S3

Proximal Humerus
Plating System

Surgical Technique

BIOMET

One Surgeon. One Patient.

Over 1 million times per year, Biomet helps one surgeon provide personalized care to one patient.

The science and art of medical care is to provide the right solution for each individual patient. This requires clinical mastery, a human connection between the surgeon and the patient, and the right tools for each situation.

At Biomet, we strive to view our work through the eyes of one surgeon and one patient. We treat every solution we provide as if it's meant for a family member.

Our approach to innovation creates real solutions that assist each surgeon in the delivery of durable personalized care to each patient, whether that solution requires a minimally invasive surgical technique, advanced biomaterials or a patient-matched implant.

When one surgeon connects with one patient to provide personalized care, the promise of medicine is fulfilled.

S³ Proximal Humerus Plating System

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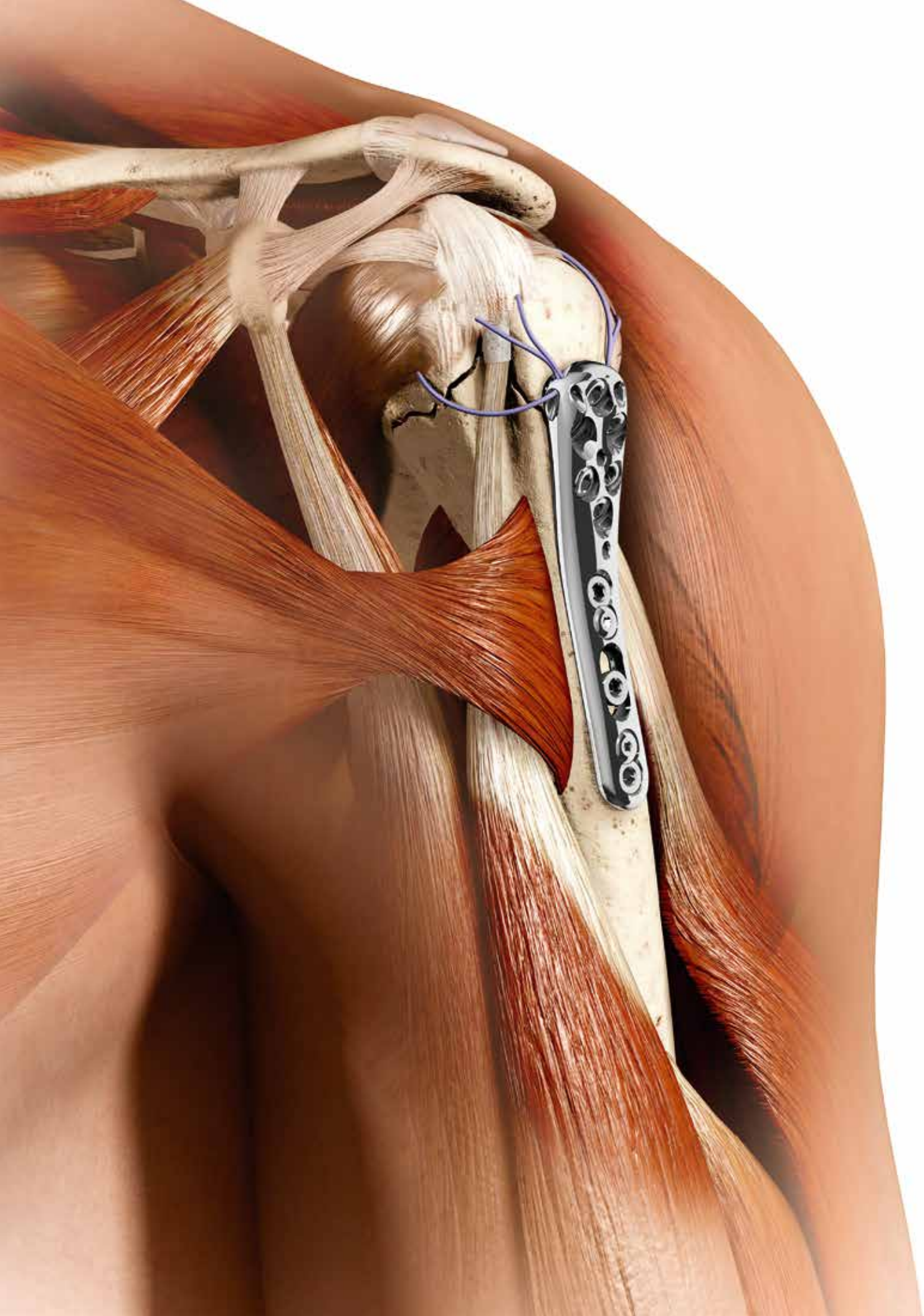


S^3 **Proximal Humerus** Plating System

Introduction

Biomet's experience in developing implants for fracture fixation through locked plating technology has been used to design the S^3 plate for the management of proximal humerus fractures. The S^3 Proximal Humerus Plate takes full advantage of the principle of spatial subchondral support successfully applied in the design of its sister product, the DVR Crosslock distal volar radiuwws plate.

