SMR®

MODULAR SHOULDER REPLACEMENT

STEMLESS

SURGICAL TECHNIQUE

Lima Corporate
Orthopaedic motion

SMR® STEMLESS SURGICAL TECHNIQUE

Index

Limacorporate spa is a manufacturer of prosthetic implants and as such does not perform medical procedures. This documentation concerning surgical techniques, which provides surgeons with general guidelines for implanting the SMR® STEMLESS, was developed with the advice of a team of surgical experts. All decisions as to the type of surgery and most suitable technique are obviously the responsibility of the health care professional. Surgeons must make their own decisions as to the adequacy of each planned implant technique based on their training, experience and the clinical condition of the patient.

LEONARDO DA VINCI: Vitruvian Man. Study of the proportions of the human body (1490).

SMR® STEMLESS SURGICAL TECHNIQUE

Indications, Contraindications, Warnings and Risk Factors

INDICATIONS

The SMR® Stemless system is intended for partial or total, primary or revision shoulder joint replacement. Revision surgery is intended only where the Stemless Core is stable, well positioned and osseointegrated and it is intended in case of:

- failed SMR® Stemless primary implant with an anatomic implant
- conversion from SMR® Stemless anatomic to SMR® Stemless reverse or CTA
- conversion from SMR® Stemless reverse to SMR® Stemless CTA
- failed SMR® Resurfacing implant.

Other revisions of the humeral prosthesis part should be treated with traditional shoulder prostheses.

The SMR® Stemless Anatomic is indicated for partial or total, primary or revision shoulder joint replacement in patients suffering from disability due to:

- non-inflammatory degenerative joint disease including osteoarthritis and avascular necrosis;
- inflammatory degenerative joint disease such as rheumatoid arthritis;
- revision of a failed SMR® Resurfacing implant;
- cuff tear arthropathy (CTA Heads only).

The SMR® Stemless Reverse is indicated for primary or revision total shoulder replacement in a grossly rotator cuff deficient joint with severe arthropathy (disabled shoulder).
Is also indicated in case of revision of a failed SMR® Stemless primary implant with conversion from anatomic to reverse.

The patient's joint must be anatomically and structurally suited to receive the selected implants and a functional deltoid muscle is necessary to use the device.

The SMR® Stemless system allows the assembly of components in various humeral and glenoid constructs. The constructs are intended for cemented (only glenoids) or uncemented use as specified in the following table.

In the Anatomic shoulder the humeral construct consists of the stemless core and the humeral head adaptor from the SMR® Stemless system coupled to SMR® Shoulder System humeral heads. In the Reverse shoulder the humeral construct consists of the stemless core and the reverse liner.

The glenoid construct, anatomic or reverse uses SMR® Shoulder System components. The Anatomic glenoid construct consists of an all polyethylene glenoid or a metal back assembled with a liner while the Reverse glenoid construct consists of the metal back, the connector and the glenosphere. On the glenoid side, the fixation of the all polyethylene glenoid or the metal back determines if the construct is cemented or uncemented.

Indications, Contraindications, Warnings and Risk Factors

System				Use	
Anatomic	Reverse	Components	Material	Cem	Not Cem
•	•	SMR® Stemless Core	Ti6Al4V		X
•		SMR® Stemless Humeral Head Adaptors	Ti6Al4V		X
	•	SMR® Stemless Reverse Liners	CoCrMo		X
•		SMR® Humeral Heads (Standard, CTA)	CoCrMo*	X	X
			Ti6Al4V	X	X
	•	SMR® Glenospheres	UHMWPE X-Lima +Ti6Al4V		X
	•	SMR® Connectors	Ti6Al4V		X
•		SMR® Cemented Glenoids	UHMWPE	X	
•		SMR® 3 Pegs Cemented Glenoids	UHMWPE X-Lima	X	
•	•	SMR® Metal Back Glenoids	Ti6Al4V+PoroTi	X	X
			Ti6Al4V+PoroTi+HA		X
•	•	SMR® TT Metal Back Baseplates	Ti6Al4V		X
•	•	SMR® TT Metal Back Peg	Ti6Al4V		X
•		SMR® Metal Back Liner	UHMWPE	X	X
•	•	SMR® Bone screws	Ti6Al4V		X
	•	SMR® Glenoid Plates	Ti		X

Note:

- SMR® shoulder system CoCrMo Humeral Heads size 38 mm are not allowed to be coupled to SMR® Stemless Core and Humeral Head Adaptor.

- The CTA head must be used only in case of good stability of the Stemless Core. If the CTA Head has to be used, make sure that an Eccentric Adaptor is used (the coupling with the Concentric Adaptor is not allowed) and that the eccentricity is in the cranial direction only.

Indications, Contraindications, Warnings and Risk Factors

WARNINGS

Please follow the instructions for use enclosed in the product packaging.

In selecting patients for surgery, the following factors can be critical to the eventual success of the procedure:

- **Partial Shoulder replacement:** in cases of a deficient and unreconstructable rotator cuff, a CTA-head is indicated;
- **Total Shoulder replacement:** the rotator cuff must be functional, intact or reconstructable. In cases of a deficient and unreconstructable rotator cuff, a hemiprosthesis with a CTA head or a Reverse Total Shoulder Arthroplasty is indicated;
- **Reverse Shoulder replacement:** the bone stock of the glenoid and humerus must be able to support the implant. In cases of significant bone loss or in which adequate fixation on the glenoid side cannot be obtained, a hemiarthroplasty with a CTA-head should be performed.

Note. For SMR® Shoulder System components refer to the proper Instructions for Use leaflet.

CONTRAINDICATIONS

Absolute contraindications include:

- local or systemic general infection;
- septicaemia;
- persistent acute or chronic local or systemic osteomyelitis;
- neurologically confirmed nerve lesion compromising shoulder joint function;
- deltoid muscle insufficiency in case of reverse prosthesis;
- poor meta-epiphyseal bone stock compromising stability of the implant (acute fracture of the humeral head, meta-epiphyseal pseudoarthrosis, osteoporosis, extended bone loss after previous prosthetic or non-prosthetic surgery);
- tumor.

Relative contraindications include:

- humeral head fracture sequelae;
- vascular or nerve diseases affecting the concerned limb;
- metabolic disorders which may impair fixation and stability of the implant;
- any concomitant disease and dependence that might affect the implanted prosthesis;
- metal hypersensitivity to implant materials;
- patient with renal impairment (CoCrMo)

RISK FACTORS

The following risk factors may result in poor results with this prosthesis:

- overweight;
- strenuous physical activities (active sports, heavy physical work);
- fretting of modular junctions;
- incorrect implant positioning;
- muscle deficiencies;
- multiple joint disabilities;
- refusal to modify postoperative physical activities;
- patient history of infections or falls;
- systemic diseases and metabolic disorders;
- local or disseminated neoplastic diseases;
- drug therapies that adversely affect bone quality, healing, or resistance to infection;
- drug use or alcoholism;
- marked osteoporosis or osteomalacia;
- patient's resistance to disease generally weakened (HIV, tumour, infections);
- severe deformity leading to impaired anchorage or improper positioning of implants;
- use or combination with products, prosthesis or instruments of another manufacturer.

PREOPERATIVE PLANNING

Standard X-Rays are used to assist with planning of the operation. It is recommended to use a normal AP-view in internal and external rotation as well as an axillary view, Bernageau or Morrison view. It is recommended to use a CT-Scan in fractures cases and for planning of the glenoid insertion.

If required an MRI can be used for clear examination of the extent of the bone deficiency and to see the muscle/capsule quality.

In post-traumatic cases, such as in special cases of disabling shoulder, a neurological exam is helpful for decision making.

Templates are used in all osteoarthritic cases; they can also be used in fracture cases but often in a limited mode, depending on the type of fracture.

The X-Ray templates provided for SMR® have a 105% scale; digital templates are available as well.

ANAESTHESIA

Understanding of the surgery and participation by the anaesthesiologist is especially important for the outcome of the surgery. This applies to accurate preoperative evaluation of the patient as well as intra op techniques.

They should have a good understanding of positioning on the operating table and postoperative pain management.

Shoulder prosthetic replacement can be performed with regional (scalenus) anaesthesia combined with sedation and/or with general anaesthesia.

The modern technique of interscalenic block was introduced by Winnie in 1970 and soon became the standard for anaesthesia and postoperative pain management in shoulder surgery.

Requested surgical positioning (beach chair position) must be accurately followed by the anaesthetic staff to avoid hypotension and consecutive brain hypoperfusion.

Postoperative analgesia is important and can be performed by intravenous, single injection or “on demand” application of analgesics. Patient-controlled analgesia (PCA) is recommended.

POSITIONING

Shoulder arthroplasty is normally performed in a “beach-chair” position; the surgeon needs complete access to the shoulder joint. The arm is free or stabilized by arm-holders. The shoulder must be positioned off the edge of the table to afford unobstructed arm extension.

The patient’s head must be supported and stabilized in the neutral position. Nerve injury due to brachial plexus traction during positioning and surgery must be avoided.

