

Surgical Technique

**OptiLock®
Upper Extremity Plating System
Proximal Humeral Plates**

Featuring
SphereLock™ Technology

- Anatomical plate contouring and diverging “showerhead” splay of bone screws allow plate to sit more distally on humerus to help avoid plate impingement with shoulder abduction
- All screw holes accept either a 3.5mm cortical locking or non-locking bone screw which can be of benefit if trying to capture a fracture fragment in the head or closely appose the plate to the bone of the humeral head

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Introduction

Proximal humeral fractures account for 4% to 5% of all fractures in the United States¹. These fractures typically occur in elderly osteoporotic patients and may involve the humeral head, surgical neck or proximal shaft. Proximal humeral fractures also occur in younger patients secondary to high energy mechanisms. Most of these fractures are minimally displaced or nondisplaced and can be managed conservatively with immobilization and early motion. However, 15% to 20% are displaced and represent a challenge to the orthopedic surgeon². As part of the OptiLock Upper Extremity Plating System, OptiLock Proximal Humeral Plates are intended to address complex fractures of the proximal humerus. These plates are low profile, stainless steel and available in 2-hole (75mm), 4-hole (99mm), 6-hole (123mm) and 10-hole (171mm) lengths. Each of these plates is anatomically side-specific, e.g. left or right.



¹ Lind T, Kroner K, Jensen J. The epidemiology of fractures of the proximal humerus. Arch Orthop Trauma Surg. 1989;108:285-287.

² Tejwani N, Et Al. Functional Outcome Following One-Part Proximal Humeral Fractures; A Prospective Study. J Shoulder Elbow Surgery 2008; Volume 17, No. 2; 216-219.

Indications and Contraindications

INDICATIONS

The OptiLock Upper Extremity Plating System is intended for fixation of fractures and osteotomies.

The System is intended for fractures and fracture dislocations, osteotomies and nonunions of the proximal humerus, particularly in osteopenic bone.

The System is intended for fixation of fractures, osteotomies and nonunions of the olecranon, humerus, radius, ulna, particularly in osteopenic bone.

Patient selection factors to be considered include:

1. Need for alignment and stabilization of bone fractures
2. Ability and willingness of the patient to follow postoperative care instructions until healing is complete
3. A good nutritional state of the patient.

CONTRAINDICATIONS

1. Active infection.
2. Patient conditions including blood supply limitations, and insufficient quantity or quality of bone.
3. Patients with mental or neurologic conditions who are unwilling or incapable of following postoperative care instructions or materials.
4. Foreign body sensitivity. Where material sensitivity is suspected, testing is to be completed prior to implantation of the device.



Design Features

- Anatomical plate contouring and bone screw trajectories allow plate to sit more distally on humerus to help avoid plate impingement with shoulder abduction
- Patent pending SphereLock™ technology allows all screw holes to accept either a 3.5mm cortical locking or a non-locking bone screw which can be of benefit if trying to capture a fracture fragment in the head or closely appose the plate to the bone of the humeral head.
- All SphereLock™ (locking and non-locking) bone screws are available in lengths of 10-44mm in increments of 2mm and 44-60mm in increments of 4mm
- The most distal hole allows for dual trajectory placement based on surgeon preference and nature of fracture
- Low profile plate and screw heads minimize soft tissue impingement



P/N 377xx
(Locking Screw)



P/N 367xx
(Non-Locking Screw)

* Although plates are pre-contoured,
Bending Irons (P/N 36595) are available if needed.

Design Features (Continued)



P/N 36110
(Proximal Humeral Plate
Left, 10-Holes, 171mm)



Lateral View
(All Plates)



P/N 36106
(Proximal Humeral Plate
Left, 6-Holes, 123mm)



P/N 36104
(Proximal Humeral Plate
Left, 4-Holes, 99mm)



P/N 36102
(Proximal Humeral Plate
Left, 2-Holes, 75mm)



P/N 37102
(Proximal Humeral Plate
Right, 2-Holes, 75mm)



P/N 37104
(Proximal Humeral Plate
Right, 4-Holes, 99mm)