The S^3 system is designed around the natural anatomy of the proximal humerus to address varus collapse. Convergent and divergent fixed angle pegs are centered around the natural 135° neck-shaft angle of the proximal humerus. The central guiding k-wire provides visual confirmation for plate positioning, ensuring that the pre-determined peg trajectories will provide consistent spatial distribution within the humeral dome. This unique concept of humeral fixation helps resist varus forces throughout the full range of motion.

The S^3 plate has been designed to help prevent subacromial impingement. The unique design of the S^3 allows the plate to be positioned more distally, minimizing the risk of impingement.

The S^3 pegs and screws utilize blunt smooth ends so that fixation can be provided directly below the hard articular shell. Engaging the subchondral bone with blunt fixation and the use of a manually inserted blunt-tipped drill bit reduces the risk for articular surface penetration.

Indications

The S^3 Proximal Humerus Plate is indicated for fractures and fracture dislocations, osteotomies, and non-unions of the proximal humerus.

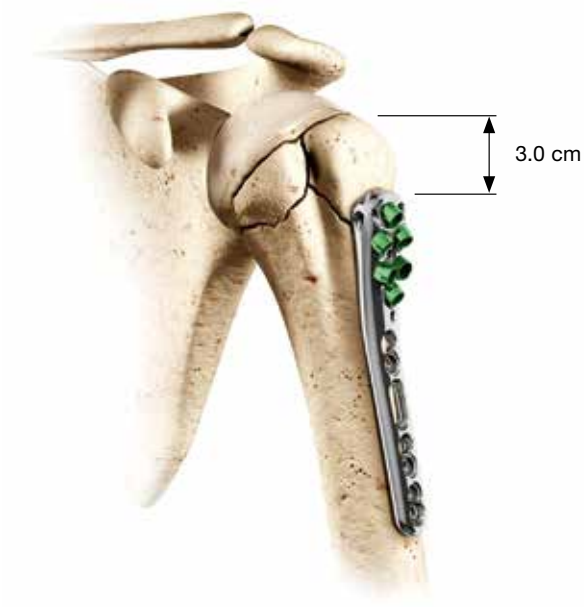
Surgical Approach

Proximal Humeral fractures are treated with the S^3 Proximal Humerus Plating System through the deltopectoral approach.

S³ Proximal Humerus Plating System

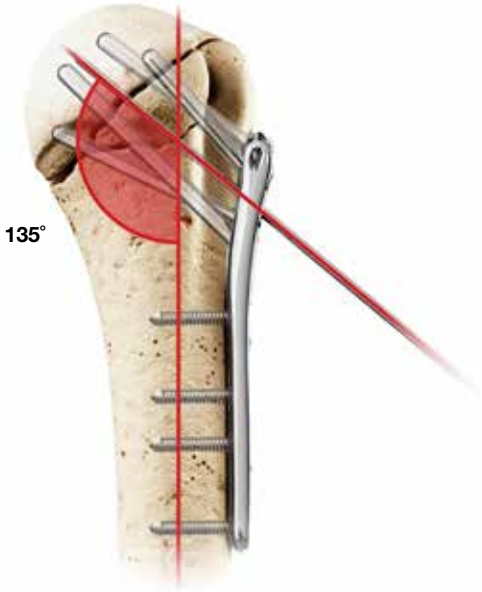
Minimizes Subacromial Impingement

- The S³ plate is designed to be positioned approximately 3.0 cm distal to the greater tuberosity helping to prevent subacromial impingement