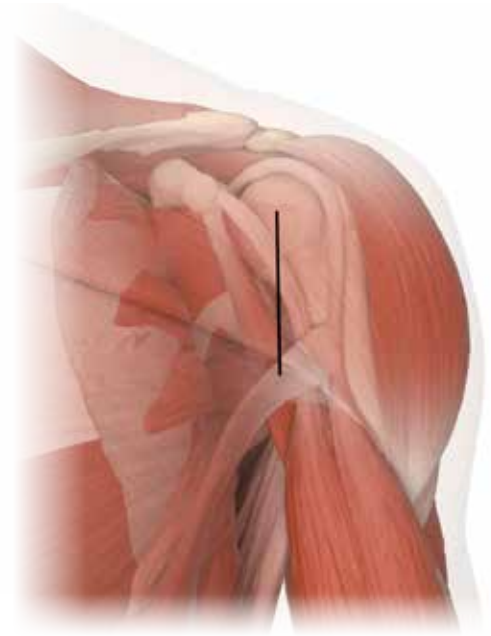
If possible, one assistant should stay behind the shoulder, the second on the opposite side of the patient, so that the surgeon has a complete anterior view of the shoulder and can move the joint without any obstacle.

ACCESS

We recommend two types of surgical approaches to the shoulder joint. As in every surgical procedure, the access depends not only on diagnosis and planned surgical treatment but also on the experience of the surgeon.

Ranges of glenohumeral motion are evaluated with the patient under anaesthesia to confirm the preoperative assessment and the extent of capsular release needed to restore the ROM postoperatively.

DELTO-PECTORAL APPROACH



Anterior vertical incision, starting 1 cm laterally of the coracoid bone, slanting towards the axillary's pouch.
If there is a metaphysal fracture, slanting laterally towards the deltoid insertion at the humerus. The cephalic vein is retracted laterally with the deltoid muscle.The clavipectoral fascia is incised along the lateral edge of the conjoined tendon up to the coracoacromial ligament. With the clavipectoral fascia incised, a retractor can easily be placed over the superolateral aspect of the humeral head to retract the deltoid. The conjoined tendon is retracted medially.
The musculocutaneous nerve penetrates the lateral coracobrachialis muscle 3 to 8 cm distally of the tip of the coracoid process. The position of the axillary nerve should be indentified along the anterior surface of the subscapularis muscle, below the conjoined tendon. The axillary nerve crosses the inferolateral border of the subscapularis 3 to 5 mm medially of its musculotendinous junction and has an intimate anatomic relation with the inferior capsule of the shoulder joint.
The anterior humeral circumflex artery and veins are visualized, ligated and divided.
The subscapularis tendon is released, divided 1 cm medially to its attachment or with some bone chip of the lesser tuberosity. Separation of the subscapularis from the capsule and incision of the capsule is performed to the inferior border of the glenoid rim, protecting the axillary nerve with a blunt retractor. Release of the subscapularis and 360° capsular release.

Closure. In fracture cases, accurate reconstruction of the minor and major tubercles by suture, bone anchors or cerclage is mandatory.
If the long head of the biceps tendon is intact, reconstruct also the biceps groove to avoid impingement. Closure of delto-pectoral groove.

ANTERO-LATERAL (DELTOID SPLITTING) APPROACH

Begin the incision at the anterolateral tip of the acromion and carry it distally over the deltoid muscle about 5 cm. Define the tendinous interval on 4 to 5 cm between the anterior and middle thirds of the deltoid; splitting the muscle here provides an avascular approach to underlying structures.

Incise the thin wall of the subdeltoid bursa and explore the rotator cuff as desired by rotating and abducting the arm to bring different parts of it into view.

SMR® STEMLESS SURGICAL TECHNIQUE

Humerus Preparation

Figure 1

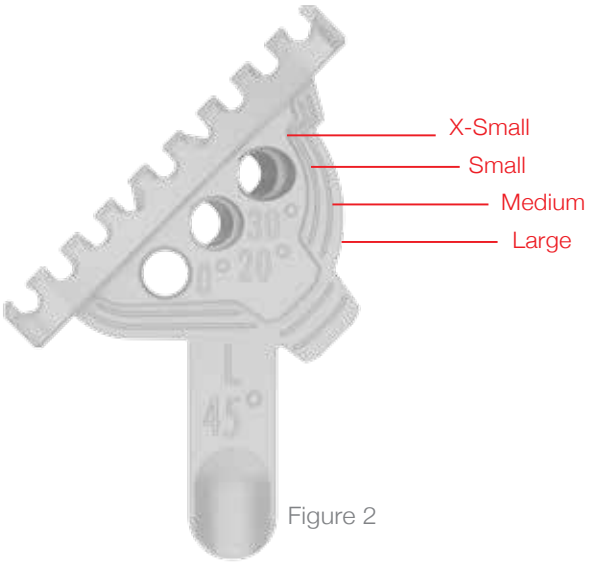


Figure 2

FOREWORD

Pre-operative planning is highly recommended with the use of templates showing a 5% enlarged image of the profiles. Normally standard AP and Axial view of the shoulder joint are used; in some cases, a preoperative CT-Scan is recommended to perform a more accurate planning. Select the core size and resection level of the humeral head, which will serve as a reference for the final implant height.

The SMR® Stemless prosthesis can be implanted with one of the usual approaches:

- *delto-pectoral*
- *antero-lateral (deltoid splitting)*

The surgical technique described hereafter referes to the delto-pectoral approach.

HUMERAL HEAD RESECTION

Two humeral head resection techniques are possible with the SMR® Stemless instrumentation: a cut using the external jig and a resection technique using the intramedullary guide. The choice is left to the surgeon according to the clinical case.

HUMERAL HEAD RESECTION USING THE EXTERNAL JIG

Take from the instrument set the *cutting template (I57)*; screw the *alignment rod (E57)* (Figure 1) in the chosen retroversion hole (0°, 20° and 30° positions are available). The cutting template can be used for a first evaluation of the Core size (X-Small, Small, Medium and Large) (Figure 2).

Humerus Preparation

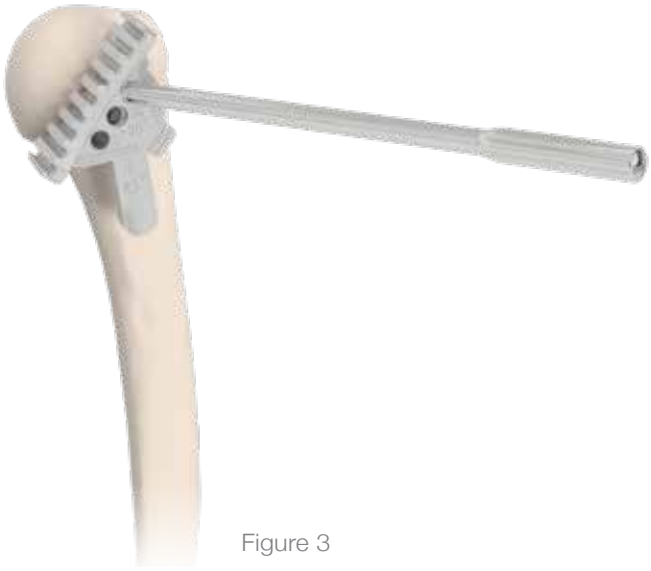


Figure 3

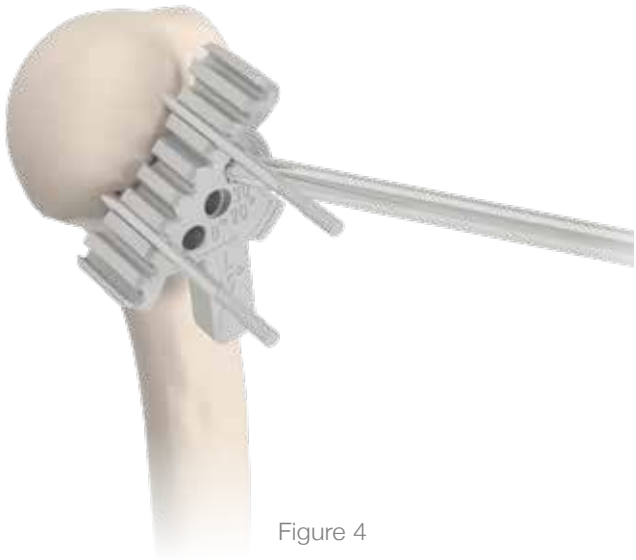


Figure 4

Place the cutting template onto the humerus (Figure 3) and align the alignment rod with the forearm flexed at 90°, finally fix the cutting template using the *Ø 3 mm pins (T57)* included into the instrument set (Figure 4).

The humeral head should be resected exactly at the level of the anatomical neck. Perform the head resection with an oscillating saw.

