and subtracting three or four centimeters from the figure obtained.

For very narrow bones, it is recommended to place the nail with a smaller diameter—at the surgeon's discretion—and, depending on the comminution and stability of the fracture, it is recommended to use a nail with a larger diameter with the aim of achieving greater fastening and stability.

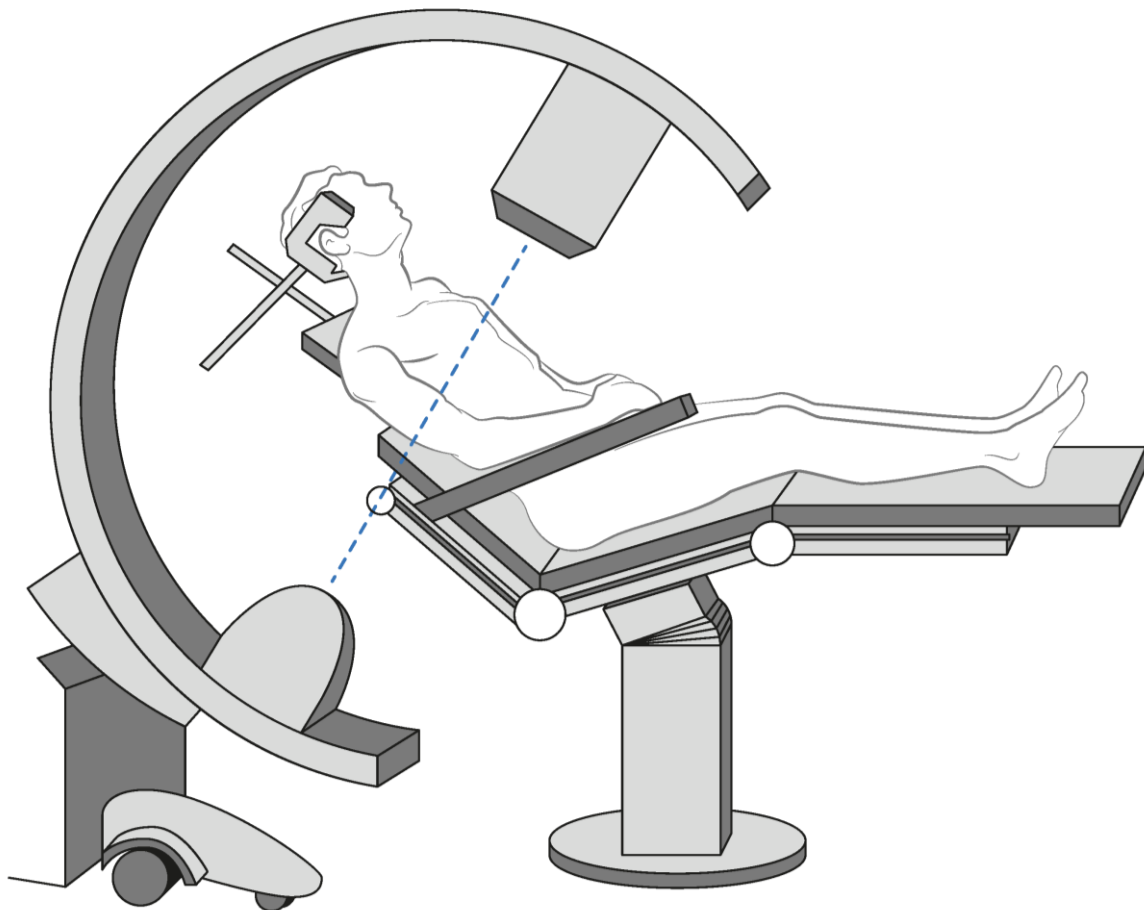


Patient Positioning

It is recommended to place the patient on the fracture table in a “beach chair” position, laying laterally or dorsally prone with the aim of facilitating both the reduction of the fracture and the surgical approach chosen by the surgeon.

Beach chair position:

The patient is placed seated with 30 to 60 degrees of flexion, the lower extremities are placed flexed over a bump, which allows for them to be supported, with the aim of diminishing venous stasis.

