DePuy Synthes

PART OF THE Johnson & Johnson FAMILY OF COMPANIES

ANGLED BLADE PLATES FOR ADULTS

Instruments and implants approved by the AO Foundation.
This publication is not intended for distribution in the USA.

SURGICAL TECHNIQUE

Image intensifier control

This description alone does not provide sufficient background for direct use of DePuy Synthes products. Instruction by a surgeon experienced in handling these products is highly recommended.

Processing, Reprocessing, Care and Maintenance
For general guidelines, function control and dismantling of multi-part instruments, as well as processing guidelines for implants, please contact your local sales representative or refer to:
http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance
For general information about reprocessing, care and maintenance of Synthes reusable devices, instrument trays and cases, as well as processing of Synthes non-sterile implants, please consult the Important Information leaflet (SE_023827) or refer to:
http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance

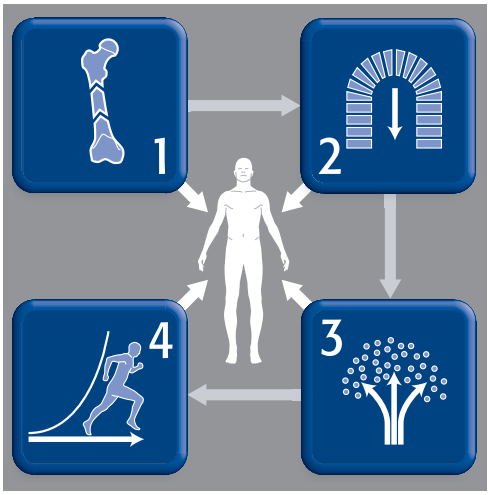
TABLE OF CONTENTS

AO PRINCIPLES

In 1958, the AO formulated four basic principles, which have become the guidelines for internal fixation[1, 2].

Anatomic reduction
Fracture reduction and fixation to restore anatomical relationships.

Early, active mobilization
Early and safe mobilization and rehabilitation of the injured of the part and the patient as a whole.



Stable fixation
Fracture fixation providing absolute or relative stability, as required by the patient, the injury, and the personality of the fracture.

Preservation of blood supply
Preservation of the blood supply to soft tissues and bone by gentle reduction techniques and careful handling.

[1] Müller ME, Allgöwer M, Schneider R, Willenegger H. Manual of Internal Fixation. 3rd edition. Berlin, Heidelberg, New York: Springer. 1991.
[2] Rüedi TP, Buckley RE, Moran CG. AO Principles of Fracture Management. 2nd edition. Stuttgart, New York: Thieme. 2007.

INTENDED USE, INDICATIONS AND CONTRAINDICATIONS

Intended Use
Angled Blade Plates are intended for temporary fixation, correction or stabilization of bones in the proximal and/or distal femur.

Indications
130° Angled Blade Plate
Fractures and revisions of the proximal third of the femur in skeletally mature patients.

Condylar Plates, 95°
Fractures and revisions of the proximal and distal third of the femur in skeletally mature patients.

Precaution: Use of the Condylar Plate on the proximal femur requires either an intact calcar of the femur or that a stable continuous medial contact is re-established.

Osteotomy Plates
90°/100°/110°/120°/130° Hip Plate

Osteotomies on the proximal femur in skeletally mature patients.

Note: Before the surgery, all components of the deformation must be recognized and the angles of correction must be defined.

Precaution: The preset angles have to be followed exactly during the intervention.

Contraindications
No specific Contraindication.

INTRODUCTION

Angled Blade Plates have been introduced in the 1960s by the AO and Synthes and belong still to surgeons basic armatorium used for fracture treatment, revision surgery and correction osteotomies. They serve as a tension band plate whenever possible (i.e., condylar plates with medial bony buttress) or as a splint (130° plates). Due to their fixed-angle shape, successful application needs carefull planning, concise orientation in all planes (AP and lateral views, rotation) and precise preparation of the channel for the blade.

FRACTURE TREATMENT

Preoperative planning

A good preoperative plan, including a step-by-step order of the procedure and preoperative drawings, is essential for the success of the surgery. Special care has to be paid to the anatomical landmarks, position and inclination of the particular used implant.

Make an X-ray of the contralateral site in order to have a template on which to plan the procedure.

For the proximal femur, the X-ray must be taken with the hip in 15°–20° internal rotation to correct for anteversion.