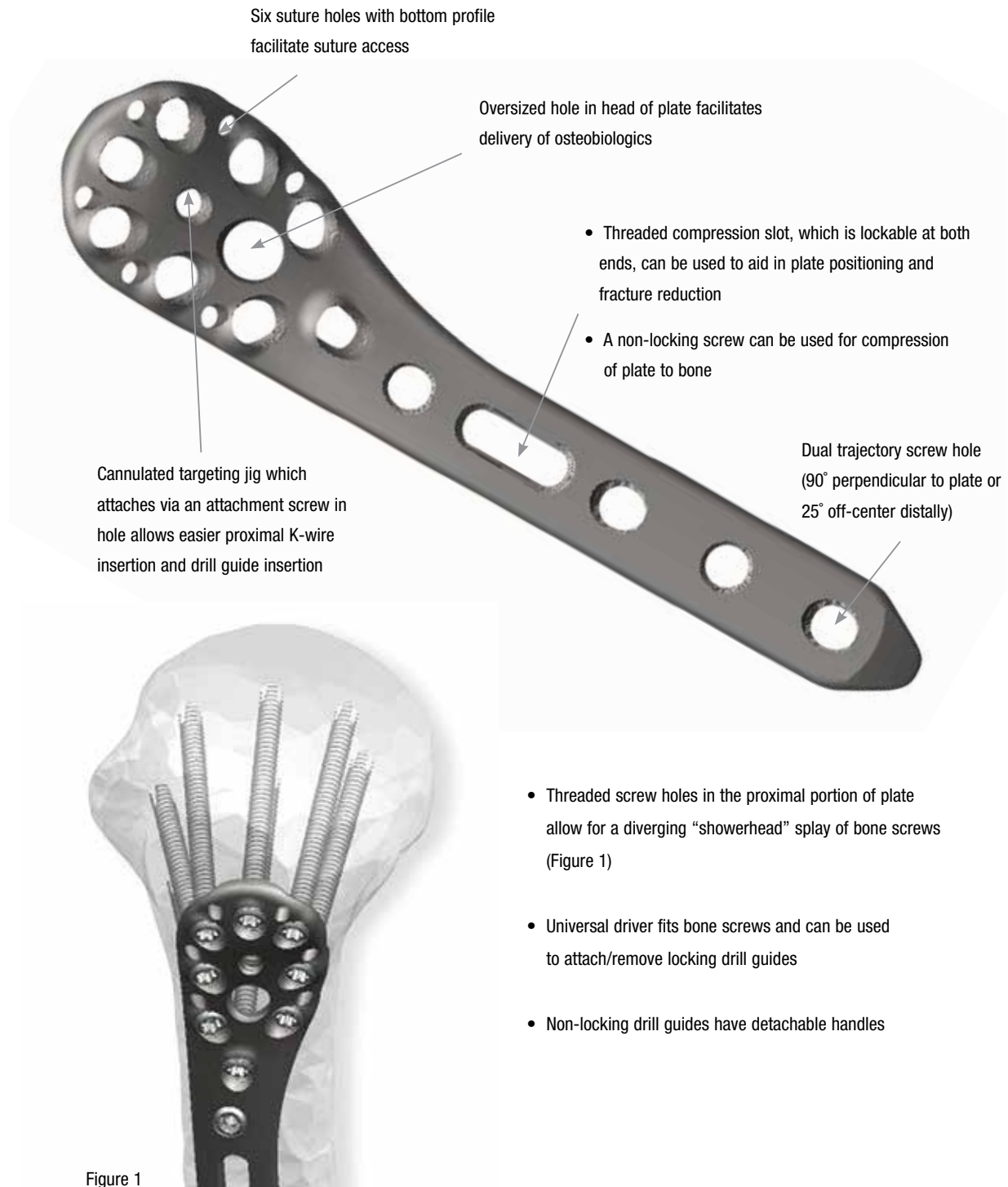


P/N 37106
(Proximal Humeral Plate
Right, 6-Holes, 123mm)



P/N 37110
(Proximal Humeral Plate
Right, 10-Holes, 171mm)

Design Features (Continued)



Surgical Technique

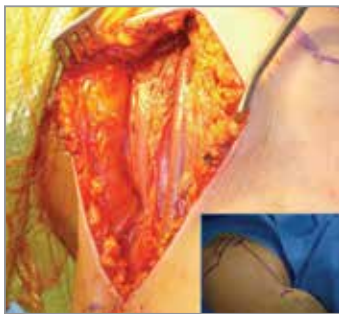
Patient Positioning

A beach-chair or supine position is recommended. The head and neck must be safely stabilized, and full access to the shoulder girdle will be required. The operating table must be oriented to allow positioning of the intraoperative image intensifier for proper AP and lateral views of the shoulder. This can be obtained with the aid of a radiolucent table or bringing the C-arm in from above the head of the patient.