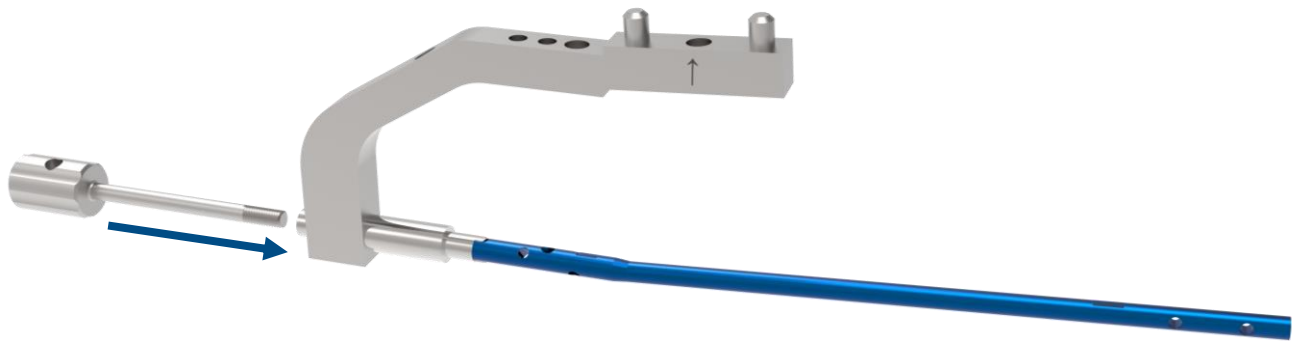




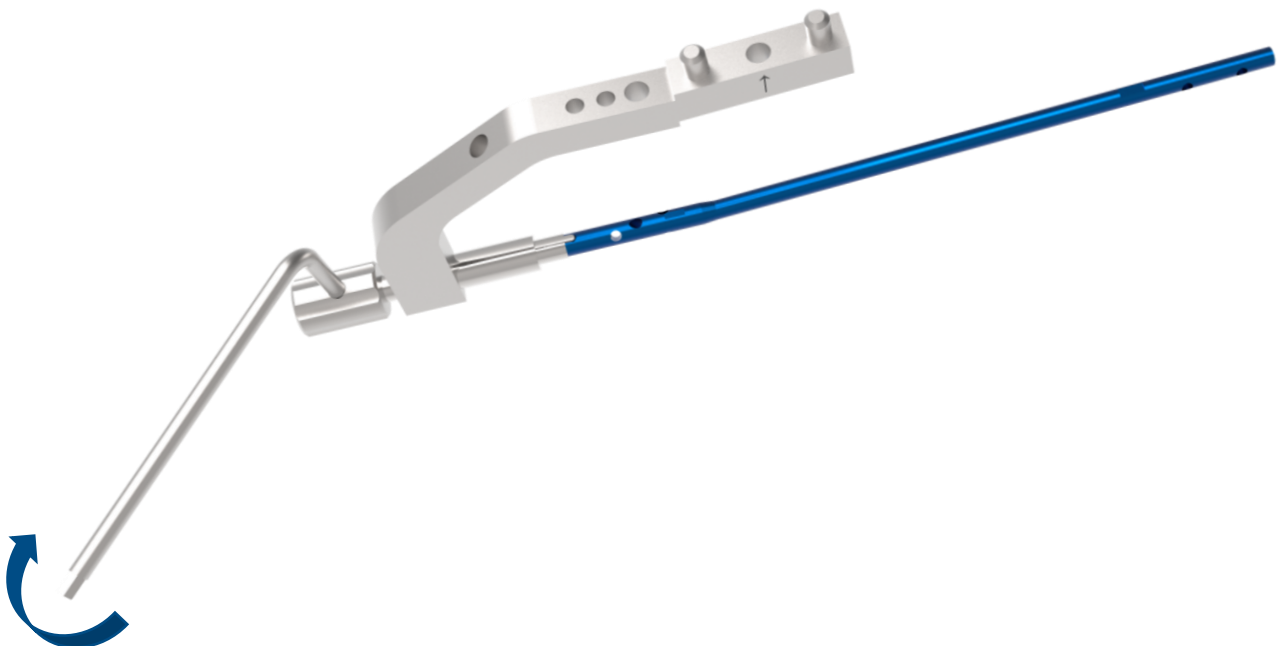
Preparing the nail and Instruments

The nail must be assembled and calibrated before it is used inside the humerus in order to allow for the free passage of the screws and create exact symmetry with the instrumental frame.

1. Place the nail in the insertion handle, ensuring that the grooves line up, and attach it to the nail connector. (Picture)
2. Fasten the nail in the insertion sleeve with the nail connector,



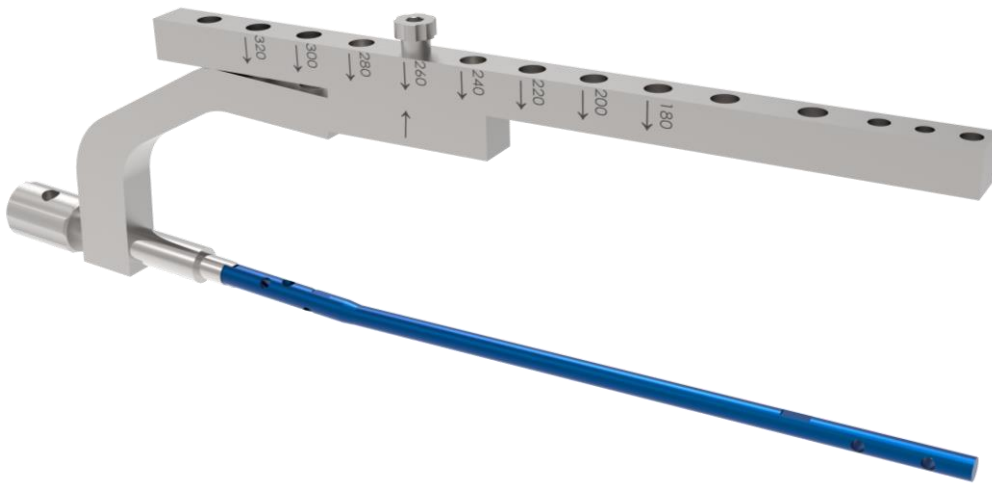
and tighten the handle firmly, using the L-handled hexagon key (Allen), introducing it into the handle's orifices.