For the distal femur, accurate anteroposterior and lateral X-rays centered on the joint are necessary.

Draw in the outlines of the proximal or the distal femur as well as all the fracture lines. The fracture pattern determines the steps of the internal fixation as well as the choice of the implant. Draw in the selected plate with the help of the templates.
The plan should
- include the order in which the different steps will be carried out,
- denote the function of the different screws,
- indicate if a gliding hole or a thread hole needs to be predrilled before the reduction is carried out.

All the guide wires which are necessary to execute the procedure must also be shown and their function and inclination carefully noted.

Approach
Use a standard lateral approach to the proximal or distal femur.

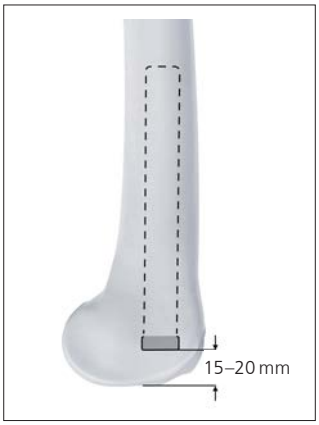
CONDYLAR PLATES, 95°

Introduction

Condylar Angled Blade Plates are used for the treatment of proximal and distal femoral fractures.

For the proximal femur the targeted final position of the tip of the applied blade is in the lower half of the femoral head. Its blade passes below the superior cortex of and lies central in the neck.

For the distal femur the targeted entry portal of the condylar plate blade must be in line with the femoral shaft axis. The final blade position lays parallel, about 15–20 mm above the joint and parallel to it. The blade is also parallel to the anterior articular surface.



Guide Wire Insertion

1

Determine anteversion of the proximal femur or frontal plane of the condyles

Instrument	
292.200.01	Kirschner Wire ∅ 2.0 mm with trocar tip, length 150 mm, Stainless Steel

For the proximal femur insert Kirschner wire A to determine the anteversion of the femoral neck and is hence parallel to the planned plane of the blade. Place the wire below the anterior ridge running along the front of the intertrochanteric area and drive it into the head. (Fig. 1)

Precaution: **Poorly defined anteversion or entry point may cause the blade to emerge posteriorly from the femoral neck.**

For the distal femur, after fixing a potential intracondylar fracture with screws which must lay anterior or posterior to the planned plate position, place orientation Kirschner wires A and B on the ventral aspect of the distal femur. (Fig. 2)

Precaution: **Kirschner wires are single-use items, do not re-use.**

Figure 1

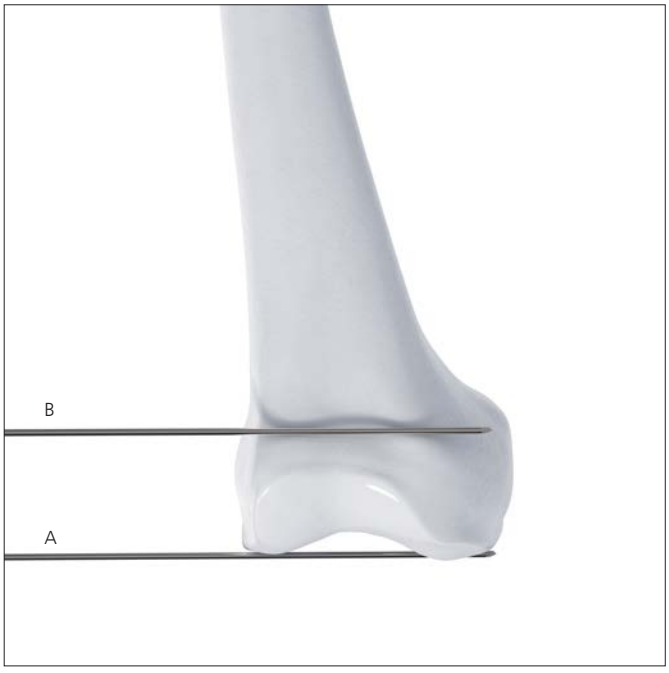


Figure 2

2
Insert guide wire

Instruments	
292.650	Guide Wire ∅ 2.0 mm with threaded tip with trocar, length 230 mm, Stainless Steel
310.190	Drill Bit ∅ 2.0 mm, length 100/75 mm, 2-flute, for Quick Coupling
333.200	Condylar Plate Guide

Proximal femur: The 95° condylar plate guide is then placed along the lateral cortex and the guide wire B is inserted, parallel in the axial view to the first guide wire and parallel with the upper edge of the condylar plate guide in the AP view. It is drilled into the greater trochanter just above the planned point of entry (Fig. 1).

