Surgical Technique

smith&nephew

# SL-PLUS◇

Non-Cemented Femoral Hip System


For use in US only.

# SL-PLUS◇ Standard and Lateral Stem

## Table of Contents



**Nota Bene**

The technique description herein is made available to the healthcare professional to illustrate the authors' suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient.

# Notes from the Author's Clinic

Our non-cemented stem system, which comprises a double-cone straight stem with a rectangular cross section, was implanted for the first time in 1979. Continuous follow-up resulted in ongoing improvement, culminating in the development of the SL stem in 1993. This system was suitable for the vast majority of surgical indications and provided results that were much better than those obtained with the first implants.

The SL-PLUS◇ Lateral shaft was added to the SL range in 2002 in order to offer additional anatomical variants which are more difficult to treat with the standard shafts in terms of optimal reconstruction of the offset.

The latest SL-PLUS straight stem that is now available integrates the proven design features of the stem large-area anchorage in the bone. However, changes have been made in the proximal section to improve intraoperative manipulation of the implant and to increase primary stability even further by improving proximal force transmission.

The extremely positive clinical results we obtained over many years, have further increased confidence in this stem design.

Professor Dr. med. K. Zweymüller
Vienna Orthopaedic Hospital – Gersthof

# Indications Standard Stem

The SL-PLUS◇ Stem with and without Ti/HA (INTEGRATION) is intended for advanced hip joint wear due to degenerative, post-traumatic or rheumatoid arthritis; fracture or avascular necrosis of the femoral head.

# Indications Lateral Stem

The SL-PLUS Lateralized Stem with and without Ti/HA (INTEGRATION) is intended for varus femur forms and trumpet shape of the proximal femur (champagne flute).

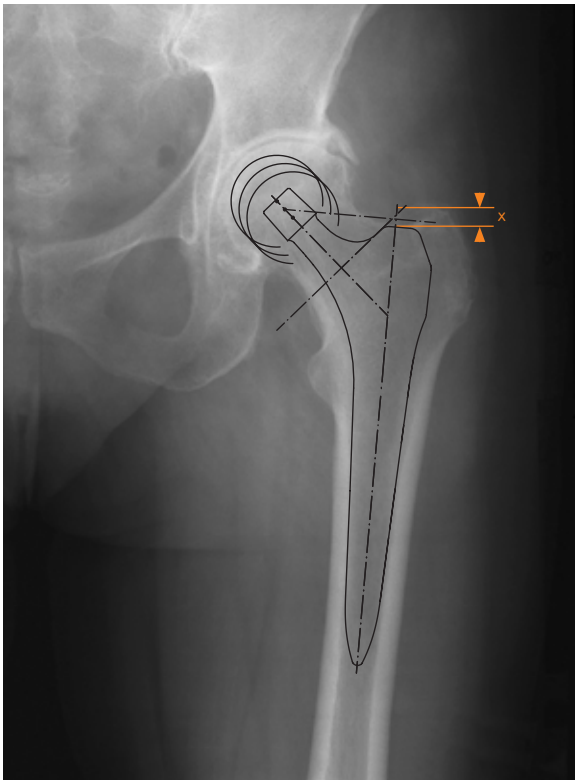
These stems are for uncemented use only. These devices are intended to aid the surgeon in relieving the patient of hip pain and restoring hip motion.

# Contraindications

- Acute or chronic infections, local or systemic
- Severe muscle, nerve, or vascular diseases that endanger the respective limb
- Lack of bone substance or defective bone quality that endangers the stable seating of the prosthesis
- Any concomitant disease that may endanger the implant function
- Revision with extensive bone defects

# Preoperative Planning

Planning the correct prosthesis size is carried out preoperatively using the X-ray template. This requires an A/P X-ray and an axial X-ray. Preoperative planning should always be carried out for orientation purposes.
X-ray templates of the SL-PLUS◇ Standard and Lateral stem are available in a magnification of 15%.