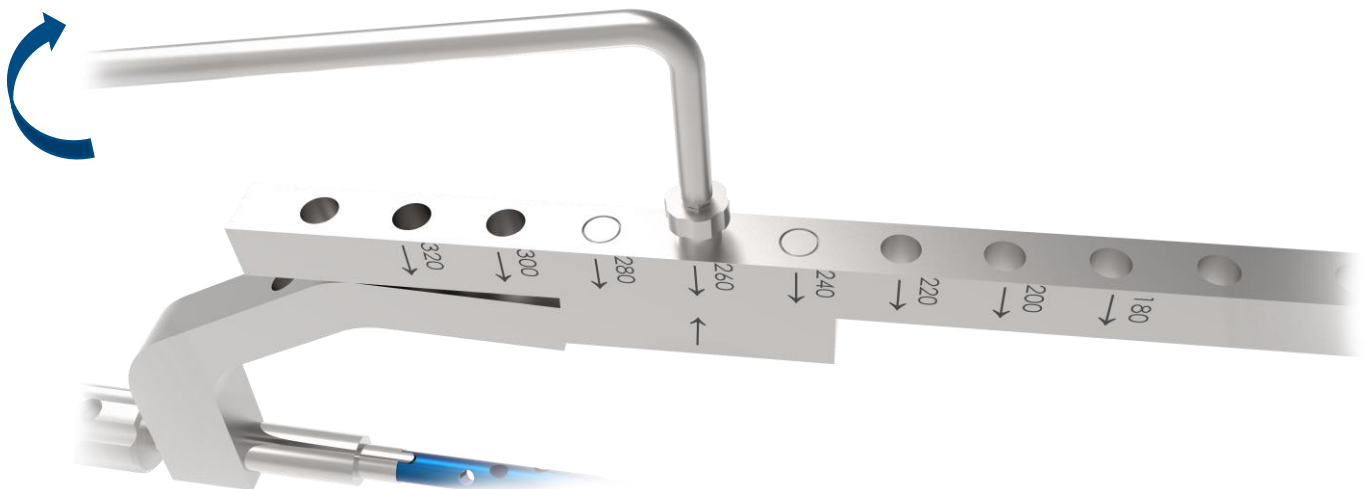


Preparing the nail and Instruments

3. Position the humeral arm.

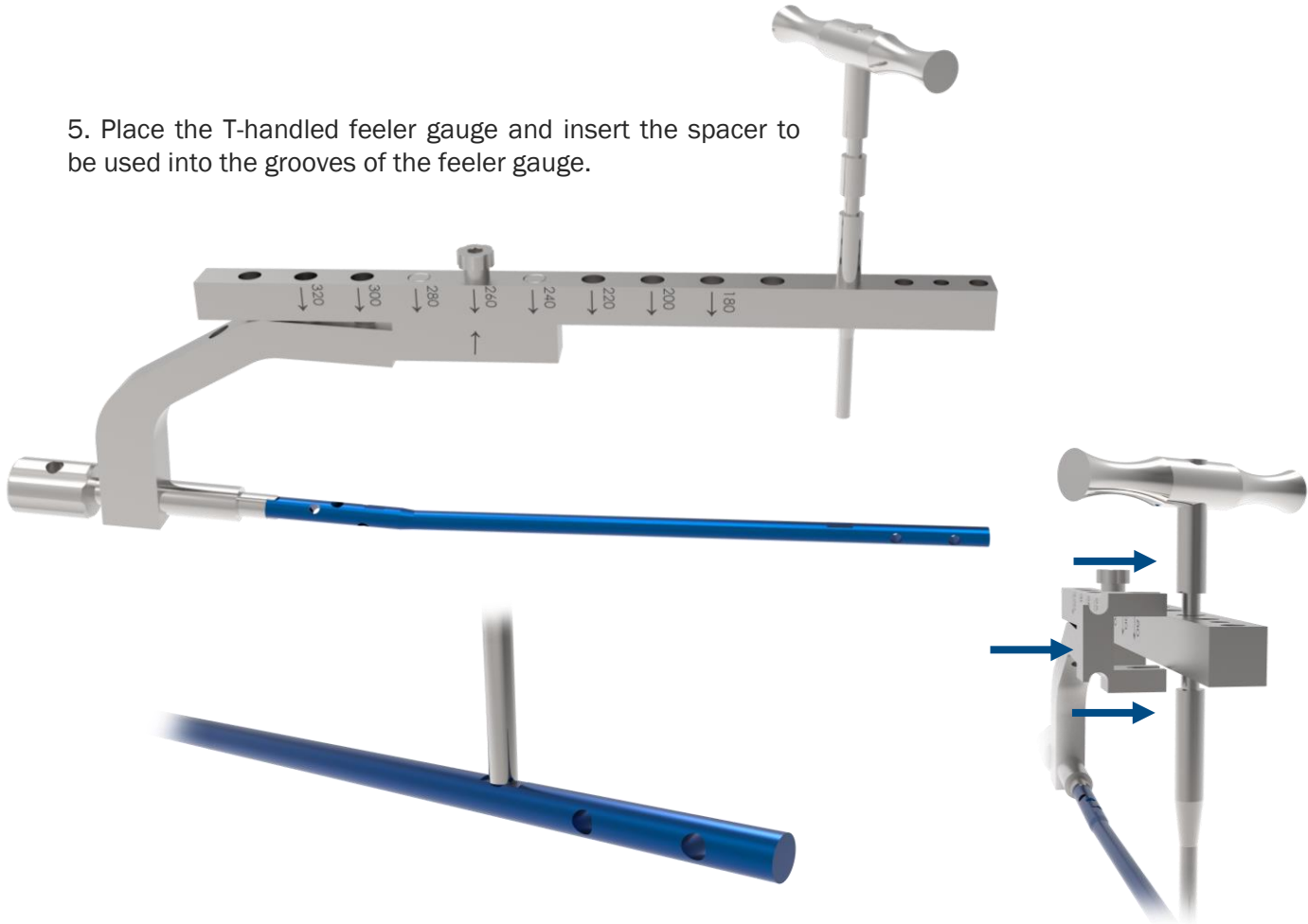


4. Secure the module by tightening the fastening screw with the L-handled hexagon key (Allen)

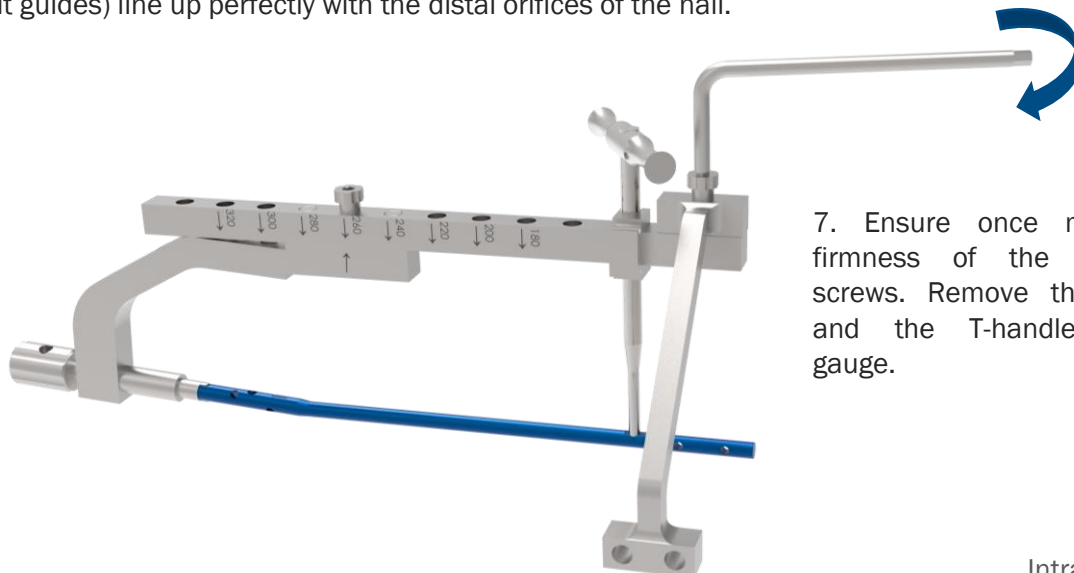




5. Place the T-handled feeler gauge and insert the spacer to be used into the grooves of the feeler gauge.



6. Calibrate the distal arm, fastening it with the fastening screw and tightening it firmly with the L-handed hexagon key (Allen), ensuring that the external sheaths for tissue protection of the internal sheaths (drill bit guides) line up perfectly with the distal orifices of the nail.