Distal femur: The final position of the blade will be about 15 to 20 mm above and parallel to the joint surface (Fig. 2). The guide wire C should indicate the direction of blade insertion. Insert wire C parallel to the wire A into distal condyles (Fig. 3).

The wire's position should be checked radiologically in both planes, and adjusted if required.

Notes:
- **Predrill with 2-mm drill bit in dense bone.**
- **The track for the seating chisel will be parallel to the definitive wire.**
- **The precise position of the guide wire is essential for the correct entry point and insertion of the blade of the plate.**

Remove the Kirschner wire A.

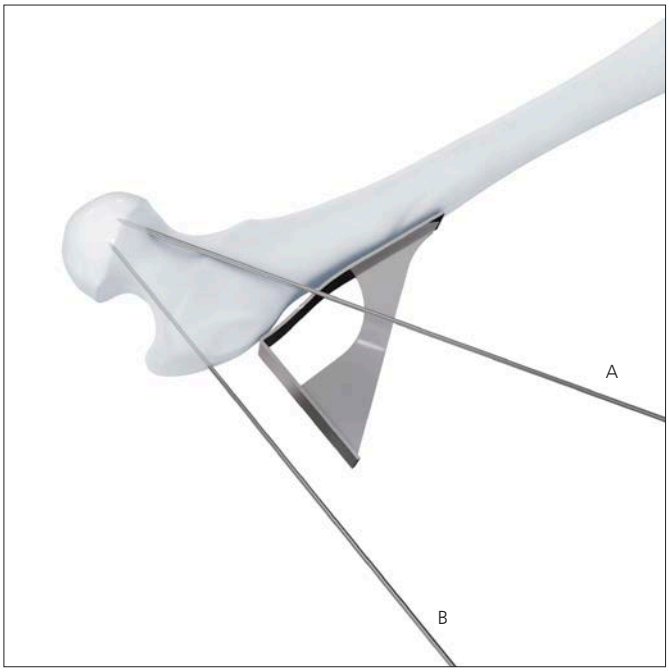


Figure 1

Figure 2
Angled Blade Plate, 95°. Distal Femur.

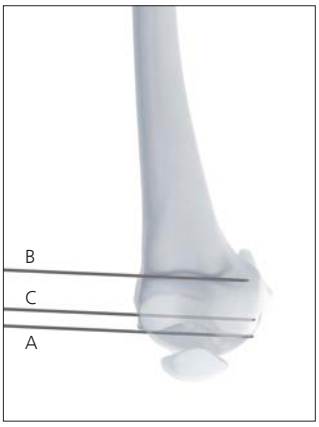


Figure 3

Plate Insertion

1

Determine blade length

The blade length is determined with the plate template on a preoperative AP X-ray or electronically preoperatively.

2

Open blade entry point

Instruments

310.440	Drill Bit ∅ 4.5 mm, length 145/120 mm, 2-flute, for Quick Coupling
332.050	Router, for Jacobs Chuck
332.060	Router, for Quick Coupling
399.540	Chisel Handle
399.560	Chisel Blade, width 16 mm

Proximal femur: Drill the first hole with a 4.5-mm drill bit to a depth of 4 to 6 cm parallel to the Guide Wire (Fig. 1/2). Leave the drill bit in the bone and use another 4.5-mm drill bit to drill an additional hole on either side of the drill left in the bone (Fig. 3).

Enlarge the drill holes with the router in order to convert the three holes to a slot able to mate the size of the seating chisel (Fig. 4). Bevel the hole towards the shaft for a few millimeters to receive the curve of the shoulder of the angled blade plate in order to prevent shattering of the lateral cortex. (Fig. 5)

Distal femur: Proceed as for the proximal femur.