Humerus Preparation

Figure 5

Figure 6

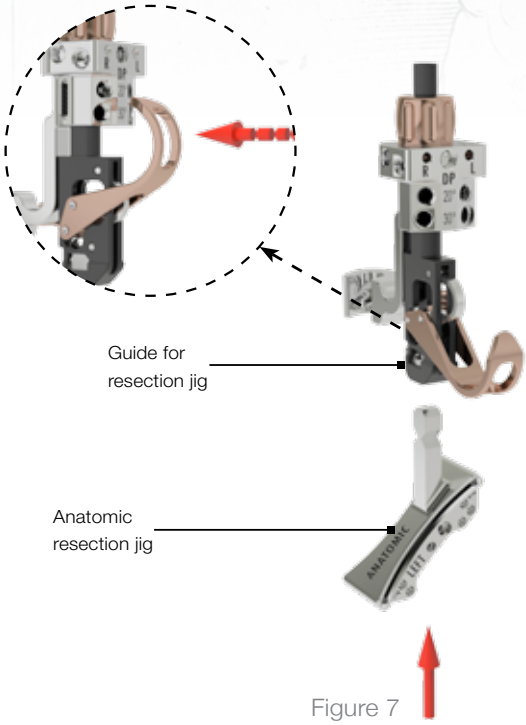


Figure 7

HUMERAL HEAD RESECTION USING THE INTRAMEDULLARY GUIDE

Open the proximal end of the humerus with the *awl (F57)* connected to the *T-handle with AO connection (N57)* (Figure 5). Connect the *Ø 6 mm pin (G57)* to the *T-handle with AO connection (N57)* and attach the *cutting jig connector (H57)* (Figure 6), finally insert the assembly into the humerus.

Prepare the *anatomic resection jig (C57)* by properly connecting it to the *guide for resection jig (B57)* (Figure 7).

Connect the *alignment rod (E57)* to the assembly on the LEFT or the RIGHT hole of the delto-pectoral (DP) side to obtain the chosen retroversion angle (0°, 20° and 30° positions are available).

Connect finally the assembly to the 6 mm pin according to the side that is being operated. For a left shoulder, the mark LEFT shall be frontally visible on the guide and viceversa the mark RIGHT for a right shoulder.

Figure 8

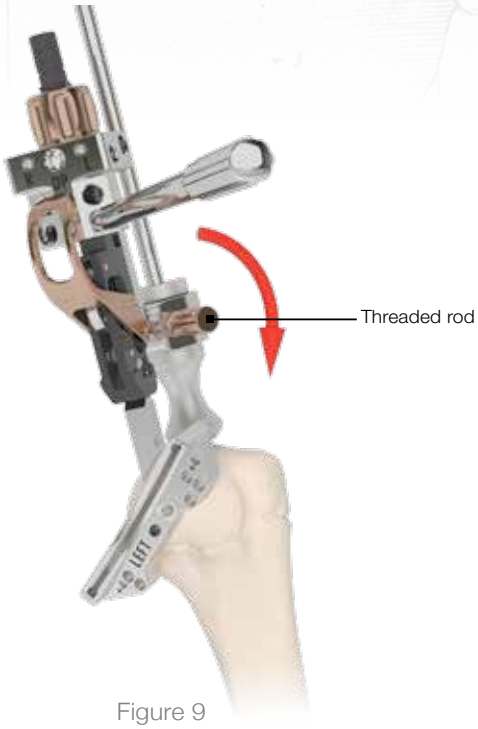


Figure 9

RETROVERSION

Keeping the forearm flexed at 90°, rotate the resection guide until the *alignment rod (E57)* and the forearm are parallel (Figure 8). Then fix the selected retroversion by screwing the threaded rod (Figure 9).

A resection with the chosen retroversion will then be performed in this position. If less or more retroversion is required, the rod should be externally or internally rotated respectively.

Humerus Preparation

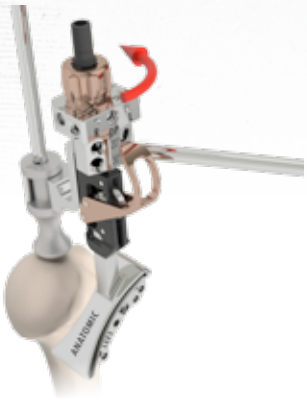


Figure 10

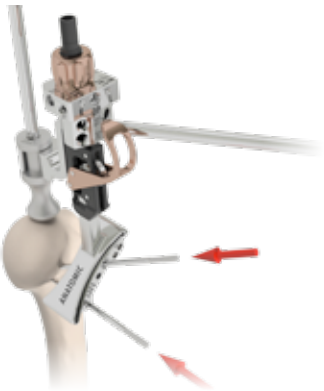


Figure 11

Figure 12

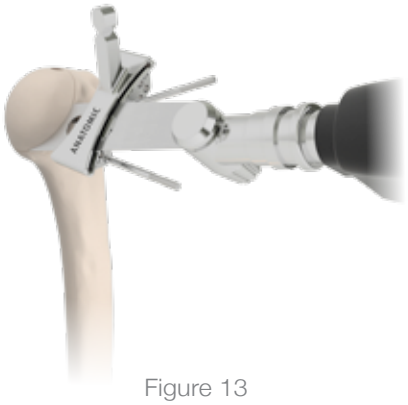


Figure 13

HEAD RESECTION

Adjust the height of the resection jig level until it is aligned with the anatomic neck.
Turn clockwise or counter-clockwise the red knob to move the jig upwards or downwards respectively (Figure 10).

Use the *sickle (D57)* to assess the resection height and secure the guide to the humerus with the *Ø 3 mm pins (T57)* (Figure 11) once the selected height is reached.

Once the jig is secured to the humerus with the pins, remove the guide by releasing the red lever and sliding upwards the guide for resection jig (Figure 12). Next, remove the central Ø 6 mm pin from the humeral canal, leaving only the jig onto the humerus.

Resect the humeral head with a blade through the guided slot of the jig (Figure 13); finally, remove the pins and the jig.

Figure 14

Figure 15

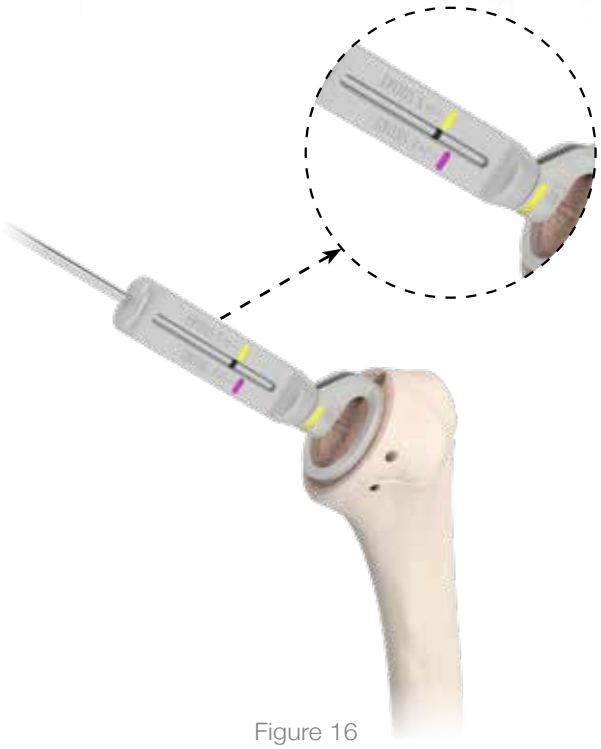


Figure 16

DETERMINATION OF THE STEMLESS CORE SIZE

The instruments feature color coding to support the surgical team using the system. The color code is yellow for the Small size, orange for the Medium size and purple for the Large size. In case of X-Small size no color is applied. Determine the size of the Stemless Core using the *sizers (L57)*. Connect the sizer (X-Small, Small, Medium or Large) to the *K-wire centering sleeve (M57)* (Figure 14) and place them over the resected surface (Figure 15).

To determine the size, the outer ring of the sizer should be centric to the resected humeral surface without involving the cortex.

Insert the *Ø 3 mm K-wire (N57)* using the centering device as a guide till fixing the controlateral cortex (Figure 16).

The K-wire centering sleeve has grooves with the same color code as per the Core sizes; the K-wire has a laser mark in order to allow the identification of the proper Core size in function of the humerus depth. If the laser mark is at the same level of the groove of the chosen size or above, use the Short Core. Otherwise implant the standard Core. Then remove the components leaving the K-wire in place.

Humerus Preparation

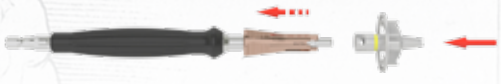


Figure 17

Figure 18

Figure 19

Figure 20

Figure 21

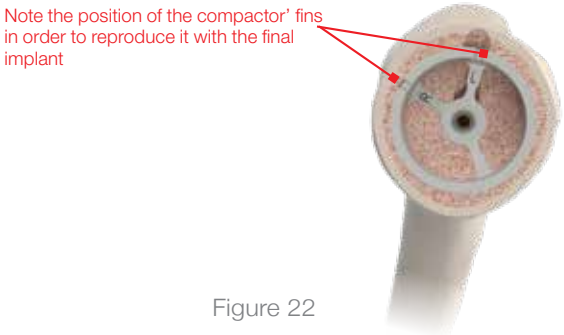


Figure 22

HUMERUS REAMING

Assemble the *reamer (P57)* of the selected size with the *reamer shaft (O57)* by pulling the red part of the handle (Figure 17) and ream the metaphysis using the K-wire as a guide. Ream carefully in order to prevent humerus breakages.