Exposure

Step 1: A standard 12-14cm incision is made from the coracoid towards the deltoid insertion on the humerus.



Step 2: The cephalic vein is isolated. This identifies the deltopectoral interval.



Step 3: Blunt dissection of the deltoid is performed to release adhesions of the proximal humerus.

Step 4: The pectoralis is retracted inferiorly and medially. The conjoint tendon is identified and retracted medially with hand-held retractors.

CAUTION: Should be used with deep self-retaining retractors to avoid injury to the musculocutaneous nerve.

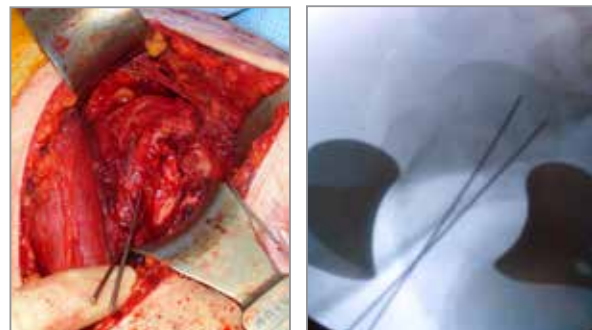
Step 5: Blunt dissection in the subacromial space and the subdeltoid area is carried out to allow full circumferential soft tissue release. The fracture is visualized. The bicep tendon is easily identified beneath the pectoralis, which helps to orientate the fracture pattern.

Step 6: After exposure of the fracture, and limited debridement to allow identification of fracture fragments, heavy #2 nonabsorbable braided sutures are placed into the supraspinatus tendon insertion on the greater tuberosity and the subscapularis tendon insertion on the lesser tuberosity.

This allows manipulation of displaced tuberosity fragments and helps facilitate reduction. In case there is severe comminution, suture repair of the rotator interval and the lesser and greater tuberosities can be done.

Under image intensifier guidance, manual manipulation and reduction of the fracture can be carried out. Correction of any medial and lateral displacements of the humeral shaft as well as ensuring that correction of the typical varus and posterior angulation of the humeral head should be carried out.

Provisional fixation with the K-wire placed along the anterior aspect of the humeral shaft into the humeral head can be done. The K-wire should be placed to avoid interference with planned placement of the OptiLock Proximal Humeral Plate.



Surgical Technique (Continued)

Attach Targeting Jig to the Plate

Attach the low profile Targeting Jig Head [P/N 36118 or 37118] (Figure 2) to the appropriate plate, left or right sided, and lock it into place by tightening the jig's attachment screw with the Hex Screwdriver [P/N 36505] (Figure 3).



Left Jig Head (P/N 36118) shown

Figure 2



Figure 3

Final Application of the Plate to the Bone

Positioning from AP view

This low profile locking plate is designed to be placed approximately 10-15mm distal to the rotator cuff attachment on the greater tuberosity (Figure 5).

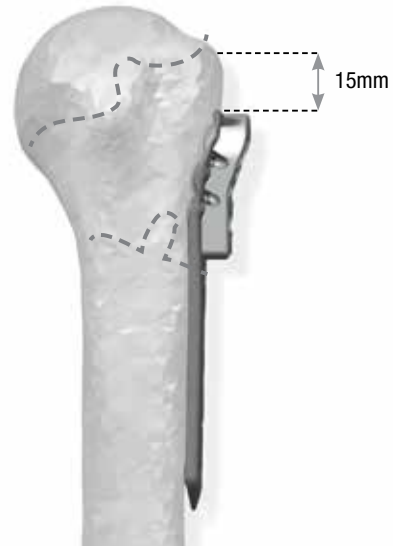


Figure 5

Provisional plate positioning can be achieved by passing two 1.6 mm K-wires [P/N 14-4014401] through the targeting jig. (Figure 6).