Figure 1

Figure 2

Figure 3

Figure 4

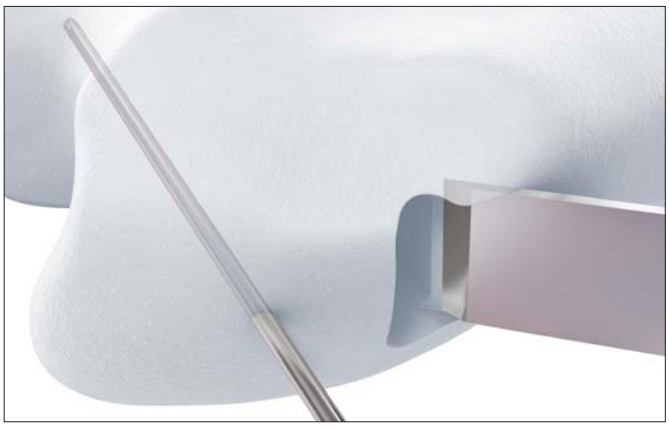


Figure 5

3
Position chisel

Instruments	
332.090	Chisel Guide, with adjustable angle
332.120	Seating Chisel, length 320 mm, U-Profile, for Hip Plates for Adults
332.200	Slotted Hammer

The chisel guide is inserted over the seating chisel.

The chisel is inserted parallel to the Kirschner wire in all planes. The flap of the chisel guide must remain in line with the long axis of the femur.

Angled Blade Plate, 95°. Chisel insertion in proximal femur.

Angled Blade Plate, 95°. Chisel insertion in distal femur.

4
Insert chisel

Instruments	
332.090	Chisel Guide, with adjustable angle
332.120	Seating Chisel, length 320 mm, U-Profile, for Hip Plates for Adults
332.200	Slotted Hammer
399.420	Hammer 500 g

Use the slotted hammer to maintain the rotational alignment of the chisel. Hammer in with slight hammer blows the seating chisel parallel to its guide wire.

When the desired depth is reached, the chisel position is checked radiologically. This determines also whether the planned blade length is appropriate.

Remove the guide and use the slotted hammer to remove the chisel.

Note: **Markings on the chisel indicate the insertion depth.**

Distal femur: Proceed as for the proximal femur.

5
Insert plate

Instruments	
332.160	Inserter/Extractor with Adjustable Clamps
399.420	Hammer 500 g
332.210	Impactor, for Angled Blade Plates
321.160	Combination Wrench ∅ 11.0 mm

Fit the inserter as close to the shoulder of the selected plate as possible (Fig. 1) and tighten with the combination wrench. The handle must be horizontally aligned with the blade.

Push the plate by hand into the prepared channel and insert with light hammer blows. Remove the inserter/extractor. Use the impactor to complete seating of the plate (Fig. 2).

Proceed equally at the distal femur.

Figure 1

Figure 2

6
Fix plate with screws

Instruments	
310.310	Drill Bit ∅ 3.2 mm, length 145/120 mm, 2-flute, for Quick Coupling
311.460	Tap for Cortex Screws ∅ 4.5 mm, length 125/70 mm
312.460	Double Drill Guide 4.5/3.2
319.100	Depth Gauge for Screws ∅ 4.5 to 6.5 mm, measuring range up to 110 mm
314.150	Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm
314.270	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove, length 245 mm
314.110	Holding Sleeve, large
321.120	Tension Device, articulated, span 20 mm

The 3.2-mm drill guide is inserted into the most proximal shaft hole. A hole is drilled with a 3.2-mm drill bit and the screw length measured. The thread is taped if necessary and the corresponding screw is inserted. (Fig. 1)

In single plane transverse or short oblique fractures, the first screw in the distal fragment is placed excentrically as shown in order to compress the fracture. (Fig. 2)

The remaining screws, at least three, are then placed in a neutral position. (Fig. 3)

Figure 1

Figure 2

Figure 3

Notes:
- **Often a second lag screw can be inserted into the proximal fragment in the proximal femur.**
- **In nonunions, sufficient compression may only be achieved by the use of the articulated tension device. (Fig. 4)**
- **Proceeding steps on the distal femur are equal.**

Note: The technical proceeding for the 130° angled blade plate is the same as for the 95° Condylar Plate, however the relevant Positioning Plate (333.060) is required.

Precaution: Achieving medial buttress is essential proximal and distal.

Figure 4

OSTEOTOMY

This description explains the steps for osteotomies. Osteotomy Angled Blade Plates are used with the same instruments as the previously described Angled Blade Plates.

Preoperative planning

Preoperative planning is of particular importance before performance of corrective osteotomies, because they are the only way the surgeon can check preoperatively the result of the osteotomy as well as the three-dimensional concept of the procedure.

The principle of preopative planning is similar as for fracture treatment. The surgical technique is based on the blade angle, which defines the final varus/valgus correction as the blade is inserted along the axis of the femoral neck in the proximal femur. Depending on the correction, determine the appropriate osteotomy plate by blade length, angle, and displacement.