The reaming is completed once the collar of the reamer sits flush with the resected surface (Figure 18). Remove the reamer leaving the K-wire in place.

Prepare the seat for the Stemless Core's fins using the *compactor (S57)*. First insert the *introducer (R57*, X-Small, Small, Medium or Large) onto the *positioning handle (Q57)* (Figure 19), then attach the appropriate size *compactor (S57)* onto it by screwing (Figure 20). Aling the R and L marks of the introducer with the Rigth and Left fins of the compactor. The curved fins of the compactor have to be placed in correspondence to the greater tuberosity, in order to prevent humerus breackages or nerve damages.

The marking L (left) or R (right), corresponding to the shoulder side that is being operated, should be placed in superolateral position. Impact the compactor into the bone using the K-wire as a guide (Figure 21). Note the position of the compactor' fins in order to reproduce it with the final implant (Figure 22) by using the R and L reference of the introducer as guide.

Stop impacting when the introducer sits flush within the prepared area. Remove the compactor by tapping it out using the positioning handle.

Note. Be aware high impact force may cause breakage to the humerus. The compactor can be used as a trial core. In this situation, unscrew the compactor handle, remove the K-wire and perform the trial reduction as described on page 19.

Figure 23

Figure 24

HUMERAL COVER USE

To prevent humerus damages or breakages during the glenoid preparation, humeral covers are provided into the SMR® Stemless General Set.

The *humeral covers (K57)* are available in three sizes (Small, Medium and Large) in order to fit with the humerus dimensions; please note that they are not related to the Core sizes.

The humeral cover have been developed in order to allow the use in both the following cases:

- after resection of the humeral head: the cover is placed on the resected surface and the fixation is obtained by means of the spikes.
- with *compactor (S57)* or Stemless Core in situ: connect the *humeral cover adaptor (J57)* to the humeral cover and then place it into the compactor or the Stemless Core (Figure 23).

The connection/disconnection of the humeral cover adaptor to/from the humeral cover is obtained by means of the *extracting pliers for reverse trial liners (J58)*, (Figure 24).

Final Implant Insertion

Figure 25

Figure 26

FINAL IMPLANT INSERTION

Remove the Stemless Core of the chosen size from sterile packaging and impact it into the humerus cavity using the *positioning handle (Q57)* and the *introducer (R57)* (Figure 25).

Place the Stemless Core in the same position as the compactor taking the laser marks as a reference (Figure 26); use the R and L reference of the introducer as a guide for proper positioning.

If a total replacement (anatomical or reverse) has to be performed, proceed with the glenoid preparation as described in the SMR® Primary Implant surgical technique.

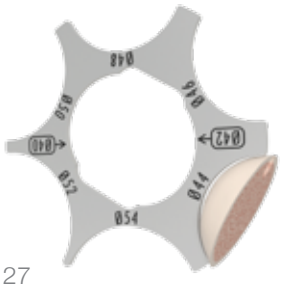


Figure 27

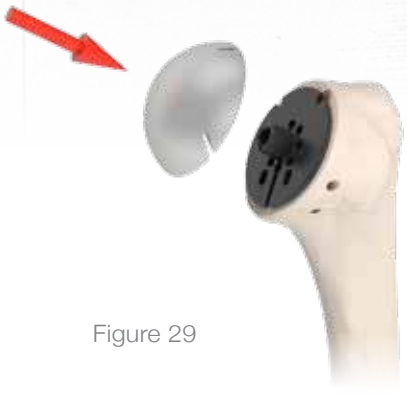


Figure 29

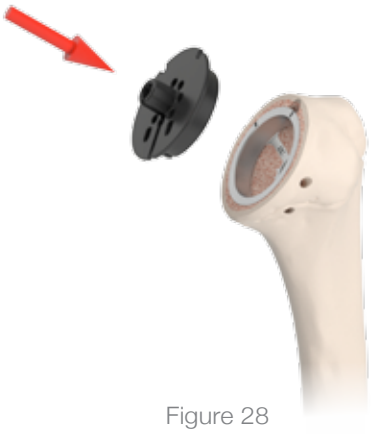


Figure 28

Figure 30

TRIAL REDUCTION

The head diameter is determined using the *head gauge (A57)* (Figure 27).

Insert the *connector for trial head adaptors (D58)* into the Stemless Core by aligning the grooves to the core laser marking (Figure 28). Apply the *trial neutral adaptor (C58)* to the *trial humeral head (B58)* by hand and fit the head to the stemless connector (Figure 29). Reduce the joint and check the match with the glenoid.
If it is not well aligned with the glenoid cavity, substitute the neutral trial adaptor with an eccentric one (2 mm and 4 mm are available).

To remove trial adaptors from the trial humeral head use the *extracting pliers for trial adaptors (O58)* (Figure 30).
If an eccentric adaptor is used, mark the position of the trial adaptor with an electric scalpel, using the direction point as a reference (Figure 31). This procedure helps to place the final head in the correct position.

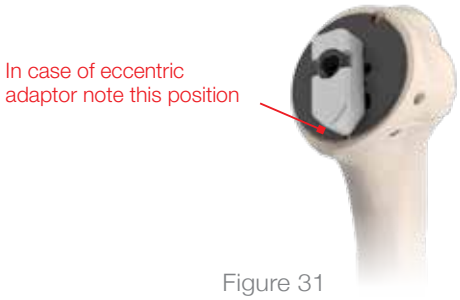


Figure 31

Figure 32

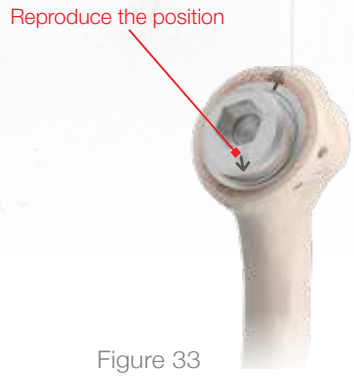


Figure 33

Figure 34

Figure 36

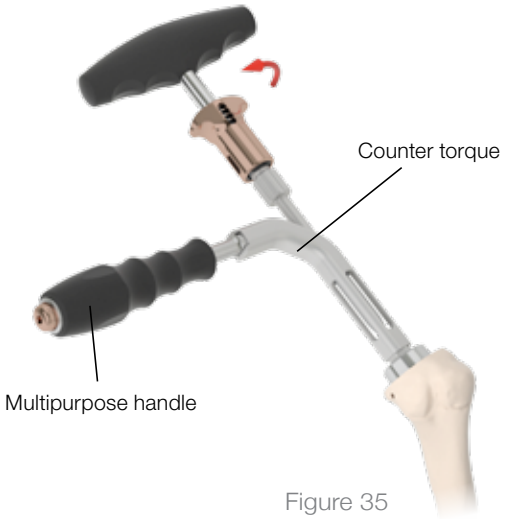


Figure 35

Figure 37

INSERTION OF THE DEFINITIVE COMPONENTS

Remove the appropriate final adaptor taper and final head from the sterile packaging. Apply the adaptor taper to the Stemless Core (Figure 32). If an eccentric adaptor taper is used, insert it by aligning the marking with the previous marked reference (Figure 33).

A safety screw is used to secure the coupling between the adaptor taper and the Stemless Core (Figure 34). Tighten the screw using the *3.5 mm allen wrench (G58)* with the *T-handle with Zimmer connection (U57)* and the *counter torque (F58)* attached to the *multipurpose handle (P58)* in order to prevent load transmission (Figure 35).

Apply the definitive humeral head to the adaptor taper (Figure 36) and secure the coupling by tapping with the *humeral head impactor (A58)* (Figure 37). The head should sit flush on the osteotomy plane.

Make sure that the contact surfaces are perfectly clean and that the head or adaptor does not contact the bone, as this could compromise the stability of the Morse taper coupling.

Finally reduce the shoulder joint.

Figure 38

CTA HEADS USE

The clinical indication for prosthetic treatment with CTA heads is secondary osteoarthritis by cuff tear arthropathy.

Note: In case of Stemless prosthesis the CTA head must be used only in case of good stability of the Stemless Core. If the CTA Head has to be used, make sure that an Eccentric Adaptor is used (the coupling with the Concentric Adaptor is not allowed) and that the eccentricity is in the cranial direction only.

To prepare the seat for the CTA Head, connect the trial humeral head dia. 40 mm (*B58*, in case of dia. 42 and 46 mm definitive CTA Head) or dia. 46 mm (*B58*, in case of dia. 50 and 54 mm definitive CTA Head) to the Stemless Core by means of the dedicated *connector for trial adaptor (D58)* and the *trial adaptor taper ecc. 2 mm or ecc. 4 mm (C58)*. Use the slots of trial head as reference to evaluate the area of the greater tuberosity where the bone has to be removed to host the CTA heads (Figure 38).

Use the *trial CTA heads (B9)* with the trial adaptor taper ecc. 2 mm or ecc. 4 mm *(C58)* to properly assess the prepared seat. Refine the seat if required until perfect seat of the trial CTA Head is achieved prior to implant the final CTA Head.