Minimizes Varus Collapse

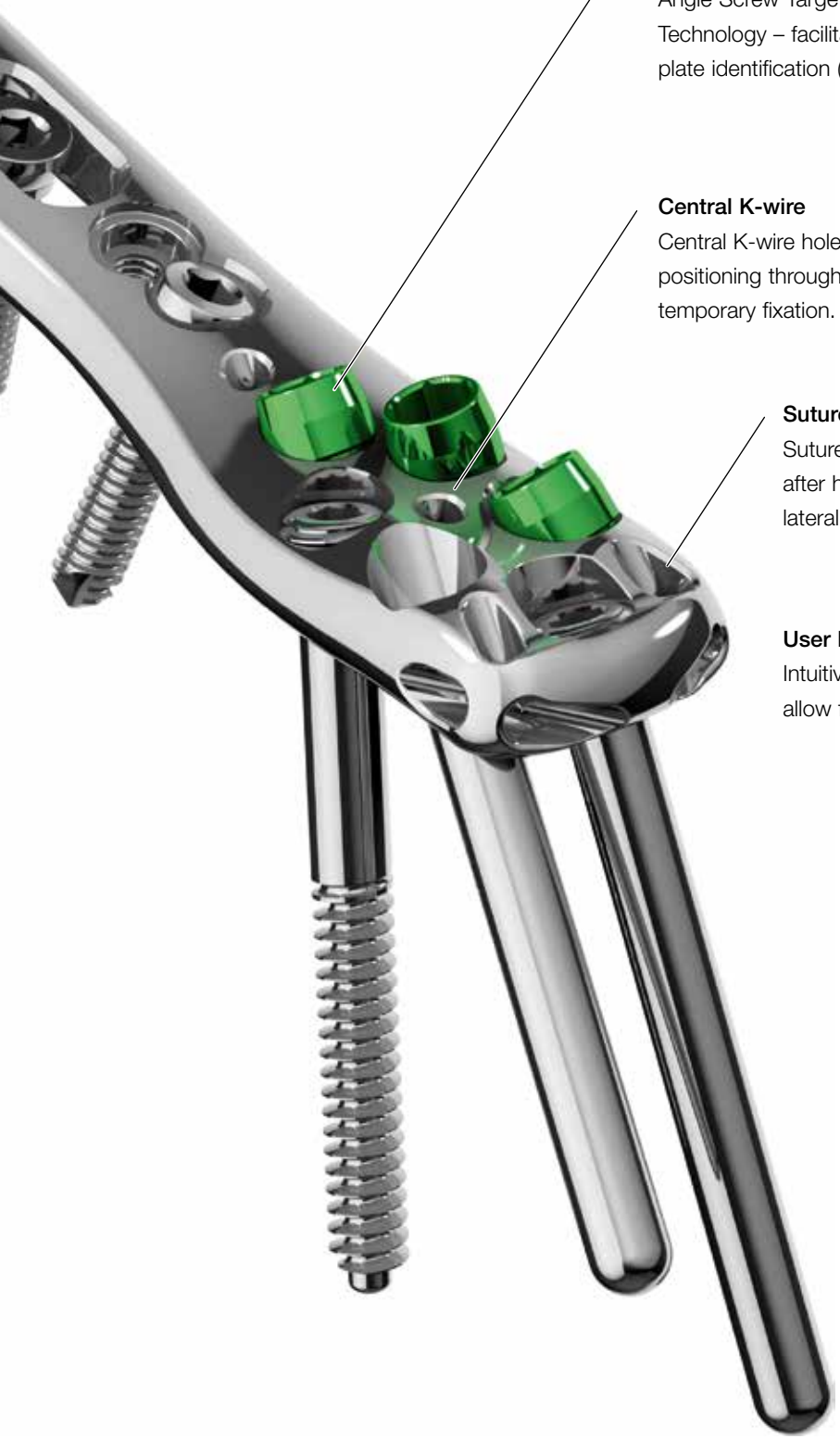
- The parametric design of the pegs distribute the loads more anatomically through the full range of motion by maintaining the neck shaft angle of 135° minimizing the risk of varus collapse.



Provides Strong and Secure Fixation

- The proximal end of the S³ plate has fixed angle locking pegs/screw holes. Its parametric design of convergent and divergent screw peg trajectories ensures a consistent spatial distribution of the pegs within the entire humeral head. This particular distribution provides spatial subchondral support to resist varus forces throughout the full range of motion.
- 4.0 mm blunt tipped subchondral support smooth or threaded pegs provide stability while preventing protrusion through the articular surface.
- Proximal and distal locking pegs and screws provide a strong interface for a stable fixation.

Ease of Use



F.A.S.T. Guide Technology
The S^3 plate comes preloaded with Fixed Angle Screw Targeting Guides – F.A.S.T. Guide Technology – facilitating accurate drilling and easy plate identification (left vs right).

Central K-wire
Central K-wire hole provides a guide for initial plate positioning through the use of fluoroscopy and temporary fixation.

Suture Holes
Suture holes allow for simplified tuberosity repairs after humeral head fixation through frontal and lateral access.

User Friendly System Design
Intuitive set layout and simple instrumentation allow for convenience in surgery.

Figure 1

Figure 3

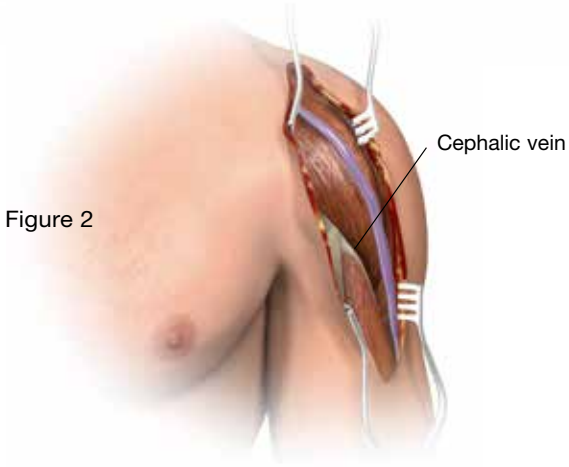


Figure 2

Deltopectoral Approach

Patient positioning and approach

The procedure can be performed in the beach-chair position or supine position (Figure 1) as per the surgeon's discretion. If necessary, a sterile mayo stand can be used to assist during dissection.