To determine the appropriate entrypoint for access of instruments to the medullary canal, it is recommended that the surgeon draw the femoral shaft axis on the AP radiograph and extend it proximally. This line indicates how far laterally it is necessary to place the box chisel to open up the canal. This entry point is easy to locate during surgery.

After the preoperative planning, the distance from the SL-PLUS stem to the greater and lesser trochanter can be measured for the purpose of intraoperative monitoring.

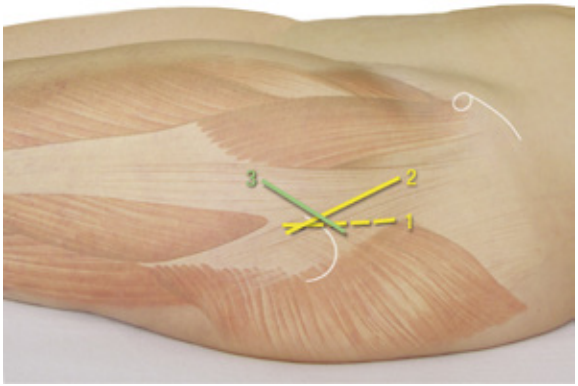
For the implantation of an SL-PLUS stem, both the SL/SLR-PLUS◇ Basic Set as well as the corresponding SL-PLUS trial broach instrumentation are required.

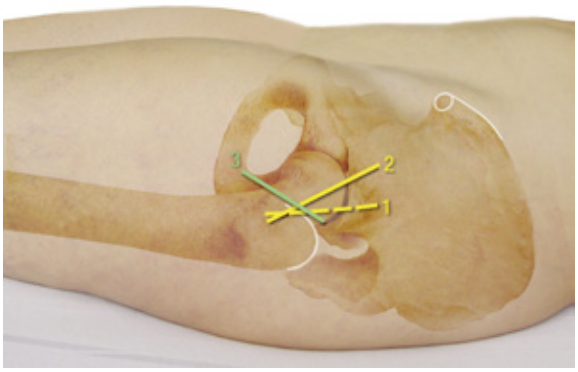
**Note**

Approach: anterolateral with patient lying in the supine position.

Users of other (minimally invasive) approaches are requested to also consult the following operative instructions: posterolateral approach (Lit. No. 1426); anterior approach (Lit. No. 1494).

## Skin incision



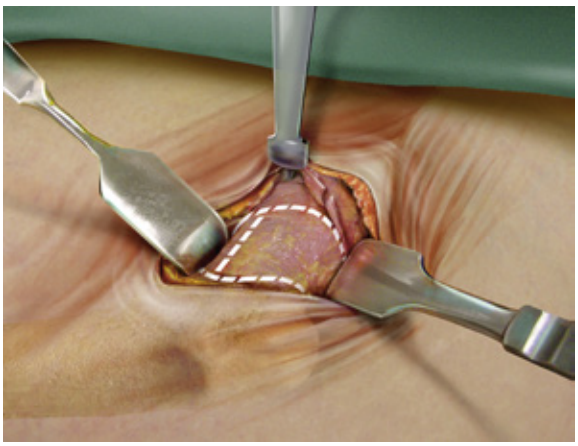




- Previous clinical experience has shown that the SL-PLUS◇ stem may be successfully implanted via several skin incisions, including:
- A longitudinal incision along the anterior edge of the greater trochanter, extending from O proximally to N distally to the tip of the trochanter (Line 1).
- An oblique incision extending from the anterior edge of the greater trochanter towards the anterior superior iliac spine (Line 2).
- A reverse oblique incision approximating the intertrochanteric line (Line 3).

The fascial incision extends from the upper edge of the tip of the trochanter towards the anterior superior iliac spine.

Dorsal incision of the iliotibial band is optionally possible.