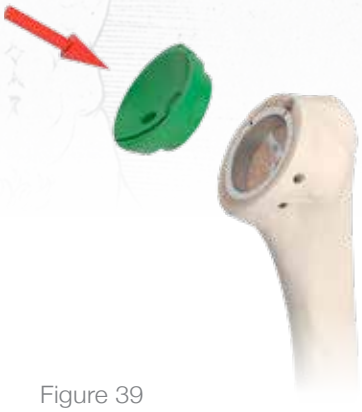


Figure 39

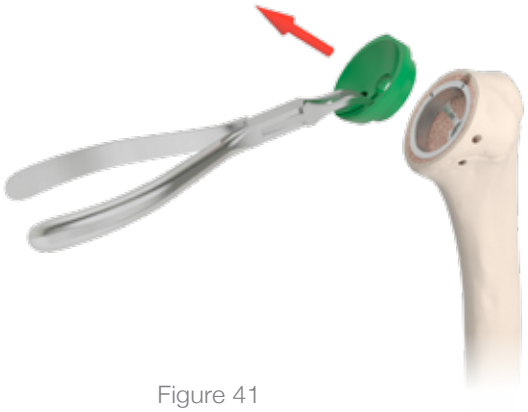


Figure 41

Figure 40

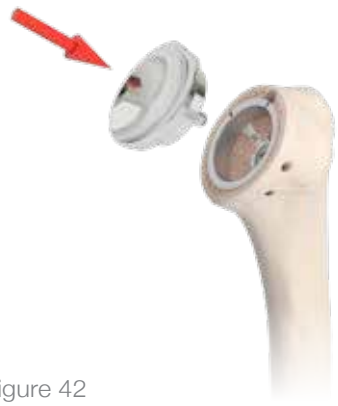


Figure 42

Important! In the reverse configuration, the SMR® Stemless is intended for use only with 40 mm or 44 mm glenospheres.

TRIAL REDUCTION

The trial components feature color coding to support the surgical team using the system. The color code for the 40 mm components is blue and for the 44 mm ones is green.

Choose the *trial reverse liner (K58)* according to the implanted 40 mm or 44 mm glenosphere and insert it into the Stemless Core (Figure 39). Align the groove of the liner with the Stemless Core marking L (Left) or R (Right) according to the shoulder side that is being operated (Figure 40).

Reduce the implant to verify the shoulder tensioning and address any laxity by replacing with the next liner size. To remove and replace the trial reverse liner use the *extracting pliers for reverse liners (J58)* (Figure 41).

INSERTION OF THE DEFINITIVE COMPONENT

Open the packaging of the reverse liner that was selected during the trial reduction. Clean the Stemless Core and impact the liner by means of the *cemented glenoid impactor (E3)* (Figure 42). To allow an easier positioning of the poly glenosphere, the *Dia.40-44 mm glenosphere orienters-Left and Right (N58)* have been introduced. They allow the orientation of the glenosphere and its introduction by means of the *glenosphere impactor-extractor (M58)*.
Finally reduce the shoulder joint.

Figure 44

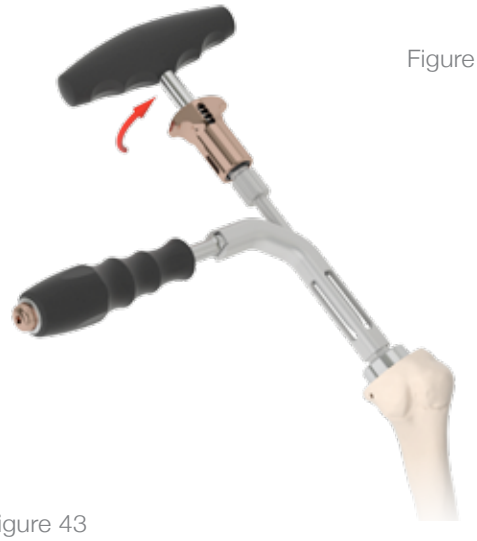


Figure 43

Figure 45

HUMERAL HEAD REMOVAL

To remove the humeral head, slide the *extractor (L58)* between the collar of the Stemless Core and the undersurface of the humeral head. Firmly tap the end of the instrument to loosen the head.

By means of the *3.5 mm allen wrench (G58)* plus *T-handle with Zimmer connection (U57)* remove the safety screw inside the adaptor whilst using the *counter torque (F58)* and the *multipurpose handle (*P58*)* to prevent load transmission (Figure 43).

Afterwards insert the *humeral head adaptors extractor (E58)* attached to the *T-handle (U57)* into the *counter torque (F58)* (Figure 44). Tighten the extractor until the disassembly operation has been completed.

REVERSE LINER REMOVAL

To remove the reverse liner from the Stemless Core, slide the *extractor (L58)* between the collar of the Stemless Core and the undersurface of the liner. Firmly tap the end of the instrument to loosen the liner (Figure 45).

Components Removal

Figure 46

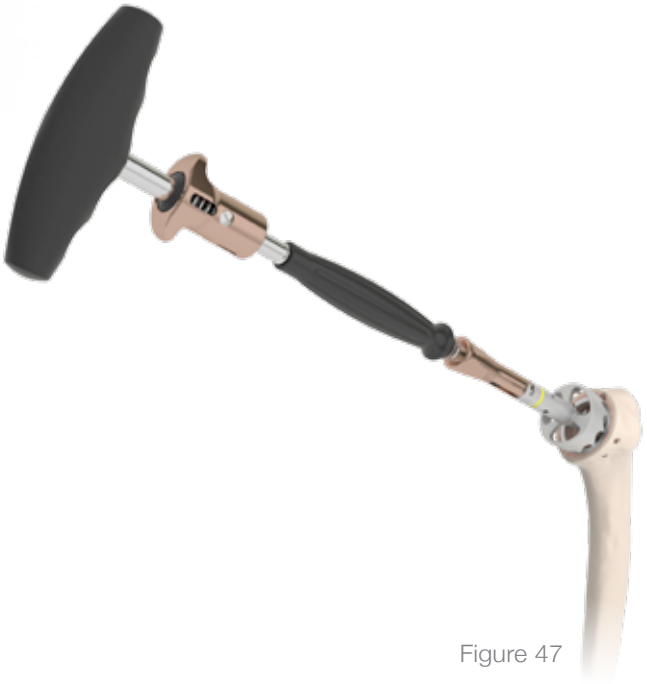


Figure 47

STEMLESS CORE REMOVAL

If necessary to remove the Stemless Core, screw the *stopper for removal reamer (H58)* into the Stemless Core (Figure 46). Select the *Stemless Core removal reamer (I58,* X-Small, Small, Medium or Large) according to the implant size and attach it to the *T-handle with Zimmer connection (U57)*.

Introduce the reamer onto the stopper and proceed to remove the Stemless Core (Figure 47).

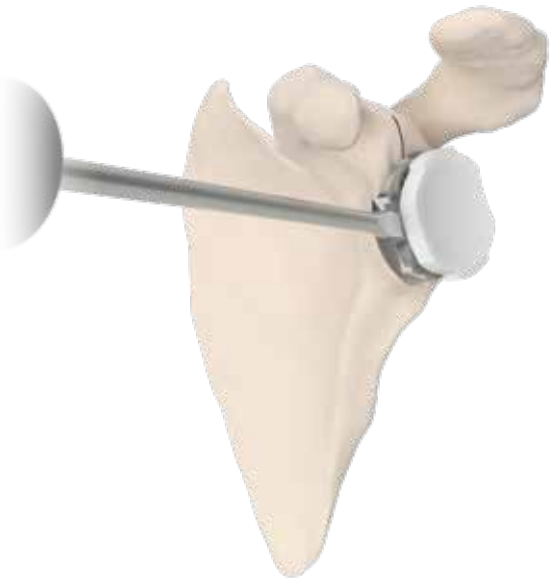


Figure 48

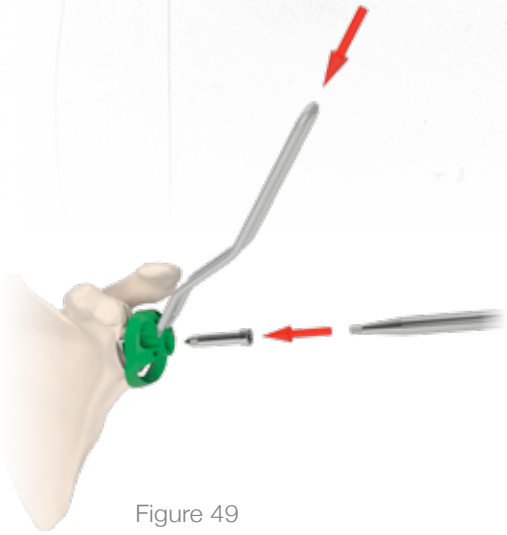


Figure 49

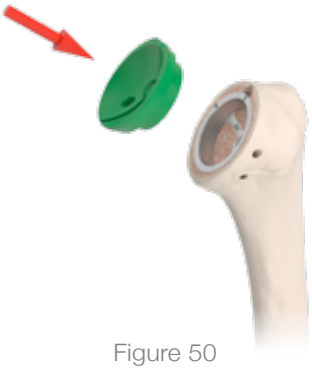


Figure 50

CONVERSION FROM ANATOMICAL TO REVERSE

Note: the conversion of the implant must be performed only in case of good stability of the implanted Stemless Core.