Assess the fracture fluoroscopically.

Examine the fracture based on intraoperative fluoroscopy. Internal rotation, external rotation and sometimes axillary views are necessary (Figure 2).

Exposure

Make an incision approximately 12–14 cm over the coracoid process, extending down to the deltoid insertion in an oblique fashion. Identify and retract the cephalic vein (Figure 3).

Note: Taking the cephalic vein medially provides additional protection against perforation during drilling.

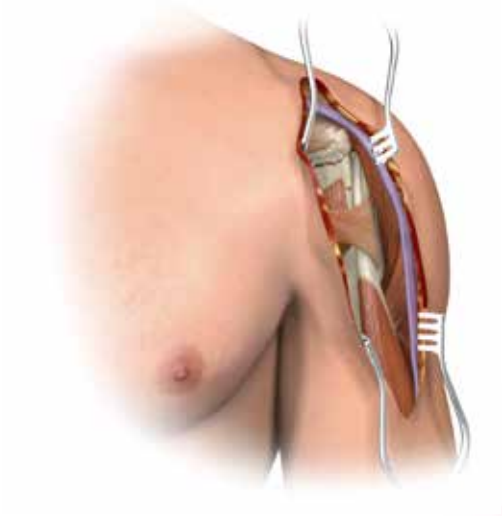


Figure 4

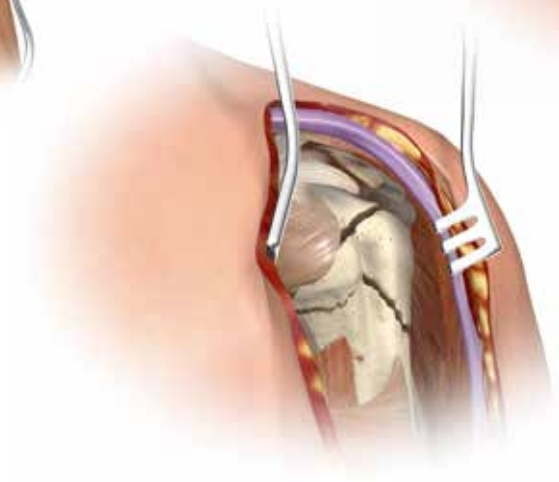


Figure 5

Figure 6

Identify the Biceps Tendon

Gently retract the coracobrachialis medially. Find the pectoralis insertion at the floor of the deltoid pectoralis interval (Figure 4). If necessary, release the proximal third of the pectoralis tendon to expose the biceps.

Complete Exposure

Develop the subacromial space and mobilize the proximal deltoid (Figure 5).

Note: Use of a large, blunt humeral head depressor can facilitate exposure.

Fracture Debridement and Reduction

Reduce the humeral head fragments using traction and manipulation and check the reduction under fluoroscopy (Figure 6).

Note: In the case of severe comminution, suturing the rotator cuff together will help reduce the tuberosities. To facilitate healing, bone graft should be considered.

Figure 7

Figure 8

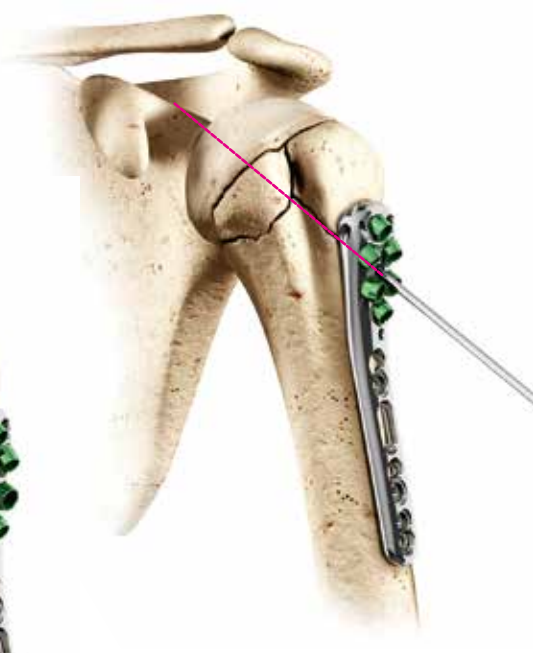


Figure 9

Surgical Technique

Plate Positioning

Select the appropriate side plate (lime=left; rose=right) and length (3, 4, 6, 8, 11 or 14 hole) (Figure 7).

Position the plate 2.5–3.0 cm distal to the greater tuberosity. The anterior border of the plate (straight border) should be immediately lateral to the bicepital groove (Figure 8).

Drill Central K-Wire

Drill the 2.0 mm K-wire (KW20SS) through the central K-wire hole on the proximal portion of the plate aiming the center of the humeral head (Figure 9).