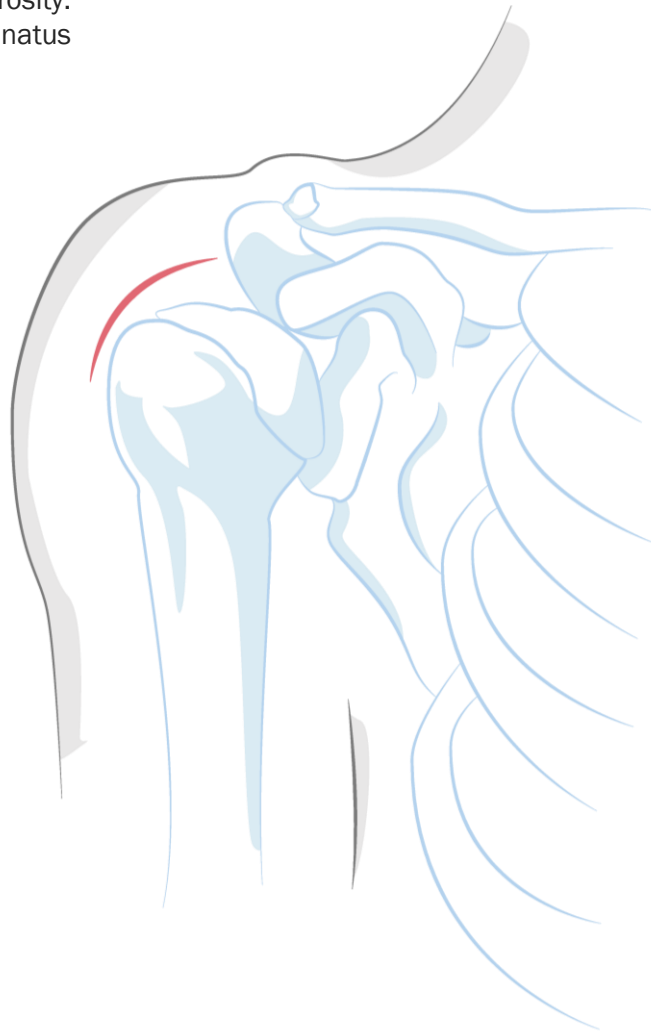


7. Ensure once more the firmness of the fastening screws. Remove the spacer and the T-handled feeler gauge.



Antegrade Solid Nail Technique

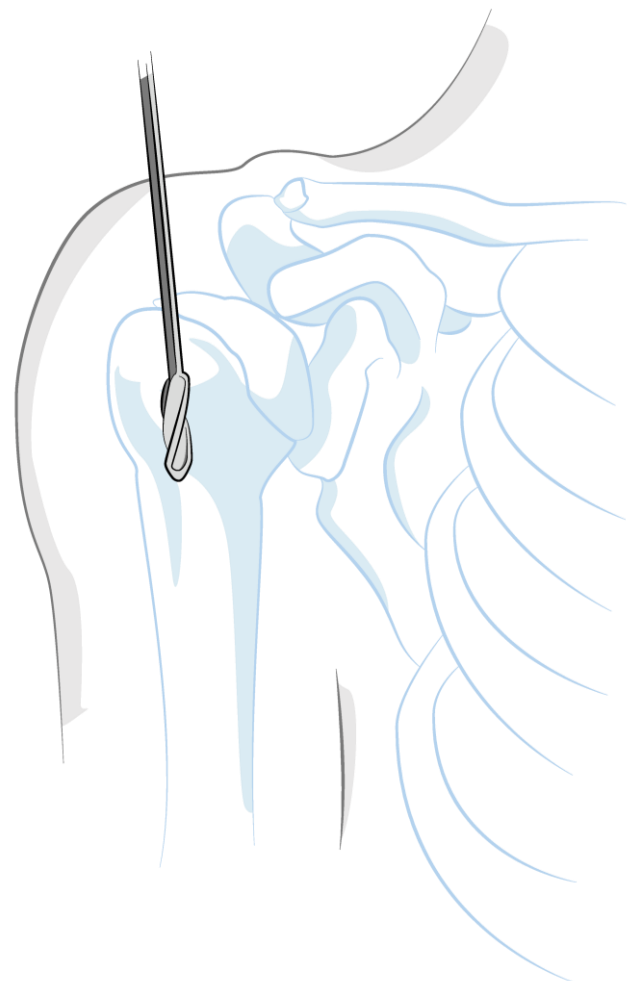
Make an incision of the skin from the anterolateral border of the acromion in the distal direction, toward the insertion of the deltoid muscles. Incise the subcutaneous tissue, and separate the muscular fibers of the deltoids. Locate the supraspinatus tendon and divide it in line with its fibers. Using blunt dissection, retract both borders with sutures on the tendon, and expose a portion of the cartilage of the humeral head medially to the greater tuberosity. Access to the point of entry is via the supraspinatus tendon.





Antegrade Solid Nail Technique

Introduce the primer punch via the opening made in the supraspinatus tendon, right on the lateral border of the humeral articular cartilage, verifying the correct position of the image intensifier on two planes and following the curvature of the primer punch, which will be rectified upon entering the medullar canal. The orifice or entry portal should be 10 mm in diameter. Remove the primer punch. Posteriorly, use the 7 and 8 mm reamer to widen the canal diameter, depending on the diameter chosen by the orthopedic surgeon.





Introduction of the Antegrade Nail

The point of access for the ARZZT humeral nail is found on the prolongation of the axis of the central humeral diaphysis, in the transition area between the bone and the cartilage. In the correct position with respect to the humeral head, the insertion point is found immediately beneath the tip of the acromion.

Once the nail is attached to the fastener handle, it must be introduced by exerting firm manual pressure with rotational movements until the tip of the nail reaches the fracture area. Perform reduction maneuvers, using the image intensifier to control the passage of the nail through the fracture line, and inserting it into the medullar canal of the distal humeral diaphysis of the fracture. To drive the nail, you may hit it with the nail impactor (hammer). The tip of the nail should be at a distance of 15 mm from the cranial limit of the olecranon fossa, with the guidance of the fastener handle directed toward the lateral surface of the arm. Verify the alignment of the fastener handle in order to perform the blocking in a completely lateral fashion.

Position the humeral module in order to locate the distal orifices, along with the distal arm. Place the external sheath (for tissue protection) and use it to make a mark where you will make the incision to introduce the feeler gauge. Make a 5 mm perforation with

the scalpel. Introduce a Kelly clamp and dissect the length and width of the incision. Introduce the external sheath (for tissue protection) and the sheath punch (dissector) until you reach the anterior cortex. Remove the sheath punch. Introduce the 4.5 mm drill bit. Use the bit to perforate the anterior cortex of the humerus. Remove and clean the residue with the T-handled bit. Introduce the feeler gauge, fastening it with the spacer.



Distal and Proximal Blocking

Place the exterior sheaths (for tissue protection) and interior sheaths (drill bit guides) in the orifices where the distal locking of the nail is to be performed. Mark its location on the skin. Makes two incisions of 5 mm each. Using a Kelly clamp, dissect the length and width of the wound. Introduce the external sheath (for tissue protection) with the sheath punch until the lateral cortex is located. Remove the sheath punch, position the internal sheath (3.5 mm drill bit guide), and perforate the humerus in both cortices. Remove the bit and the internal sheath (3.5 mm drill bit guide). Determine the longitude of the locking screw by using the depth gauge. Introduce the 3.5 mm screw. Perform the same maneuver for the most proximal of the distal orifices.