REMOVAL OF THE HUMERAL HEAD AND ADAPTOR

Remove the humeral head and the adaptor as described on page 23 of the present surgical technique.
If no metal back glenoid has been implanted previously, proceed with the glenoid preparation as described in the SMR® Primary Implant surgical technique.

PREVIOUS METAL BACK GLENOID

Remove the polyethylene liner by inserting a small osteotome between the liner and the MB glenoid (Figure 48).

INSERTION OF TRIAL COMPONENTS

Apply the *trial 40 or 44 mm glenosphere (E42 or F42)* and position it near the glenoid Metal Back (Fig. 49) using the *trial glenosphere positioner (H42)*. Slide the *trial glenosphere screw (C42 or D42)* through the central hole and tighten until reaching the end stop.
If necessary, the system allows a corrective version of the 44 mm diameter size with a 4 mm eccentric component. Maintain the eccentricity of the component in one of the bottom quadrants of the glenoid and tighten the module in the same way as for the concentrical 44 mm glenosphere.

Expose the humerus, choose the *trial reverse liner (K58)* according to the implanted 40 mm or 44 mm glenosphere and insert it into the Stemless Core as described on page 22 of the present document (Figure 50).
Reduce the implant to verify the shoulder tensioning and address any laxity by replacing with the next liner size.

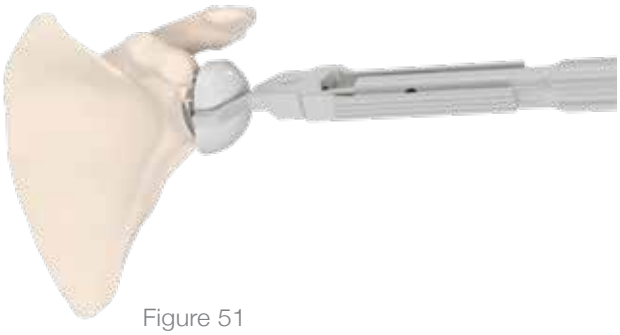


Figure 51

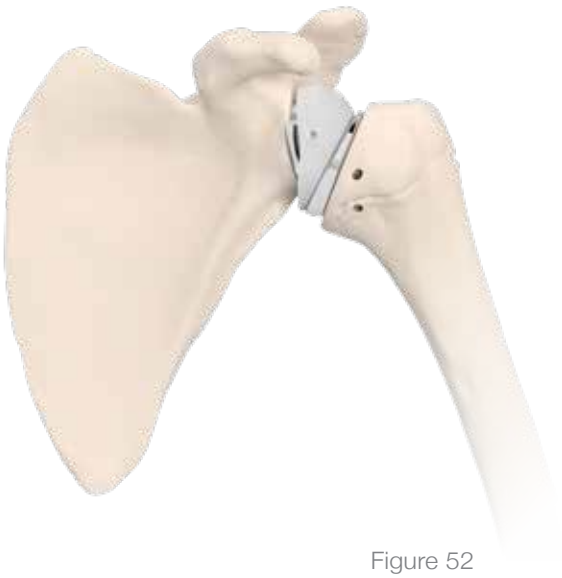


Figure 52

INSERTION OF THE DEFINITIVE COMPONENTS

Open the package containing the peg and screw relating to the size of the implanted Metal Back, then the selected glenosphere package. Assemble the peg on the glenosphere by tapping. Screw the *glenosphere impactor-extractor (M58)* in the central hole of the glenosphere and afterwards the *Dia.40-44 mm glenosphere orienter Left or Right (N58),* afterwards implant the system in the Metal Back (Fig. 51) by tapping. Unscrew the impactor and fasten by tightening the safety screw. Press-fit the central cap in the central hole of the implanted component using the *positioner for glenosphere plug (G42)*.

Open the packaging of the reverse liner that was selected during the trial reduction. Clean the Stemless Core and impact the liner by means of the *cemented glenoid impactor (E3).*

Finally reduce the shoulder joint (Figure 52).

SMR® STEMLESS SURGICAL TECHNIQUE

Product Combination

SMR® Stemless Core (Ti6Al4V)
8 sizes

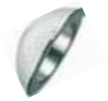
ANATOMIC

SMR® Stemless Adaptor Tapers with Screw (Ti6Al4V)

Concentric

Eccentric
2 sizes

SMR® Humeral Heads



SMR® Humeral Heads
(CoCrMo) 8 sizes

SMR® Humeral Heads
(Ti6Al4V) 7 sizes

SMR® Flattened Humeral Heads
(CoCrMo) 3 sizes

SMR® CTA Humeral Heads
(CoCrMo) 4 sizes

For Anatomic Use

SMR® Cemented Glenoids
(UHMWPE) 3 sizes

SMR® Cemented Glenoids 3-Pegs
(UHMWPE X-LIMA) 2 sizes

REVERSE

SMR® Stemless Reverse Liners (CoCrMo)

Dia. 40 mm
3 sizes

Dia. 44 mm
3 sizes

SMR® Reverse HP glenospheres (UHMWPE X-LIMA + Ti6Al4V)

Dia. 40 mm
Standard

Dia. 44 mm
Standard

Dia. 44 mm
Corrective

SMR® Connectors with Screw
(Ti6Al4V) 2 sizes

SMR® Glenoid Plate
(CP Ti) 2 sizes

For Reverse Use

SMR® Cementless Glenoids L1
(Ti6Al4V+PoroTi+HA) 4 sizes

SMR® TT Metal Back
(Ti6Al4V) 3 sizes

SMR® AXIOMA TT Metal
Back (Ti6Al4V) 3 sizes

SMR® TT Metal Back Peg
(Ti6Al4V) 8 sizes

SMR® Liners for Metal Back Glenoid L1
(UHMWPE) 4 sizes

SMR® Liners for AXIOMA TT Metal Back Glenoid
(UHMWPE) 3 sizes

SMR® Bone Screw (Ti6Al4V) 5 sizes
to be used with Anatomic and Reverse

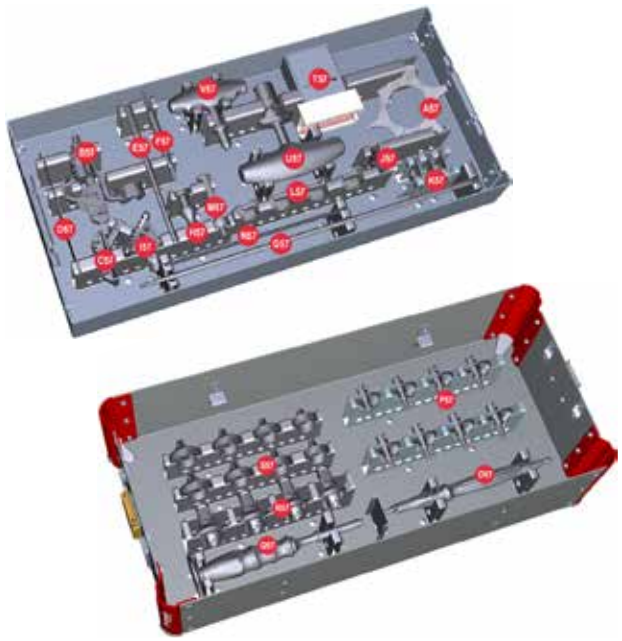
* Optional

** Available only in Europe

***Available only in Australia and New Zealand

For the detailed description of the product combinations refer to the dedicated surgical technique.