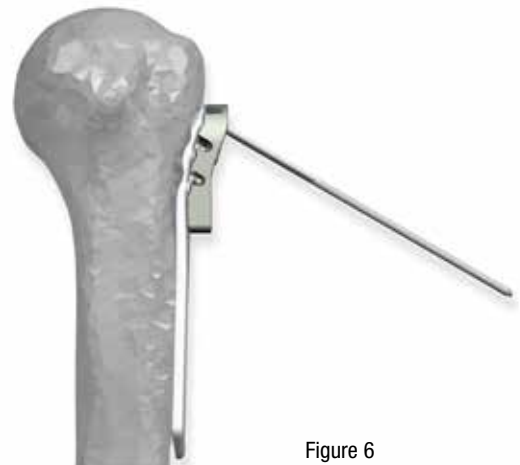


Figure 6

Surgical Technique (Continued)

Positioning from a lateral view

The plate should be positioned against the greater tuberosity (Figure 7), placed just lateral to bicipital groove.

NOTE: To check the placement of the plate, before inserting screws, 1.6mm K-wires can be used through the proximal K-wire holes.*

*K-wires and suture have been omitted for better visual.

Check plate and K-wire placement on multiple C-Arm views including AP, axillary and lateral views.



Figure 7

Insert Screws*

The placement of the initial screw will depend on the fracture type and the reduction achieved.

OPTION 1: Insertion of proximal screws first

- This will permit fixation of proximal fragments initially.
- Verify the correct placement of the plate in the proximal-distal dimensions with image intensifier, and proper reduction of the fracture.
- Locking screw guides [P/N 36526] are then utilized to place locking screws into the humeral head.

***IMPORTANT:**

- 1) Placement of distal screws first can compromise the proximal screw trajectories. Special care must be taken at this point to ensure the fracture is properly reduced and the plate is aligned correctly on the greater tuberosity.**
- 2) Only place ONE screw in the slotted hole.**
- 3) Use of the Torque Limiting Coupler (p/n 36510) is strongly recommended if inserting the bone screws under power. Final turns of the bone screws are then to be done by hand.**
- 4) Do not use the Torque Limiting Coupler with the A/O Driver Handles (p/n 22875, 22880).**

Surgical Technique (Continued)

Proximal locking screw insertion

- Insert a 1.6mm K-Wire, 150mm [P/N 14-4014401] through the hole designation in the jig assembly to hold plate to bone.
- Insert the appropriate locking drill guide [P/N 36526] into the Targeting Jig Head [P/N 36118 or 37118] (Figure 8).
- Drill the near cortex with the 2.7mm Drill Bit [P/N 36550] (Figure 9). Screw length can then be read directly off the calibrated drill bit while in the drill guide, or measured using the Depth Gauge [P/N 36515] (Figure 10).

IMPORTANT: Selection of screw length for the proximal screws must take into account possible fracture collapse. Make sure the screws are 4mm shorter than measured so that they do not protrude through the joint surface if collapse does occur.

NOTE: Inserting strong, non-absorbable sutures through the provided suture holes on the outer perimeter can help control, anatomically reduce the fragments and also increase construct stability post-operatively. The suture can be inserted/passed through the suture holes before or after plate placement due to scalloping of plate.



Figure 8



Figure 9

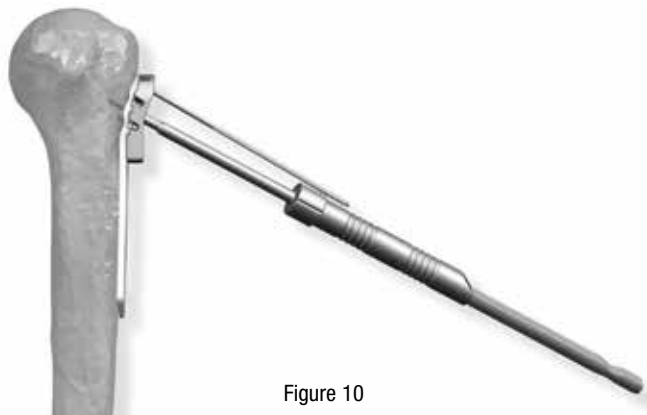


Figure 10

Insert Screws (Continued)

Insert the appropriate length locking screw using the Hex Screwdriver, [P/N 36505] (Figure 11).