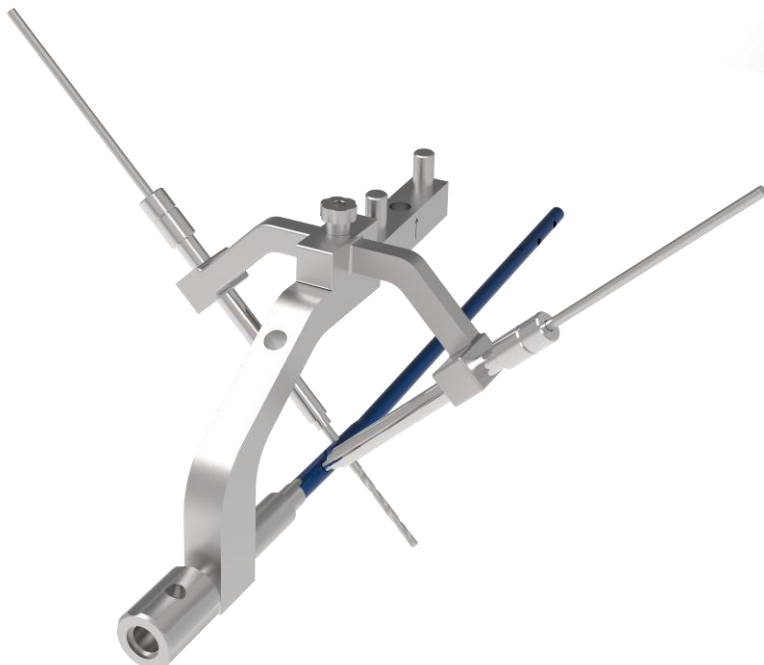
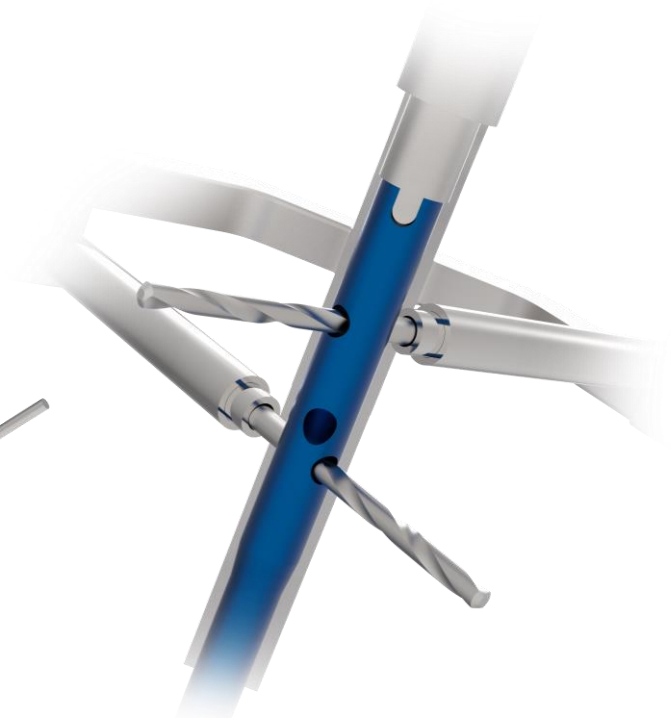
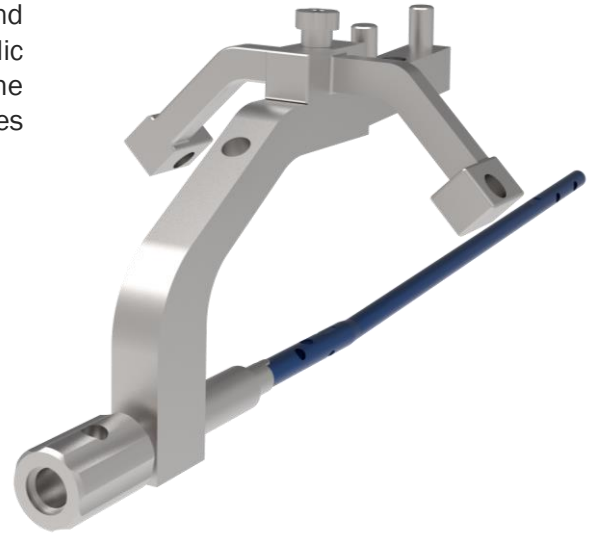


Distal and Proximal Blocking

Remove the feeler gauge and the humeral arm. Proceed to locate and perforate the proximal orifices, which are found at three different locations on three planes. The orthopedic surgeon will choose which are required and whether the characteristics of the fracture allow for the three orifices and three screws to be used without impediment.

Perform the same maneuvers for the location, perforation, and blocking to be used for the distal orifices. Using the proximal arm for support, introduce the blocking screws of the required longitude. Verify the reduction and the longitude of the screws. If there is no problem, remove the fastener handle from the nail, and introduce the sealing cap. Repair the rotator cuff, suture the subcutaneous cellular tissue with vicryl #2-0 and the skin with nylon #3-0, with this depending on the preferences of the orthopedic surgeon.

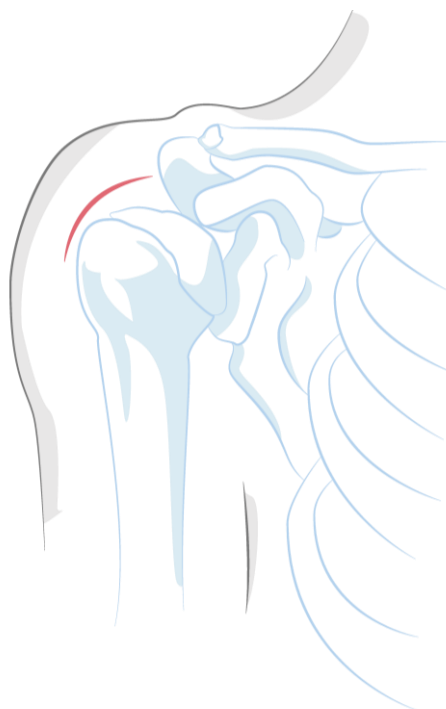
Cover the wound with a dressing and apply a shoulder immobilizer or sling. The surgery is complete.





Drilled Cannulated Nail Technique

Make an incision of the skin from the anterolateral border of the acromion in the distal direction toward the insertion of the deltoid muscles. Incise the subcutaneous tissue, and separate the muscular fibers of the deltoids. Locate the supraspinatus tendon and divide it in line with its fibers. Using blunt dissection, retract both borders with sutures on the tendon, expose a portion of the cartilage of the humeral head medially to the greater tuberosity. Access to the point of entry is via the supraspinatus tendon.



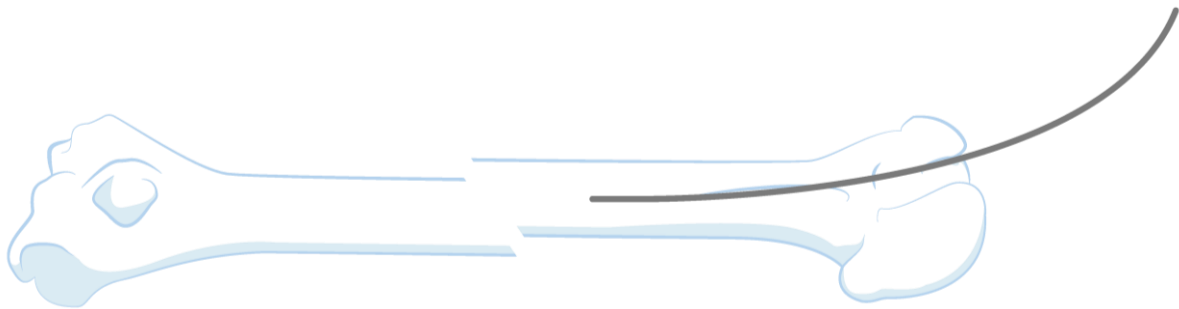
Introduce the awl via the opening made in the supraspinatus tendon right on the lateral border of the humeral articular cartilage, verifying the correct positioning with the image intensifier on two planes, following the curvature of the primer punch, which will be rectified upon entering the medullar canal. The orifice or portal must be 10 mm in diameter. Remove the primer punch. Posteriorly, introduce the guide wire to initiate the medullar drilling.