9013.57.000 SMR® Stemless General Set



Ref.	CODE	DESCRIPTION	Qty.
A57	9013.22.800	Head Gauge	1
B57	9013.50.303	Guide for Resection Jig	1
C57	9013.50.304	Anatomic Resection Jig	1
D57	9013.50.305	Sickle	1
E57	9013.50.316	Alignment Rod	1
F57	9013.55.001	Awl	1
G57	9013.55.006	Pin Ø 6 mm	1
H57	9013.55.010	Cutting Jig Connector	1
I57	9013.55.015	Cutting Template	1
J57	9013.55.016	Humeral Cover Adaptor	1
K57	9013.55.017	Humeral Cover Small	1
K57	9013.55.018	Humeral Cover Medium	1
K57	9013.55.019	Humeral Cover Large	1
L57	9013.55.021	#X-SMALL Sizer	1
L57	9013.55.023	#SMALL Sizer	1
L57	9013.55.025	#MEDIUM Sizer	1
L57	9013.55.028	#LARGE Sizer	1
M57	9013.55.031	K-Wire Centering Sleeve	1
N57	9013.55.032	Ø 3 mm K-Wire	2
O57	9013.55.039	Reamer Shaft	1
P57	9013.55.041	#X-SMALL Short Reamer	1
P57	9013.55.043	#SMALL Short Reamer	1
P57	9013.55.045	#MEDIUM Short Reamer	1
P57	9013.55.048	#LARGE Short Reamer	1
P57	9013.55.051	#X-SMALL Reamer	1
P57	9013.55.053	#SMALL Reamer	1
P57	9013.55.055	#MEDIUM Reamer	1
P57	9013.55.058	#LARGE Reamer	1
Q57	9013.55.070	Positioning Handle	1
R57	9013.55.071	#X-SMALL Introducer	1
R57	9013.55.073	#SMALL Introducer	1
R57	9013.55.075	#MEDIUM Introducer	1
R57	9013.55.078	#LARGE Introducer	1
S57	9013.55.081	#X-SMALL Short Compactor	1
S57	9013.55.083	#SMALL Short Compactor	1
S57	9013.55.085	#MEDIUM Short Compactor	1
S57	9013.55.088	#LARGE Short Compactor	1
S57	9013.55.091	#X-SMALL Compactor	1
S57	9013.55.093	#SMALL Compactor	1
S57	9013.55.095	#MEDIUM Compactor	1
S57	9013.55.098	#LARGE Compactor	1
T57	9066.15.095	Pin Ø 3 x 80 mm	6
U57	9095.11.200	T-Handle with Zimmer Connection	1
V57	9095.11.202	T-Handle with AO Connection	1
	9013.57.9PY	Instrument Tray	1

SMR® STEMLESS SURGICAL TECHNIQUE

Instrument set

9013.58.000 SMR® Stemless Trials and Revision Set

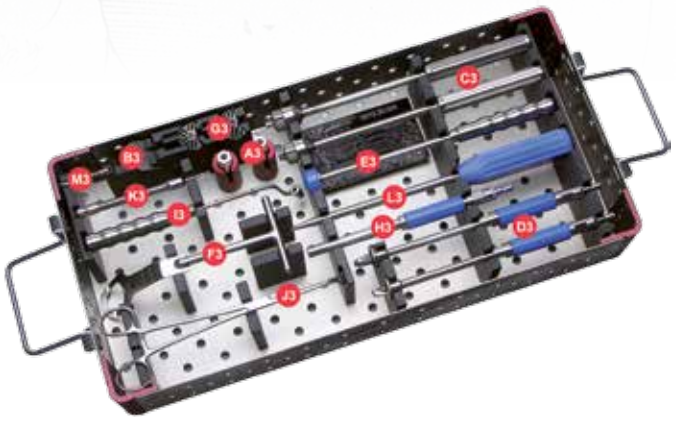
Ref.	CODE	DESCRIPTION	Qty.
A58	9013.22.100	Humeral Head Impactor	1
B58	9013.22.405	Trial Humeral Head Dia. 40 mm	1
B58	9013.22.425	Trial Humeral Head Dia. 42 mm	1
B58	9013.22.445	Trial Humeral Head Dia. 44 mm	1
B58	9013.22.465	Trial Humeral Head Dia. 46 mm	1
B58	9013.22.485	Trial Humeral Head Dia. 48 mm	1
B58	9013.22.505	Trial Humeral Head Dia. 50 mm	1
B58	9013.22.525	Trial Humeral Head Dia. 52 mm	1
B58	9013.22.545	Trial Humeral Head Dia. 54 mm	1
C58	9013.30.011	Trial Adaptor Taper Neutral	1
C58	9013.30.016	Trial Adaptor Taper Ecc. 2 mm	1
C58	9013.30.021	Trial Adaptor Taper Ecc. 4 mm	1
D58	9013.35.101	Connector for Trial Adaptors	1
E58	9013.35.165	Humeral Head Adaptors Extractor	1
F58	9013.35.200	Counter Torque for Humeral Head Adaptors	1
G58	9013.50.211	Allen Wrench 3.5 mm	1
H58	9013.55.400	Stopper for Removal Reamer	1
I58	9013.55.431	#X-SMALL Stemless Core Removal Reamer	1
I58	9013.55.433	#SMALL Stemless Core Removal Reamer	1
I58	9013.55.435	#MEDIUM Stemless Core Removal Reamer	1
I58	9013.55.438	#LARGE Stemless Core Removal Reamer	1
J58	9013.60.101	Extracting Pliers for Reverse Trial Liners	1
K58	9013.65.405	Dia. 40 mm Reverse Trial Liner #SHORT	1
K58	9013.65.406	Dia. 40 mm Reverse Trial Liner #MEDIUM	1
K58	9013.65.407	Dia. 40 mm Reverse Trial Liner #LONG	1
K58	9013.65.445	Dia. 44 mm Reverse Trial Liner #SHORT	1
K58	9013.65.446	Dia. 44 mm Reverse Trial Liner #MEDIUM	1
K58	9013.65.447	Dia. 44 mm Reverse Trial Liner #LONG	1
L58	9013.65.501	Extractor	1
M58	9013.74.141	Glenosphere Impactor-Extractor	1
N58	9013.74.651	Dia. 40-44 mm Glenosphere Orienter - LEFT	1
N58	9013.74.652	Dia. 40-44 mm Glenosphere Orienter - RIGHT	1
O58	9066.35.610	Extracting Pliers for Trial Adaptors	1
P58	9095.11.251	Multipurpose Handle	1
	9013.58.9PY	Instrument Tray	1

9013.42.000 SMR® Reverse HP

Ref.	CODE	DESCRIPTION	Qt.
A42	9013.62.010	Trial Liner SHORT Dia. 44 mm	1
A42	9013.62.015	Trial Liner MEDIUM Dia. 44 mm	1
A42	9013.62.020	Trial Liner LONG Dia. 44 mm	1
A42	9013.62.115	Trial Liner Lateralizing MEDIUM Dia. 44 mm	1
A42	9013.62.120	Trial Liner Lateralizing LONG Dia. 44 mm	1
B42	9013.65.010	Trial Liner SHORT Dia. 40 mm	1
B42	9013.65.015	Trial Liner MEDIUM Dia. 40 mm	1
B42	9013.65.020	Trial Liner LONG Dia. 40 mm	1
B42	9013.65.115	Trial Liner Lateralizing MEDIUM Dia. 40 mm	1
B42	9013.65.120	Trial Liner Lateralizing LONG Dia. 40 mm	1
C42	9013.74.105	Guide-Screw SMALL-R Trial Glenosphere	2
D42	9013.74.120	Guide-Screw Trial Glenosphere	2
E42	9013.74.401	Trial Glenosphere Dia. 40 mm	1
F42	9013.74.440	Trial Glenosphere Dia. 44 mm	1
F42	9013.74.444	Trial Glenosphere Dia. 44 mm Corrective	1
G42	9013.74.605	Positioner for Glenosphere Plug	1
H42	9013.74.650	Trial Glenosphere Positioner	1
	9013.42.950	Sterilizable Box	1

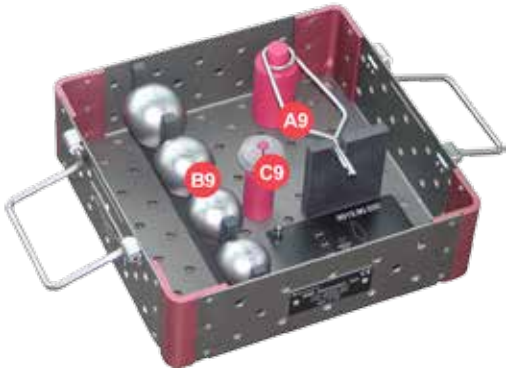
SMR® STEMLESS SURGICAL TECHNIQUE
Instrument set

9013.30.000 'Glenoid' Instrument Set for SMR® Shoulder Prosthesis



Ref.	CODE	DESCRIPTION	Qty.
A3	9013.02.305	Extractor for SMALL-R M-B Glenoid	1
A3	9013.02.310	Extractor for M-B Glenoid	1
B3	9013.50.150	Humeral Cover	1
C3	9013.75.100	SMALL-R M-B Glenoid Impactor	1
C3	9013.75.110	SMALL/STD/LARGE M-B Glenoid Impactor	1
D3	9013.75.115	SMALL-R Glenoid Drill	1
D3	9013.75.120	Glenoid Drill	1
E3	9075.10.140	Cemented Glenoid Impactor	1
F3	9075.10.280	Fukuda Retractor	1
G3	9075.10.300	Glenoid Reamer - SMALL	1
G3	9075.10.310	Glenoid Reamer - STD	1
H3	9075.10.350	Glenoid Reamers Shaft	1
I3	9075.10.400	Drill Guide	1
J3	9095.10.115	Pliers for Screws	1
K3	9095.10.180	Flexible Mandrel	1
L3	9095.10.222	Screwdriver	1
M3	9095.10.249	Helix Drill - Dia. 3.5 x 50 mm	1
	9013.30.950	Sterilizable Box	1