Note: **The blade channel is always prepared before the osteotomy is performed.**

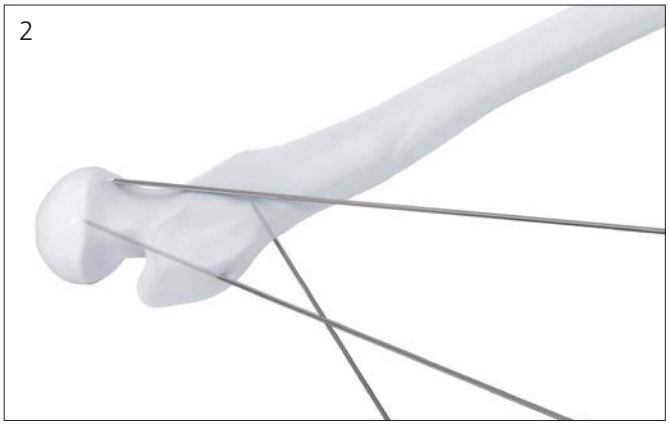
Precaution: **The preoperatively predetermined angles must be followed exactly during operation.**

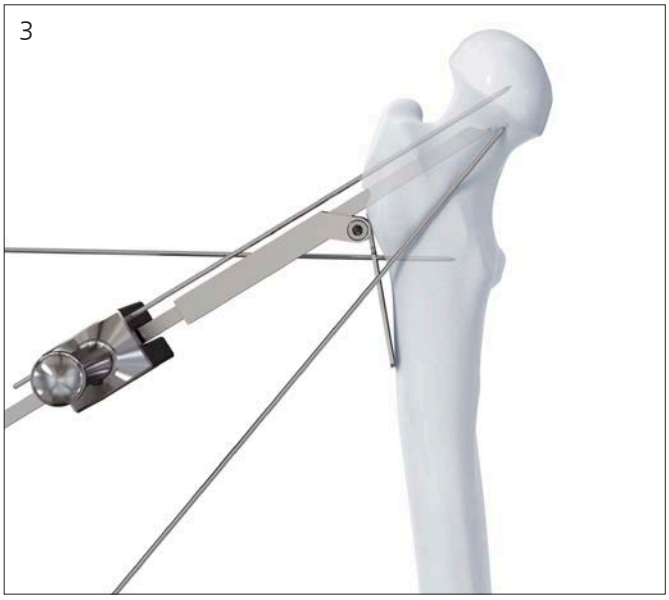
Procedure

1. With a Kirschner wire the anteversion of the neck of the femur is defined. Parallel to the the triangular guide plate (e.g. 60°) the Guide Wire is inserted. This wire parallel to the femoral neck axis is indicating the blade direction.

2. After drilling a 2-mm hole about 5 mm distal to the site of the planned osteotomy, a Kirschner wire is inserted. Two additional Kirschner wires may be inserted in derotation osteotomies to mark the necessary correction.

3. About 20 mm above the site of the planned osteotomy and far to the front, the cortex is opened with a chisel for insertion of the plate. The seating chisel is then inserted into the center of the neck, parallel to the Guide Wire, to a depth of 40–50 mm. The flap of the chisel guide is parallel to the femoral shaft. The chisel is then withdrawn 10–20 mm to facilitate later removal.





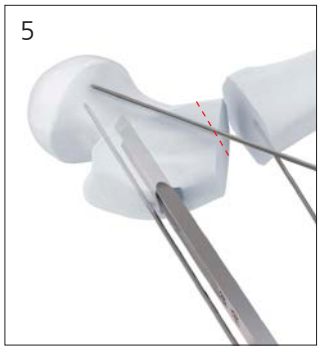
4. The femur is transected at right angles to the shaft with an oscillating bone saw.

5. With the seating chisel as a handle, the proximal fragment is tipped upward. Starting from the middle of the osteotomy, another cut (5b) is made parallel to the seating chisel, and the excised wedge is removed.

6. After removal of the seating chisel the selected plate is inserted into the precut channel. The plate may be clamped to the shaft with a reduction forceps.

7. The tension device is fixed to the femur and tightened to achieve compression.

8. The plate is screwed to the femoral shaft. The tension device is removed.



IMPLANT REMOVAL

Instruments

332.160	Inserter/Extractor with Adjustable Clamps
332.200	Slotted Hammer
321.160	Combination Wrench ∅ 11.0 mm

To remove the Angled Blade Plate, first remove tissue and bone from all screw heads and drives. Insert the screwdriver in the screw recess making sure that the screwdriver is perfectly seated in the screw head and subsequently remove all screws.