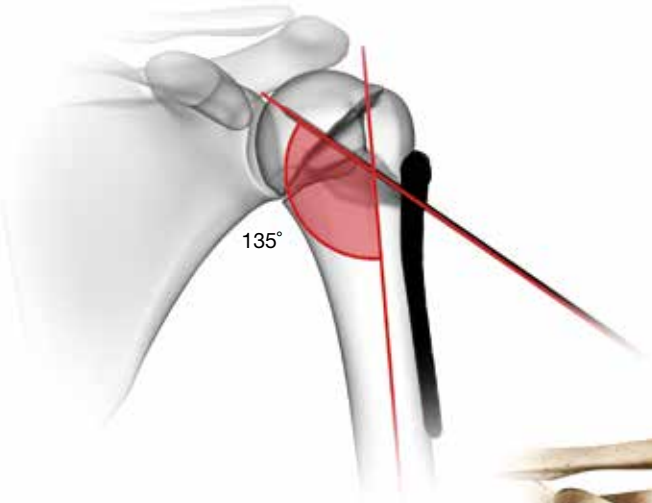


Figure 10

Figure 11

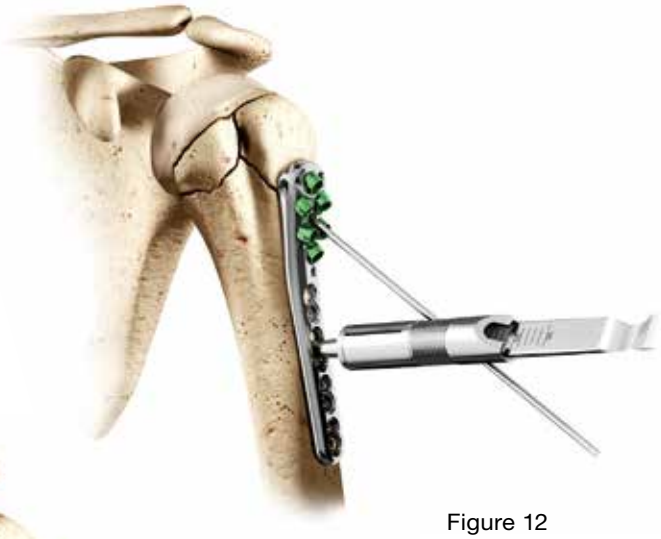


Figure 12

Verify Central K-Wire

Check the trajectory of the central K-wire under fluoroscopy. If there's a deviation from the center of the humeral head remove the K-wire and redrill until the center is reached (Figure 10).

Note: Verify the positioning of the central k-wire, it should be in the center/ center position and centered on Anterior Posterior and Laterial views.

Note: Other distal K-wire holes can be used to aid in fracture reduction and provisionally fix the plate to the bone.

Distal Plate Provisional Fixation

Drill through the oblong hole of the plate shaft with the 2.8 mm Drill Bit (DB28) using the Soft Tissue Protector (SSTG) (Figure 11).

Determine the required screw depth using the Depth Gauge (SBDG) (Figure 12).

Figure 13

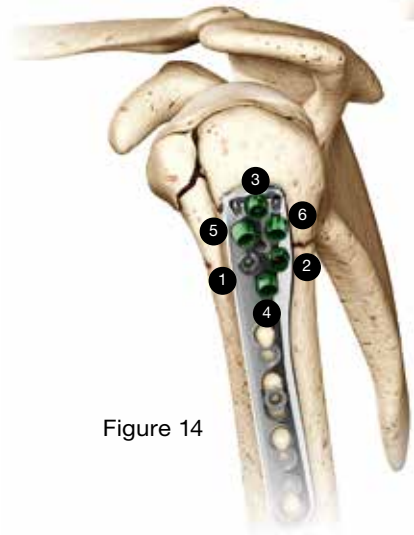


Figure 14

Figure 15

Fix the plate into place with a 3.8 mm Multidirectional Cortical Screw (MD20-MD38) using the Hex Driver (FHDS) (Figure 13).

Note: Do not fully tighten the screw to allow for later plate adjustments.

Note: Insert the second kickstand k-wire and/or the screw in the oblong hole, to reduce the possibility of the plate and fragments moving.

Proximal Plate Fixation

Drill through the inferior anterior F.A.S.T. Guide inserts with the 4.0 mm Short Drill Bit (FDB40S), and perforate the cortex. The drill bit has a stop that will only allow it to penetrate the near cortex.

Note: The K-wire can be bent to avoid drill bit obstruction.

Note: Fully seat the FDB40S (Short drill bit) into the F.A.S.T Guide before turning on power

Note: To aid with peg engagement, start with the anterior and posterior inferior peg holes first, and then finish by drilling the remaining proximal holes in a crisscross, opposing fashion (Figure 14).

Manual Drill for Subchondral Support Pegs

To prevent the drill from protruding through the rear cortex the following step should be made by manual drilling (Figure 15).

With the 4.0 mm Long Drill Bit (FDB40L or FDS40) attached to the Driver Handle (QCH), advance through the proximal plate hole F.A.S.T. Guide inserts until resistance from subchondral bone is felt. This will ensure the peg engages subchondral bone for optimal fixation.