9013.90.000 'CTA' Instrument Set for SMR® Shoulder Prosthesis



Ref.	CODE	DESCRIPTION	Qty.
A9	9013.30.100	Pliers for Trial Adaptor	1
B9	9013.23.420	Trial CTA Head Dia. 42 mm	1
B9	9013.23.460	Trial CTA Head Dia. 46 mm	1
B9	9013.23.500	Trial CTA Head Dia. 50 mm	1
B9	9013.23.540	Trial CTA Head Dia. 54 mm	1
C9	9013.23.600	Trial Adaptor Dia. 36 mm	1
	9013.90.950	Instrument Tray	1

Product Codes

STEMLESS CORE

Ti6Al4V	1355.14.131	X-Small Short
	1355.14.231	X-Small
	1355.14.133	Small Short
	1355.14.233	Small
	1355.14.135	Medium Short
	1355.14.235	Medium
	1355.14.138	Large Short
	1355.14.238	Large

STEMLESS ADAPTOR WITH SCREW

Ti6Al4V	1335.15.200	Concentric Adaptor With Screw
	1335.15.202	2 mm Eccentric Adaptor With Screw
	1335.15.204	4 mm Eccentric Adaptor With Screw

HUMERAL HEADS

CoCrMo	1322.09.400	Dia. 40 mm	■
	1322.09.420	Dia. 42 mm	
	1322.09.440	Dia. 44 mm	
	1322.09.460	Dia. 46 mm	
	1322.09.480	Dia. 48 mm	
	1322.09.500	Dia. 50 mm	
	1322.09.520	Dia. 52 mm	
	1322.09.540	Dia. 54 mm	

■ Upon Request

SMR® STEMLESS SURGICAL TECHNIQUE

Product Codes

HUMERAL HEADS

Ti6Al4V	1322.15.420	Dia. 42 mm	■
	1322.15.440	Dia. 44 mm	■
	1322.15.460	Dia. 46 mm	■
	1322.15.480	Dia. 48 mm	■
	1322.15.500	Dia. 50 mm	■
	1322.15.520	Dia. 52 mm	■
	1322.15.540	Dia. 54 mm	■

CTA HUMERAL HEADS

CoCrMo	1323.09.420	Dia. 42 mm
	1323.09.460	Dia. 46 mm
	1323.09.500	Dia. 50 mm
	1323.09.540	Dia. 54 mm

STEMLESS REVERSE LINERS

CoCrMo		40 MM
	1365.09.405	Short
	1365.09.406	Medium
	1365.09.407	Long
		44 MM
	1365.09.445	Short
	1365.09.446	Medium
	1365.09.447	Long

REVERSE HP GLENOSPHERE

UHMWPE X-LIMA + Ti6Al4V		40 MM
	1374.50.400	Glenosphere
		44 MM
	1374.50.440	Glenosphere
	1374.50.444	Corrective Glenosphere

CONNECTORS WITH SCREW

Ti6Al4V	1374.15.305	Small-R
	1374.15.310	Small STD

CEMENTED GLENOID

UHMWPE	1378.50.005	Small-R
	1378.50.010	Standard
	1378.50.020	Small

CEMENTED GLENOID 3 PEGS

UHMWPE	1379.51.010	Standard
X-LIMA	1379.51.020	Small

METAL BACK GLENOIDS L1

Ti6Al4V + PoroTi + HA	1375.20.005	Small - R
	1375.20.020	Small
	1375.20.010	Standard
	1375.20.030	Large ■

LINERS FOR METAL BACK GLENOID L1

UHMWPE	1377.50.005	Small - R
	1377.50.020	Small
	1377.50.010	Standard
	1377.50.030	Large ■

BONE SCREWS

Ti6Al4V		DIA. 6.5 MM
	8420.15.010	L. 20 mm
	8420.15.020	L. 25 mm
	8420.15.030	L. 30 mm
	8420.15.040	L. 35 mm
	8420.15.050	L. 40 mm

SMR® STEMLESS SURGICAL TECHNIQUE

Product Codes

GLENOID PLATES *

Ti CP	1374.15.505	Small-R - Double
	1374.15.510	Small STD - Double

* Glenoid Plates are suitable only for REVERSE HP

CORTICAL BONE SCREWS

Ti6Al4V		DIA. 4.5 MM
	8430.15.010	L. 32 mm
	8430.15.020	L. 36 mm
	8430.15.030	L. 40 mm
	8430.15.040	L. 44 mm
	8430.15.050	L. 48 mm
	8430.15.060	L. 52 mm

Lima Corporate
Orthopaedic motion

Limacorporate spa
Via Nazionale, 52
33038 Villanova di San Daniele
Udine - Italy
Tel.: +39 0432 945511
Fax: +39 0432 945512
E-mail: info@limacorporate.com
www.limacorporate.com

Lima Implantes slu
Fontsanta, 46 5ª planta
08970 Sant Joan Despí
Barcelona - Spain
Tel.: +34 93 480 8505
Fax: +34 93 419 6527

Lima France sas
Les Espaces de la Sainte Baume
Parc d' Activité de Gémenos - Bât.A5
30 Avenue du Château de Jouques
13420 Gémenos - France
Tel.: +33 (0) 4 42 01 63 12
Fax: +33 (0) 4 42 04 17 25
E-mail: info@limafrance.com

Lima O.I. doo
Ante Kovacic 3
10000 Zagreb - Croatia
Tel.: +385 (0) 1 2361 740
Fax: +385 (0) 1 2361 745
E-mail: lima-oi@lima-oi.hr

Lima Switzerland sa
Birkenstrasse, 49
CH-6343 Rotkreuz - Zug
Switzerland
Tel.: +41 (0) 41 747 06 60
Fax: +41 (0) 41 747 06 69
E-mail: info@lima-switzerland.ch

Lima Japan kk
Shinjuku Center Building, 29th floor
1-25-1, Nishi-shinjuku, Shinjuku,
Tokyo - Japan
163-0629
Tel.: +81 3 5322 1115
Fax: +81 3 5322 1175

Lima CZ sro
Do Zahrádek I., 157/5
155 21 Praha 5 – Zličín
Czech Republic
Tel.: +420 222 720 011
Fax: +420 222 723 568
E-mail: info@limacz.cz

Lima Deutschland GmbH
Kapstadtring 10
22297 Hamburg - Germany
Tel.: +49 40 6378 4640
Fax: +49 40 6378 4649
E-mail: info@lima-deutschland.com

Lima Austria GmbH
Seestadtstrasse 27 / Top 6-7
1220 Wien - Austria
Tel.: +43 (1) 2712 469
Fax: +43 (1) 2712 469 100
E-mail: office@lima-austria.at

Lima SK s.r.o.
Zvolenská cesta 14
97405 Banská Bystrica - Slovakia
Tel.: +421 484 161 133
Fax: +421 484 161 138
E-mail: info@lima-sk.sk

Lima Netherlands
Havenstraat 30
3115 HD Schiedam
The Netherlands
Tel.: +31 (0) 10 246 26 60
Fax: +31 (0) 10 246 26 61
E-mail: info@limanederland.nl
www.limanederland.nl

Lima Implantes Portugal S.U. Lda
Rua Olavo D'Eça Leal Nº6 Loja-1
1600-306 Lisboa - Portugal
Tel.: +35 121 727 233 7

Lima Orthopaedics Australia Pty Ltd
Unit 1, 40 Ricketts Rd
Mt Waverley 3149
Victoria Australia
Tel.: +61 (03) 9550 0200
Fax: +61 (03) 9543 4003
www.limaortho.com.au

Lima Orthopaedics New Zealand Ltd
Zone 23, Unit 102, Edwin Street, Mt Eden
Auckland, 1024
New Zealand
Tel.: +64 (09) 531 5522
Fax: +64 (09) 522 3380

Lima Orthopaedics UK Limited
Unit 2, Campus 5
Third Avenue
Letchworth Garden City
Herts. SG6 2JF
United Kingdom
Tel.: 0844 332 0661
Fax: 0844 332 0662

Lima USA Inc.
2001 NE Green Oaks Blvd., Suite 100
Arlington, TX 76006
Tel.: +1 817-385-0777
Fax: +1 817-385-0377

Lima Sweden AB
Företagsallén 14 B
SE-184 40 Åkersberga
Sweden
Tel.: +46 8 544 103 87
Fax: +46 8 540 862 68
www.linksweden.se

Lima Italy
Centro Direzionale Milanofiori
Strada 1 - Palazzo F1
20090 Assago - Milano
Italy
Tel.: +39 02 57791301

Lima Korea Co. Ltd
Trade Tower 27th Fl.
511 Yeongdongdae-ro Gangnam-Gu,
Seoul, 135-729, Korea
Tel.: +82-2-6007-2230
Fax: +82-2-6007-2703

Lima do Brasil Ltda.
Av. Sagitário 138, Sala 2707
Edificio Torre City, Condominio Alpha Square
06473-073 Barueri SP
Brasil

Lima SM spa
Strada Borrana 38
47899 Serravalle, Republic of San Marino
Tel.: +378 0549 961911
Fax: +378 0549 961912
E-mail: info@lima-sm.com

The people appearing in the photographs on this publication are models and used for illustrative purposes only.

This publication is not intended for distribution in the U.S.

limacorporate.com

B.1355.23.010.1 061500