After removal of all screws, attach the Inserter/Extractor to the Angled Blade Plate as for insertion and remove the plate using the Slotted Hammer.

If a screw cannot be removed with the screwdriver, consult the separate Synthes publication "Screw Extraction Set: Instruments for removing Synthes screws (DSEM/TRM/0614/0104)" which explains how screws can be removed.

IMPLANTS

Condylar Plate 95°

Pure Titanium (TiCP)	Stainless steel	Shaft length (mm)	Holes	Blade length (mm)
437.500	237.500	92	5	50
437.520	237.520	92	5	60
437.540	237.540	92	5	70
437.560	237.560	92	5	80
437.700	237.700	124	7	50
437.720	237.720	124	7	60
437.740	237.740	124	7	70
437.760	237.760	124	7	80
437.900	237.900	156	9	50
437.920	237.920	156	9	60
437.940	237.940	156	9	70
437.960	237.960	156	9	80
437.200	237.200	204	12	50
437.220	237.220	204	12	60
437.240	237.240	204	12	70
437.260	237.260	204	12	80
	237.400	236	14	50
	237.420	236	14	60
	237.440	236	14	70
	237.460	236	14	80
	237.600	268	16	50
	237.620	268	16	60
	237.640	268	16	70
	237.660	268	16	80
	237.800	300	18	50
	237.820	300	18	60
	237.840	300	18	70
	237.860	300	18	80

For sterile implants add "S" to article number.

Angled Blade Plate 130°

Pure Titanium (TiCP)	Stainless steel	Shaft length (mm)	Holes	Blade length (mm)
438.360	238.360	60	4	50
438.380	238.380	60	4	60
438.440	238.440	60	4	70
438.450	238.450	60	4	75
438.460	238.460	60	4	80
438.470	238.470	60	4	85
438.480	238.480	60	4	90
438.490	238.490	60	4	95
438.400	238.400	60	4	100
438.410	238.410	60	4	105
438.420	238.420	60	4	110
438.600	238.600	104	6	50
438.620	238.620	104	6	60
438.640	238.640	104	6	70
438.660	238.660	104	6	80
438.680	238.680	104	6	90
438.940	238.940	152	9	70
	238.960	152	9	80
438.980	238.980	152	9	90
438.240	238.240	200	12	70
438.260	238.260	200	12	80
438.280	238.280	200	12	90

For sterile implants add "S" to article number.

Hip Plate 90°
All plates with 4 DCP holes

Pure Titanium (TiCP)	Stainless steel	Displacement (mm)	Blade length (mm)
439.280	239.280	10	40
	239.200	10	50
	239.210	10	55
	239.220	10	60
	239.230	10	65
	239.240	10	70
	239.780	15	40
439.700	239.700	15	50
	239.710	15	55
439.720	239.720	15	60
	239.730	15	65
	239.740	15	70
	239.600	20	50
439.620	239.620	20	60
	239.640	20	70

For sterile implants (stainless steel only) add "S" to article number.

Hip Plate 100°
All plates with 4 DCP holes

Pure Titanium (TiCP)	Stainless steel	Displacement (mm)	Blade length (mm)
	239.300	10	50
439.320	239.320	10	60
	239.340	10	70

For sterile implants (stainless steel only) add "S" to article number.

Hip Plate 110°
All plates with 4 DCP holes

Pure Titanium (TiCP)	Stainless steel	Blade length (mm)
439.430	239.430	65
439.450	239.450	75
439.470	239.470	85

For sterile implants (stainless steel only) add "S" to article number.

Hip Plate 120°
All plates with 4 DCP holes

Pure Titanium (TiCP)	Stainless steel	Blade length (mm)
439.530	239.530	65
439.550	239.550	75
439.570	239.570	85

For sterile implants (stainless steel only) add "S" to article number.

Hip Plate 130°
All plates with 4 DCP holes

Pure Titanium (TiCP)	Stainless steel	Blade length (mm)
439.830	239.830	65
439.840	239.840	70
439.850	239.850	75
439.860	239.860	80
439.870	239.870	85
439.880	239.880	90
439.890	239.890	95
439.800	239.800	100
439.810	239.810*	105
439.820	239.820*	110

For sterile implants (stainless steel only) add "S" to article number.
* Article 239.810 and 239.820 are only available non-sterile.