Note: Do not use powered drilling for inserting the subchondral pegs. When manual drilling for smooth pegs use the Long Drill Bit (FDB40L). When manual drilling for partially threaded pegs use the Step Drill Bit (FDS40).

Note: Make multiple passes with the hand drill (FDB40L) to remove all material before inserting pegs.

Figure 16

Figure 18

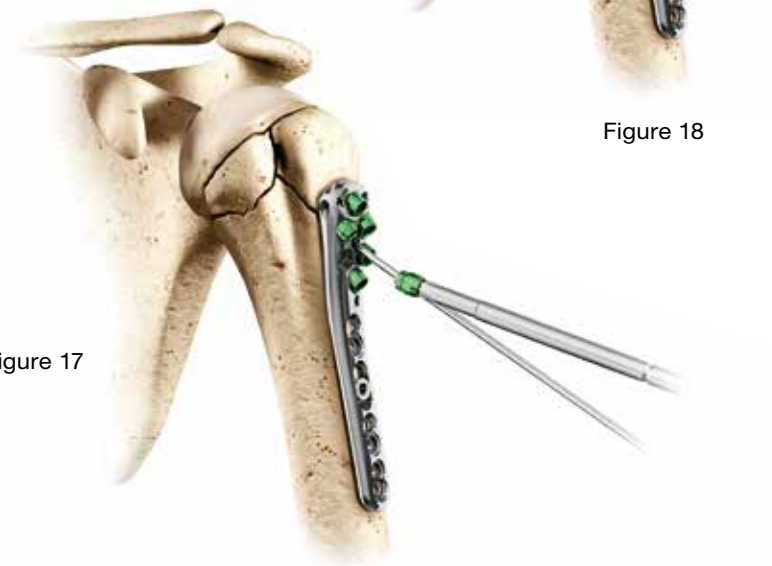


Figure 17

Determine Peg Length

Once resistance is felt, fluoroscopy imaging should verify that the tip of the manual drill is close to the subchondral bone (Figure 16). Care should be taken not to penetrate the subchondral bone. Use the appropriate side of the dual scale drill bit to determine the correct peg size.

Note: If a F.A.S.T. Guide insert was removed before the screw length was recorded, insert the 4.0 mm Drill Guide (DRGSH) and measure using the appropriate side of the dual scale stepped Depth Gauge (FSDGS).

Peg Insertion

Remove and discard the respective F.A.S.T. Guide inserts (Figure 17) and insert the appropriate size peg using the Hex Driver (FHDS) (Figure 18).

Note: If the pegs do not engage initially, re-insert the F.A.S.T. Guide insert or drill guide (DRGSH) and drill again using the hand drill (FDB40L)