Use of the Torque Limiting Coupler [P/N 36510] is recommended.

NOTE: This depth gauge will give a measurement for the proximal screws when used through the Insertion Guide and will give a measurement for the distal screws when seated in hole of plate. To ensure that the screw tip is a sufficient distance from the joint surface, 5mm should be deducted from depth gauge readings for the proximal screw. Check K-wire and screw placement on multiple C-Arm views including AP, axillary and lateral views to avoid articular penetration.

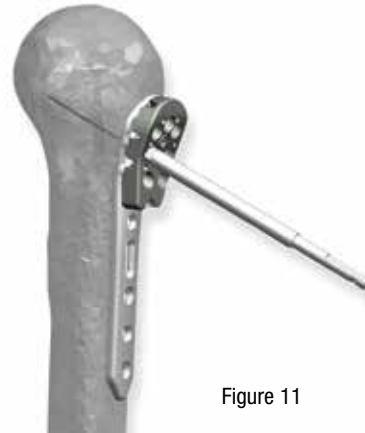
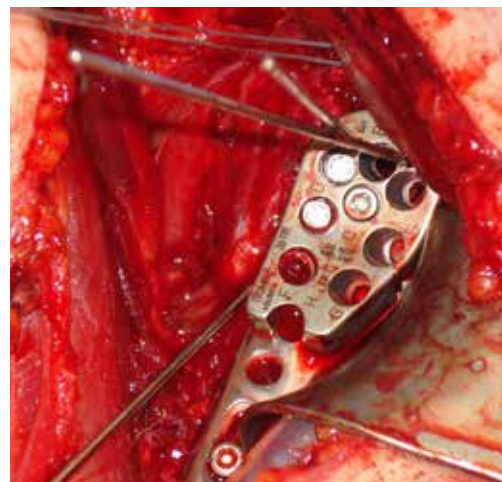


Figure 11



Surgical Technique (Continued)

OPTION 2: Insertion of distal screw first.

This will provide fixation of the shaft fragment (Figure 12).

A non-locking screw placed into the oval hole will allow reduction of the plate to the humeral shaft. This will also allow fine adjustments of the plate proximally or distally.

Proximal screws may then be placed utilizing the locking drill guides and the targeting jig.

NOTE: It is recommended that 5mm be subtracted from the measured distance of the lateral humeral cortex to the subchondral bone.

Distal locking screw insertion

- Insert the threaded portion of the Drill Guide into the threaded part of the shaft holes.
- Drill with the 2.7mm Drill Bit and remove the Drill Guide.
- Measure screw length with the Depth Gauge [P/N 36515].

For proper drilling, the 2.7mm Threaded Drill Guide [P/N 36526] must be used for locking screws.

NOTE: For more rigid fixation, insertion of the locking screw through both cortices is recommended.

Distal standard screw insertion

- For non-locking screws, use the standard screw insertion technique.
- Use the 2.7mm Threaded Drill Guide when drilling holes for the 3.5mm locking screws in the shaft holes of the plate.
- Use the 2.5mm Drill Bit for drilling when using non-locking screws.

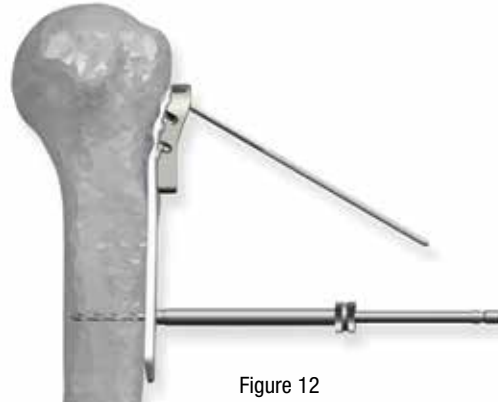
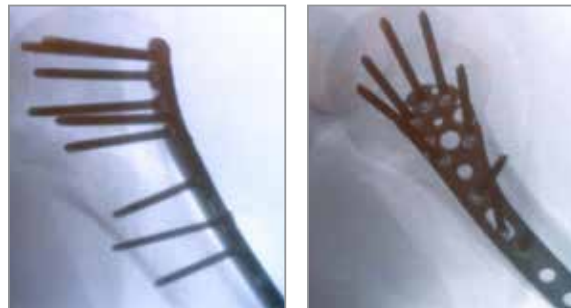


Figure 12

Final Construct



Implant Removal

To remove locking screws, loosen all screws 1-2 turns, disengaging from the plate, then remove the screws completely from the bone. This will prevent rotation of the plate when removing the last locking screw.