INSTRUMENTS

292.200.01	Kirschner Wire ∅ 2.0 mm with trocar tip, length 150 mm, Stainless Steel
292.650	Guide Wire ∅ 2.0 mm with threaded tip with trocar, length 230 mm, Stainless Steel
310.190	Drill Bit ∅ 2.0 mm, length 100/75 mm, 2-flute, for Quick Coupling
310.310	Drill Bit ∅ 3.2 mm, length 145/120 mm, 2-flute, for Quick Coupling
310.440	Drill Bit ∅ 4.5 mm, length 145/120 mm, 2-flute, for Quick Coupling
311.460	Tap for Cortex Screws ∅ 4.5 mm, length 125/70 mm
312.460	Double Drill Guide 4.5/3.2
314.110	Holding Sleeve, large
314.150	Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm
314.270	Screwdriver, hexagonal, large, ∅ 3.5 mm, with Groove, length 245 mm
319.100	Depth Gauge for Screws ∅ 4.5 to 6.5 mm, measuring range up to 110 mm
321.160	Combination Wrench ∅ 11.0 mm
321.120	Tension Device, articulated, span 20 mm
322.430	DCP Hip Drill Guide 4.5, for neutral and load position
332.010	Triple Drill Guide 130°
332.050	Router, for Jacobs Chuck
332.060	Router, for Quick Coupling
332.090	Chisel Guide, with adjustable angle
332.120	Seating Chisel, length 320 mm, U-Profile, for Hip Plates for Adults
332.160	Inserter/Extractor with Adjustable Clamps
332.200	Slotted Hammer
332.210	Impactor, for Angled Blade Plates
333.060	Positioning Plate, triangular, length 45 mm, 90°/50°/40°
333.070	Positioning Plate, triangular, length 45 mm, 80°/70°/30°
333.080	Positioning Plate, triangular, length 45 mm, 100°/60°/20°
333.160	Positioning Plate, quadrangular, height 45 mm, for Varus Osteotomy
333.200	Condylar Plate Guide
399.420	Hammer 500 g
399.540	Chisel Handle
399.560	Chisel Blade, width 16 mm

MRI INFORMATION

Torque, Displacement and Image Artifacts according to ASTM F 2213-06, ASTM F 2052-06e1 and ASTM F 2119-07

Non-clinical testing of worst case scenario in a 3 T MRI system did not reveal any relevant torque or displacement of the construct for an experimentally measured local spatial gradient of the magnetic field of 3.69 T/m. The largest image artifact extended approximately 169 mm from the construct when scanned using the Gradient Echo (GE). Testing was conducted on a 3 T MRI system.

Radio-Frequency-(RF-)induced heating according to ASTM F 2182-11a

Non-clinical electromagnetic and thermal testing of worst case scenario lead to peak temperature rise of 9.5 °C with an average temperature rise of 6.6 °C (1.5 T) and a peak temperature rise of 5.9 °C (3 T) under MRI Conditions using RF Coils (whole body averaged specific absorption rate [SAR] of 2 W/kg for 6 minutes [1.5 T] and for 15 minutes [3 T]).

Precautions: The above mentioned test relies on non-clinical testing. The actual temperature rise in the patient will depend on a variety of factors beyond the SAR and time of RF application. Thus, it is recommended to pay particular attention to the following points:

- **It is recommended to thoroughly monitor patients undergoing MR scanning for perceived temperature and/or pain sensations.**
- **Patients with impaired thermoregulation or temperature sensation should be excluded from MR scanning procedures.**
- **Generally, it is recommended to use a MR system with low field strength in the presence of conductive implants. The employed specific absorption rate (SAR) should be reduced as far as possible.**
- **Using the ventilation system may further contribute to reduce temperature increase in the body.**

DePuy Synthes
PART OF THE Johnson&Johnson FAMILY OF COMPANIES
People inspired™

Synthes GmbH
Eimattstrasse 3
4436 Oberdorf
Switzerland
Tel: +41 61 965 61 11
Fax: +41 61 965 66 00
www.depuysynthes.com

Not all products are currently available in all markets.

This publication is not intended for distribution in the USA.

All surgical techniques are available as PDF files at
www.depuysynthes.com/ifu

CE
0123

 DSEM/TRM/0416/0657(1) 06/16