Figure 19

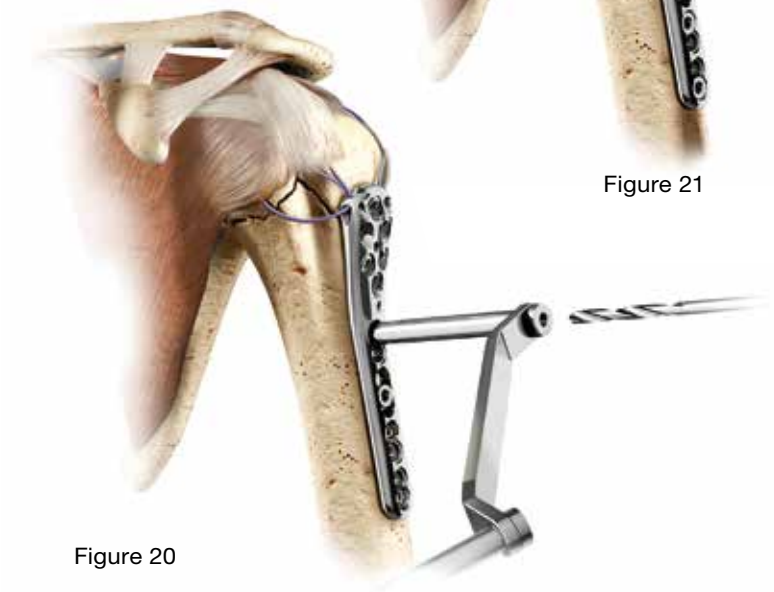


Figure 20

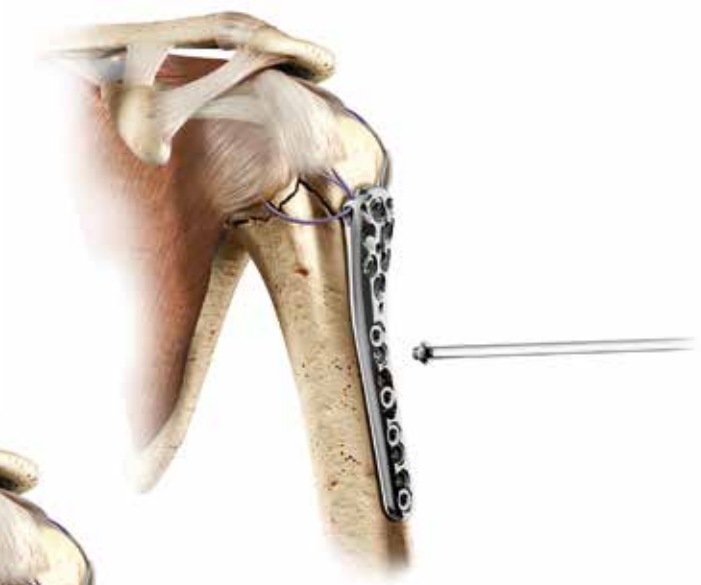


Figure 21

Attach Tuberosities to Plate

Secure the tuberosities to the plate by passing the needles close to the insertion of the tendon and then through to side, front or top loading wire attachment points found on the proximal end of the plate (Figure 19).

Note: An alternate approach is to apply the sutures to the plate prior to placing the subchondral support pegs. This may aid in reduction.

Insert Distal Screws

Use the appropriate end of the Soft Tissue Protector (SSTG) and drill to the far cortex with the 2.8 mm Drill Bit (DB28) (Figure 20). Measure with the Barrel Depth Gauge (SBDG).

Fix the remaining Shaft Cortical Screws with either 90º Locking Screws (NL20-NL38; NLSS) or Multidirectional Screws (MD20-MD38) (Figure 21).

Use a Set Screw (NLSS) to lock each 90º Screw to the plate. Do not use a set screw when using Multidirectional Screws.

Figure 22

Figure 23

Final Verification

Evaluate the humerus under fluoroscopy to assess the reduction and to confirm proper plate positioning (Figure 22 & 23).

S³ Proximal Humerus Plating System

Ordering Information

Pegs and Screws

Smooth Peg, Locking
Provide spatial subchondral support.

Cat No:	Size:
STP20	20 mm
STP25	25 mm
STP30	30 mm
STP325	32.5 mm
STP35	35.5 mm
STP375	37.5 mm
STP40	40 mm
STP425	42.5 mm
STP45	45 mm
STP475	47.5 mm
STP50	50 mm
STP525	52.5 mm
STP55	55 mm
STP575	57.5 mm
STP60	60 mm
STP625	62.5 mm
STP65	65 mm

Threaded Pegs, Locking
Help to capture and lag the humeral head.

Cat No:	Size:
STPT20	20 mm
STPT25	25 mm
STPT30	30 mm
STPT325	32.5 mm
STPT35	35 mm
STPT375	37.5 mm
STPT40	40 mm
STPT425	42.5 mm
STPT45	45 mm
STPT475	47.5 mm
STPT50	50 mm
STPT525	52.5 mm
STPT55	55 mm
STPT575	57.5 mm
STPT60	60 mm
STP625	62.5 mm
STP65	65 mm

90˚ Cortical Screws, Non-locking
Provide bi-cortical fixation while locking to the plate using the NLSS set screws.

Cat No:	Size:
NL20	20 mm
NL22	22 mm
NL24	24 mm
NL26	26 mm
NL28	28 mm
NL30	30 mm
NL32	32 mm
NL34	34 mm
NL36	36 mm
NL38	38 mm

Multi-directional Cortical Screws, Non-Locking
Provide multi-directional fixation when used through the oblong hole.

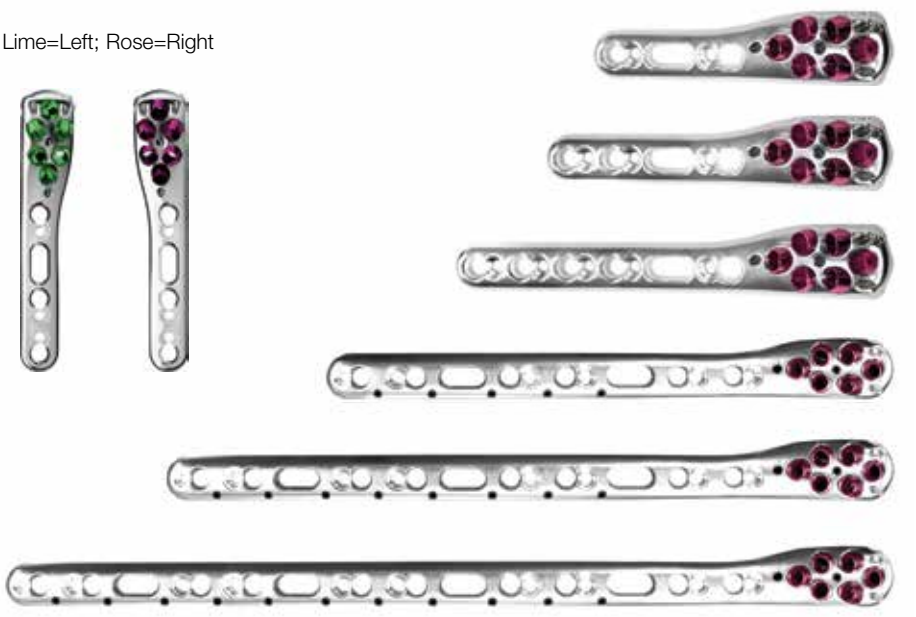
Cat No:	Size:
MD20	20 mm
MD22	22 mm
MD24	24 mm
MD26	26 mm
MD28	28 mm
MD30	30 mm
MD32	32 mm
NL34	34 mm
NL36	36 mm
MD38	38 mm

90˚ Locking Set Screw
Secures the 90˚ lock distal screws to the plate.