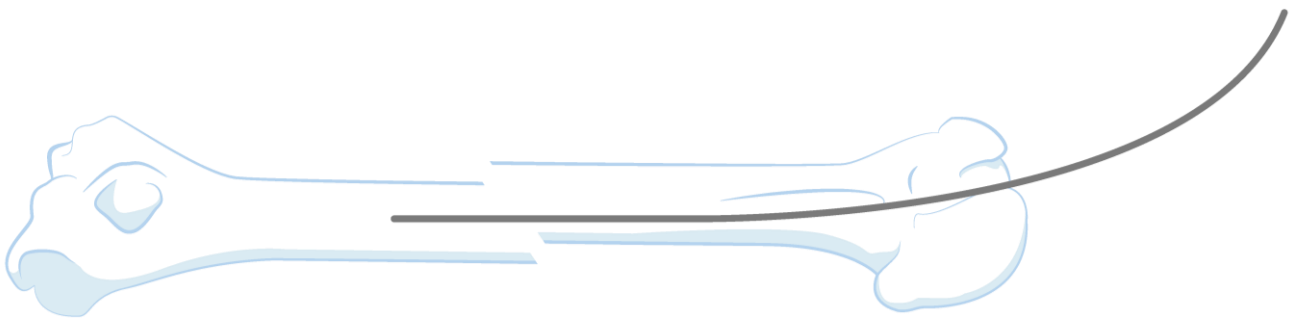


Drilled Cannulated Nail Technique

Guide rod (2.0 mm in diameter / 800 mm in longitude)



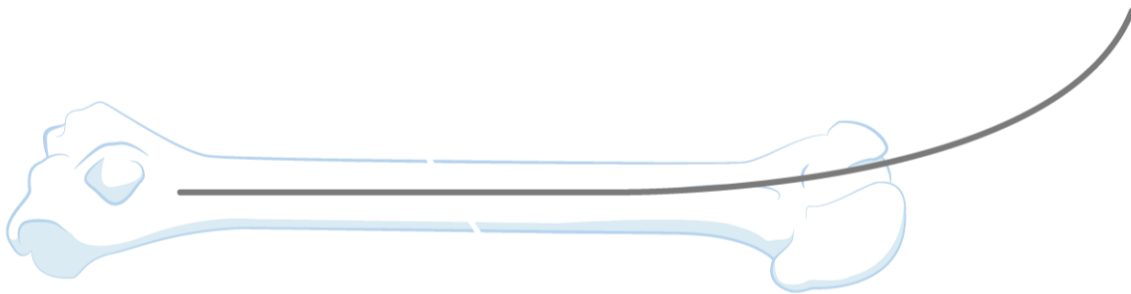
The drilling technique begins with the insertion of the guide wire (2.0 mm in diameter / 800 mm in longitude) through the access orifice or portal. With the help of the image intensifier, perform fracture reduction maneuvers in order to pass the distal end of the guide rod through the fracture site.



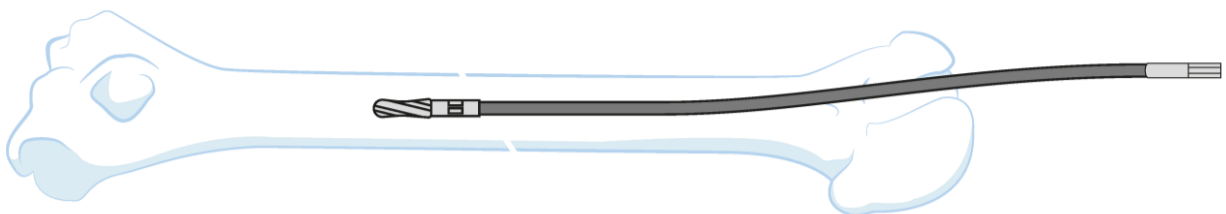


Drilled Cannulated Nail Technique

Using the image intensifier, confirm the passage of the guide wire through the fracture site. Introduce the guide wire up to 10 mm above the cranial limit of the olecranon fossa.



Begin the drilling of the medullar canal with the reamer of the smallest diameter, progressing in increments from the 0.5 mm medullar reamer. The final diameter is obtained once the reamer makes contact with the humeral cortex, and must be 1 to 1.5 mm greater than the diameter of the nail to be used.





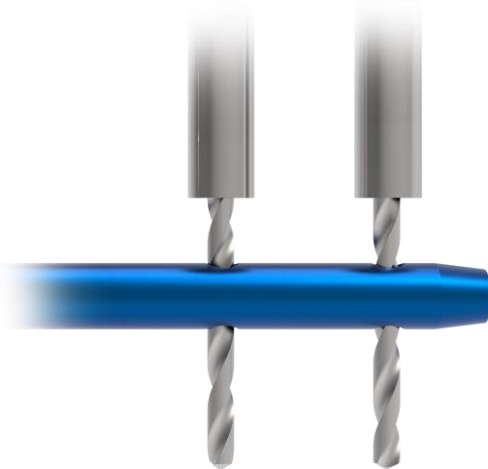
Introduction of the Antegrade Nail

With the humeral nail already mounted and fastened to the insertion handle, introduce the nail via the guide wire, exerting firm manual pressure with rotational movements until the tip of the nail reaches the fracture site. Perform maneuvers to reduce the fracture, using the image intensifier to control the passage of the nail through the fracture line, and inserting it into the medullar canal of the distal humeral diaphysis of the fracture. To drive the nail, you may hit it with the nail impactor (hammer). The tip of the nail should be at a distance of 15 mm from the cranial limit of the olecranon fossa, with the guide of the insertion handle directed toward the later surface of the arm.

Confirm the correct insertion of the humeral nail, as well as the alignment (reduction) of the fracture. Remove the guide rod. Verify the alignment of the fastener handle in order to perform the blocking in a completely lateral fashion.

Position the proximal arm in order to locate the distal orifices, along with the distal arm. Position the external sheath (for tissue protection) and use it to mark where you will make the incision to introduce the feeler gauge. Make a 5 mm perforation with the scalpel. Introduce a Kelly clamp and dissect the length and width of the incision.

Introduce the external sheath (for tissue protection) and the sheath punch (dissector) until you reach the anterior cortex. Remove the sheath punch. Introduce the internal sheath (4.5 mm drill bit guide). Use the bit to perforate the anterior cortex of the humerus. Remove and clean the residue with the T-handled bit. Introduce the feeler gauge, fastening it with the spacer.