A Hex Driver can be used, but superior torque can be achieved utilizing the Torx Driver (P/N 36505).

NOTE: Supplied Torx Driver can withstand more torque than hex.

Osteobiologics

To help facilitate healing in the resultant defect, the use of Biomet osteobiologics should be considered:

- Osteobiologic material (DBM, scaffolding and osteogenic material) may be placed in the fracture gap through the oversized osteobiologics hole in the plate.
- InterGro DBM Paste may be directly inserted through the hole using accessory extensions included in packaging (extensions are included in 2cc and 5cc sizes of **InterGro** Paste and 5cc and 10cc sizes of Biomet DBM Putty).
- Scaffolding material (Pro Osteon 500R Granules) may be inserted manually through the same hole followed by a DBM to assist in holding the scaffold in place. Osteogenic material (bone marrow aspirate for example) may be injected through the hole as well.

Proximal Humeral Plates and Screws



Proximal Humeral Plate (Left, 2 Holes, 75mm) P/N: 36102



Proximal Humeral Plate (Right, 2 Holes, 75mm) P/N: 37102



Proximal Humeral Plate (Left, 4 Holes, 99mm) P/N: 36104



Proximal Humeral Plate (Right, 4 Holes, 99mm) P/N: 37104



Proximal Humeral Plate (Left, 6 Holes, 123mm) P/N: 36106



Proximal Humeral Plate (Right, 6 Holes, 123mm) P/N: 37106



Proximal Humeral Plate (Left, 10 Holes, 171mm) P/N: 36110



Proximal Humeral Plate (Right, 10 Holes, 171mm) P/N: 37110



3.5mm Non-Locking Screws P/N: 36710 through 36760



3.5mm Locking Screws P/N: 37710 through 37760

Instruments*



Drill A/O Connector
P/N: 22855



Torque Limiting Coupler
P/N: 36510



Fixed A/O Handle
P/N: 22875



2.0mm Depth Gauge
P/N: 36515



Ratcheting A/O Handle
P/N: 22880



2.0mm Guide Wire Sleeve, 2.7mm Drill Guides (Locking)
P/N: 36522, 36526



Torx A/O Driver
P/N: 36505



2.5mm, 3.5mm Drill Guides (Non-Locking)
P/N: 36534, 36538

Instruments (Continued)*



3.5mm Non-Locking Screw Tap

P/N: 36546



3.5mm Locking Screw Tap

P/N: 36551



Drill Guide Handle

P/N: 36575



Large Plate Holding Forceps

P/N: 36597



Left Humeral Jig Head

P/N: 36118



Right Humeral Jig Head

P/N: 37118

* Not shown are 3.5mm Locking and Non-Locking Screw Taps (p/n 36551) and Large Bone Holding-Forceps (p/n 22896).

Disposables



2.5mm, 2.7mm, 3.5mm A/O Drill Bit
P/N: 36545, 36550, 36555



1.6mm x 150mm Guide Wire
P/N: 14-4014401

Osteobiologics



InterGro DBM Paste



Pro Osteon 500R Granules

Ordering Information

OptiLock Upper Extremity Plating System

Proximal Humeral Plates*

Catalog No.	Description	Set Qty
36102	Proximal Humeral Plate, Left 2 Holes, 75mm	2
36104	Proximal Humeral Plate, Left 4 Holes, 99mm	2
36106	Proximal Humeral Plate, Left 6 Holes, 123mm	1
36110	Proximal Humeral Plate, Left 10 Holes, 171mm	1
37102	Proximal Humeral Plate, Right 2 Holes 75mm	2
37104	Proximal Humeral Plate, Right 4 Holes, 99mm	2
37106	Proximal Humeral Plate, Right 6 Holes, 123mm	1
37110	Proximal Humeral Plate, Right 10 Holes, 171mm	1