Cat No: NLSS

S³ Proximal Humerus Plating System Options

Lime=Left; Rose=Right



S³ Plate, 3 Holes:
16 mm x 71 mm
SSPL3 / SSPR3

S³ Plate, 4 Holes:
16 mm x 84 mm
SSPL4 / SSPR4

S³ Plate, 6 Holes:
16 mm x 108 mm
SSPL6 / SSPR6

S³ Plate, 8 Holes:
16 mm x 150 mm
SSPL8 / SSPR8

S³ Plate, 11 Holes:
16 mm x 190 mm
SSPL11 / SSPR11

S³ Plate, 14 Holes:
16 mm x 236 mm
SSPL14 / SSPR14

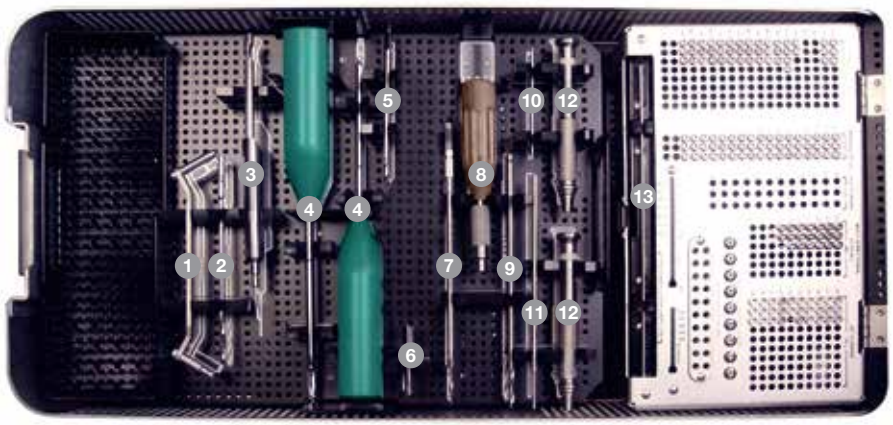
The S³ plate, pegs and screws are manufactured from 316L Stainless Steel.

S³ Proximal Humerus Plating System

S³ Proximal Humerus Plating Modular Tray

Top Tray

1	SSTG	Soft Tissue Guide
2	DB28	Drill Bit 2.8 mm
3	SBDG	Depth Gauge
4	FHDS	Hex Driver
5	FDB40S	Drill Bit 4.0 mm Short
6	DRGSH	Drill Guide 4.0 mm
7	FDS40	Drill Bit 4.0 mm Step
8	QCH	Quick Connect Handle
9	FDB40L	Drill Bit Fast 4.0 mm Long
10	SDI	Square Driver Insert 2.0mm
11	FSDGS	Depth Gauge Step Shoulder Fast
12	MQC	Mini Quick Connect Handle
13	KW20SS	K-wire 2.0 mm SS



Bottom Tray

	SSPL03	3 Hole Plate, Left
14	SSPL04	4 Hole Plate, Left
15	SSPL06	6 Hole Plate, Left
	SSPL08	8 Hole Plate, Left
16	SSPL14	14 Hole Plate, Left
17	SSPL11	11 Hole Plate, Left
	SSPR03	3 Hole Plate, Right
18	SSPR04	4 Hole Plate, Right
19	SSPR06	6 Hole Plate, Right
	SSPR08	8 Hole Plate, Right
20	SSPR11	11 Hole Plate, Right
21	SSPR14	14 Hole Plate, Right

SNP Shoulder Nail Plate

- The SNP Anatomic Plate Module Tray contains all SNP Anatomic Plate components
- All other instruments and pegs/screws are found in the S³ Proximal Humeral Tray System

The SNP Proximal Humeral Plating System provides the surgeon with a less invasive option than the S³ Proximal Humerus plate for fractures of the proximal humerus. The SNP combines the proximal stability of fixed angle locking pegs and suture attachments with the minimal soft tissue disruption of an intramedullary nail.

S3 Proximal Humerus Plating System

Indications:
The S3 Shoulder FIxation System is indicated for fractures and fracture dislocations, osteotomies, and non-unions of the proximal humerus.

Contraindications:
If any of the following are suspected, tests are to be performed prior to implantation. Active or latent infection. Sepsis. Insufficient quantity or quality of bone and/or soft tissue. Material sensitivity. Patients who are unwilling or incapable of following post operative care instructions.

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