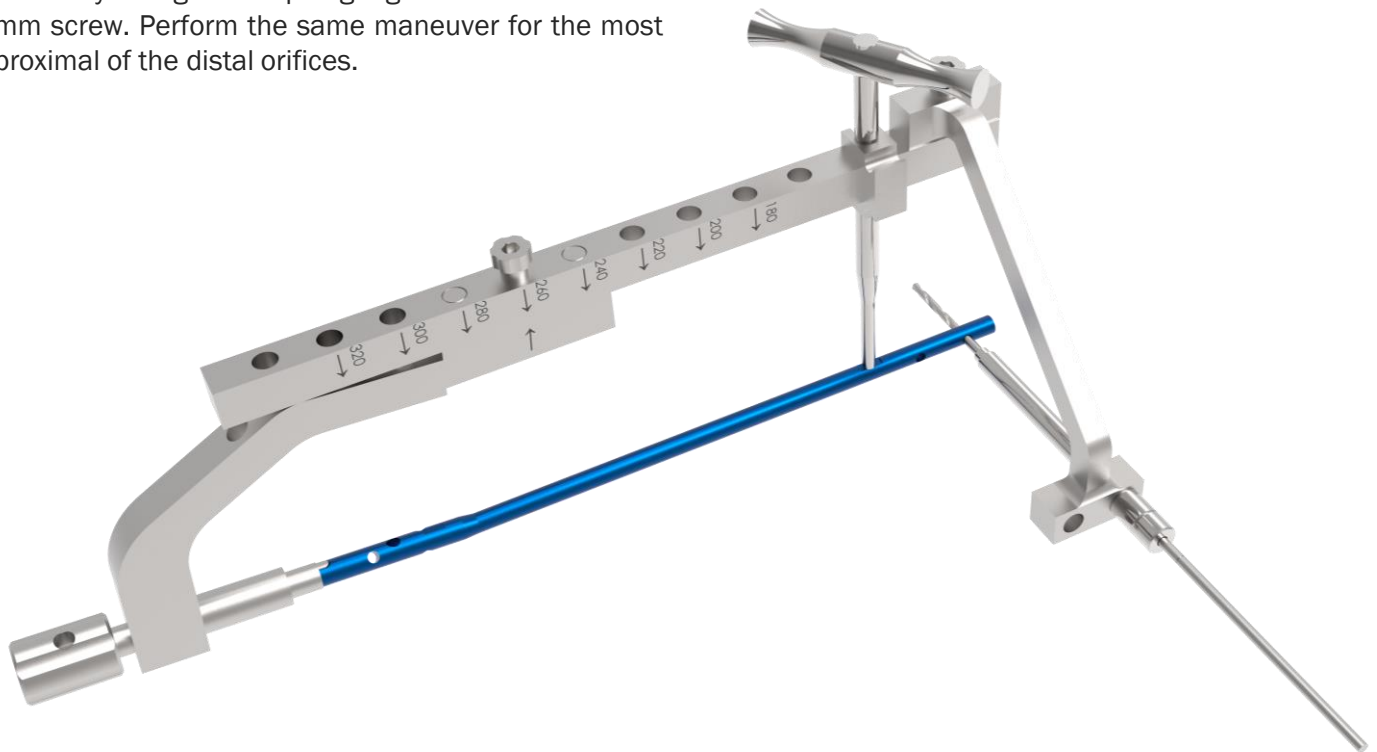




Distal and Proximal Blocking

Place the exterior sheaths (for tissue protection) and interior sheaths (drill bit guides) in the orifices where the distal locking of the nail is to be performed. Mark its location on the skin. Makes two incisions of 5 mm each. Using a Kelly clamp, dissect the length and width of the wound. Introduce the external sheath (for tissue protection) with the sheath punch until the lateral cortex is located. Remove the sheath punch, place the internal sheath (3.5 mm drill bit guide), and perforate the humerus in both cortices.

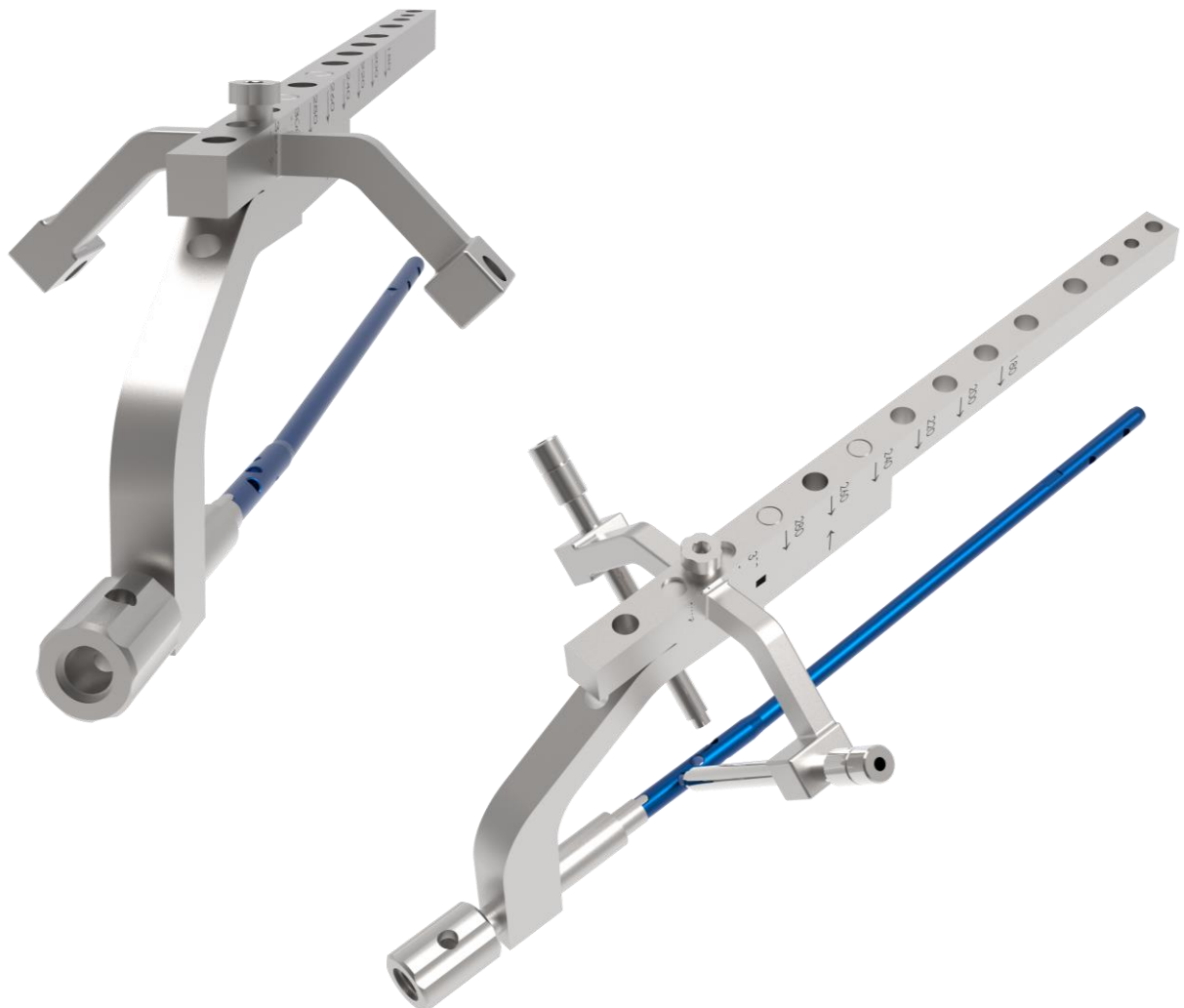
Remove the bit and the internal sheath (3.5 mm drill bit guide). Determine the longitude of the locking screw by using the depth gauge. Introduce the 3.5 mm screw. Perform the same maneuver for the most proximal of the distal orifices.