3.5mm Non-Locking Screws

Catalog No.	Description	Set Qty
36710	3.5mm x 10mm Non-Locking Screw	2
36712	3.5mm x 12mm Non-Locking Screw	2
36714	3.5mm x 14mm Non-Locking Screw	2
36716	3.5mm x 16mm Non-Locking Screw	2
36718	3.5mm x 18mm Non-Locking Screw	2
36720	3.5mm x 20mm Non-Locking Screw	2
36722	3.5mm x 22mm Non-Locking Screw	2
36724	3.5mm x 24mm Non-Locking Screw	2
36726	3.5mm x 26mm Non-Locking Screw	2
36728	3.5mm x 28mm Non-Locking Screw	2
36730	3.5mm x 30mm Non-Locking Screw	2
36732	3.5mm x 32mm Non-Locking Screw	2
36734	3.5mm x 34mm Non-Locking Screw	2
36736	3.5mm x 36mm Non-Locking Screw	2

3.5mm Non-Locking Screws (cont'd)

Catalog No.	Description	Set Qty
36738	3.5mm x 38mm Non-Locking Screw	2
36740	3.5mm x 40mm Non-Locking Screw	2
36742	3.5mm x 42mm Non-Locking Screw	2
36744	3.5mm x 44mm Non-Locking Screw	2
36748	3.5mm x 48mm Non-Locking Screw	2
36752	3.5mm x 52mm Non-Locking Screw	2
36756	3.5mm x 56mm Non-Locking Screw	2
36760	3.5mm x 60mm Non-Locking Screw	2

3.5mm Locking Screws

Catalog No.	Description	Set Qty
37710	3.5mm x 10mm Locking Screw	5
37712	3.5mm x 12mm Locking Screw	5
37714	3.5mm x 14mm Locking Screw	5
37716	3.5mm x 16mm Locking Screw	5
37718	3.5mm x 18mm Locking Screw	5
37720	3.5mm x 20mm Locking Screw	5
37722	3.5mm x 20mm Locking Screw	5
37724	3.5mm x 24mm Locking Screw	5
37726	3.5mm x 26mm Locking Screw	5
37728	3.5mm x 28mm Locking Screw	5
37730	3.5mm x 30mm Locking Screw	5
37732	3.5mm x 32mm Locking Screw	5
37734	3.5mm x 34mm Locking Screw	5
37736	3.5mm x 36mm Locking Screw	5
37738	3.5mm x 38mm Locking Screw	5
37740	3.5mm x 40mm Locking Screw	5
37742	3.5mm x 42mm Locking Screw	5
37744	3.5mm x 44mm Locking Screw	5
37748	3.5mm x 48mm Locking Screw	5
37752	3.5mm x 52mm Locking Screw	5
37756	3.5mm x 56mm Locking Screw	5
37760	3.5mm x 60mm Locking Screw	5

*Description includes total length of plate, e.g. 75mm.

Instruments

Catalog No.	Description	Set Qty
22855	Drill A/O Connector	1
22875	Fixed A/O Handle	1
22880	Ratcheting A/O Handle	1
36118	Left Low Profile Humeral Jig Head	1
36505	Torx A/O Driver	2
36510	Torque Limiting Coupler	1
36515	2.0mm Depth Gauge	1
36522	Guide Wire Sleeve	2
36534	2.5mm Drill Guide (Non-Locking)	2
36526	2.7mm Drill Guide (Locking)	3
36538	3.5mm Drill Guide (Non-Locking)	2
36546	3.5mm Non-Locking Screw Tap	1
36551	3.5mm Locking Screw Tap	1
36575	Drill Guide Handle	2
36594	Plate Holding Forceps	1
36595	Plate Bender	2
36597	Large Plate Holding Forceps	1
37118	Right Low Profile Humeral Jig Head	1

Disposables

Catalog No.	Description	Set Qty
36545	2.5mm A/O Drill Bit	2
36546	3.5mm Non-Locking Screw Tap	1
36550	2.7mm A/O Drill Bit	2
36551	3.5mm Locking Screw Tap	1
36555	3.5mm A/O Drill Bit	2
14-4014401	1.6mm x 150mm Guide Wire (Non-threaded)	5

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