Distal and Proximal Blocking

Remove the feeler gauge and the proximal module. Proceed to locate and perforate the proximal orifices, which are found at three different locations on three planes. The orthopedic surgeon will choose which are required and whether the characteristics of the fracture allow for the three orifices and three screws to be used without impediment.

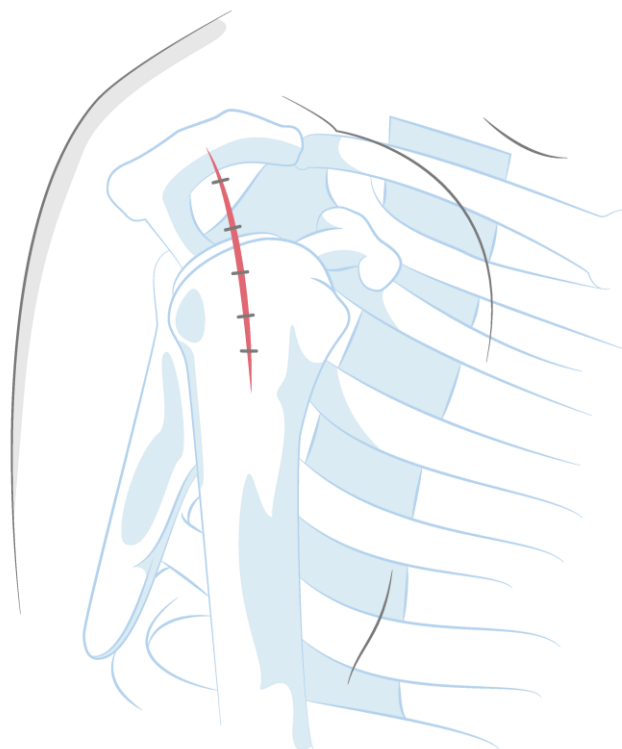




Distal and Proximal Blocking

Perform the same maneuvers for the location, perforation, and blocking to be used for the distal orifices. Using the proximal arm for support, introduce the locking screws of the required longitude. Verify the reduction and the longitude of the screws. If there is no problem, remove the fastener handle from the nail, and introduce the sealing cap. Repair the rotator cuff, suture the subcutaneous cellular tissue with vicryl #2-0 and the skin with nylon #3-0, with this depending on the preferences of the orthopedic surgeon.

Cover the wound with a dressing and apply a shoulder immobilizer or sling. The surgery is complete.





Post-Operative Care

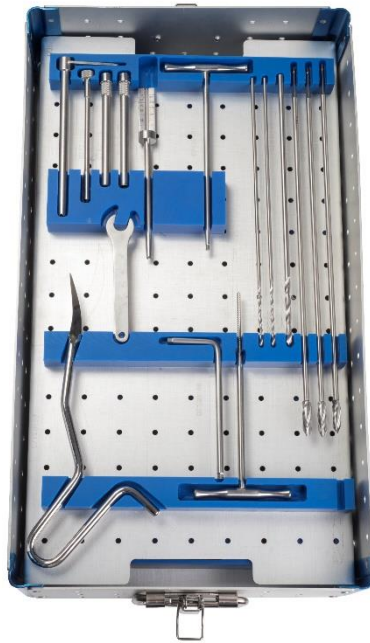
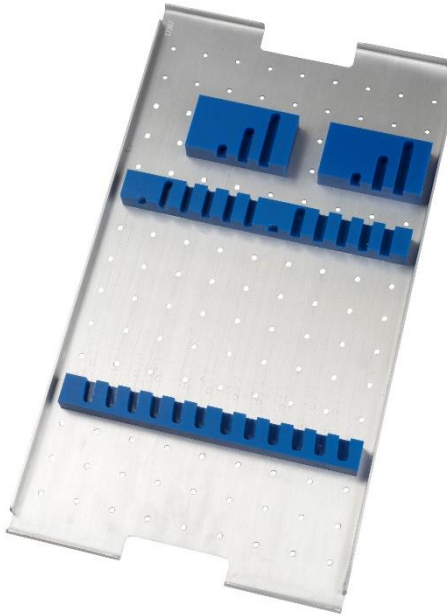
Given that the stability provided for fractures fixed by the ARZZT intramedullary nail for the humerus, there is no need for external stabilization with splints. The use of physical therapy to reduce edema, as well as the optimal time to resume movement and remove stitches, is left to the judgment of the orthopedic surgeon.

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Set of Instruments

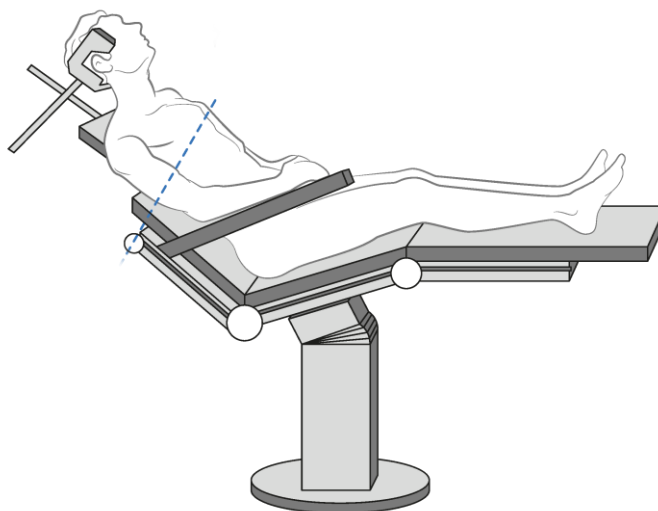




Implant Extraction

Patient positioning

The simple extraction of the nail requires placing the patient in a “beach chair” position. Without requiring a special surgical table, this position allows one to obtain the adequate exposure to facilitate the removal of the nail via the previous incisions.



Surgical technique

1. Remove the proximal locking screws using the previous incisions.
2. Before proceeding with the extraction of the distal locking screws, one must make sure to fasten the proximal portion of the nail with the insertion handle and the nail connector, thus avoiding the rotation of the nail, which makes its removal more difficult.
3. It is recommended to use the prior surgical incision with an incision of 3 cm, enough to facilitate the extraction of the implant.
One must perform a layered dissection of the subcutaneous cellular tissue, the deltoid muscles, the supraspinatus tendon (in a direction parallel to its fibers), until one feels the point of the nail (proximal portion).
4. Carefully remove the fibrous tissue located at and around the closing screw, obtaining a direct view of the implant. In the event that one encounters bone tissue over the nail, use the guide punch until the implant is located.
5. Extract the end cap from the nail.



Implant Extraction

6. Setting up the instruments for extraction.

Proceed to place the fastening handle on the proximal portion of the nail, fixing it with the connecting screw.

7. Remove the distal screws with the ARZZT screwdriver.

8. Proceed with the extraction of the nail using the impactor/extractor in a retrograde fashion.

9. Use saline solution to wash the medullar canal, and perform an adequate surgical debridement.

10. Proceed to close the wound in layers, and cover it with a sterile dressing. Depending on the surgical bleeding, you may drain the wound.





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Approved by



Intramedullary Nail System
Humerus Nail Kit

Code 08050001