## Capsular incision and dissection

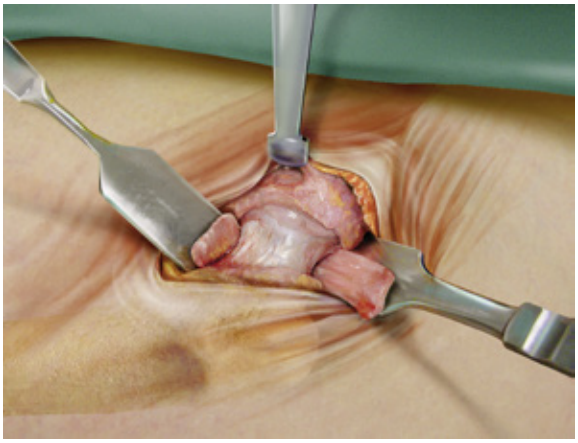


After blunt lateral entry between the tensor fasciae latae and gluteus medius/minimus, the raspatory is used to dissect along the femoral neck.

Sharp lateral retractors and a blunt medial Hohmann retractor are used during the surgical exposure. The arc of the rectus tendon is visualized, underpinned, incised, and released from its capsule.

The femoral neck is exposed via an H-shaped incision of the joint capsule, consisting of:

- A longitudinal incision, placed as far medially as possible, and extending from the acetabular margin to the intertrochanteric line and
- a proximal transverse incision of the acetabular labrum, extending around the acetabular margin from approximately the nine o'clock to the three o'clock position and
- a distal transverse incision distal extending along the intertrochanteric line.

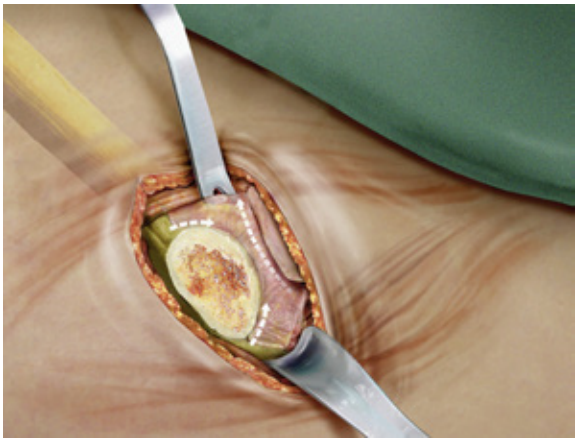


After the wing-like opening of the joint capsule, additional dissection of the capsule can be performed by extending the distal incision in the direction of the lesser trochanter and the proximal incision medially and/or laterally.

Two blunt Hohmann retractors are positioned intra-articularly. Problematic osteophytes on the acetabular rim are removed.

The technique used for the neck resection depends on the patient (coxa vara/valga) and is selected by the surgeon (single-incision or double-incision technique).

**Capsule release**



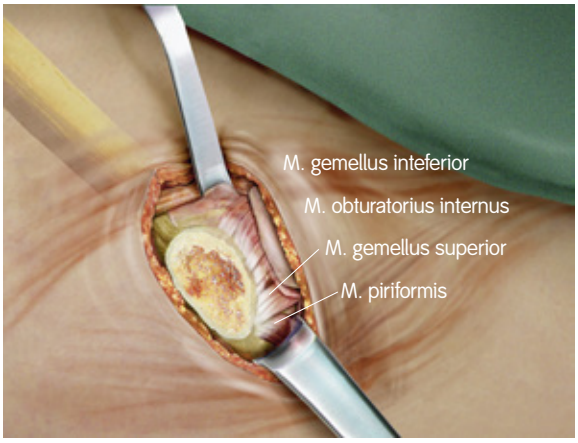
In order to facilitate alignment of the cup, an additional release of the posterior capsule is performed with the leg in the «Figure 4» position.

The knee of the operative leg is flexed, allowing it to be placed under the extended contralateral leg. In this position, the operative hip is placed in approx. 30°– 40° of adduction and 90° external rotation.

The proximal femur is mobilized with two hooks: one placed lateral to the trochanter and the other placed on the medial side of the neck of the femur.

Capsule releases have to be carried out in the direction of the lesser trochanter and the trochanteric fossa to the trochanteric tip. Additional capsular release can also be carried out on the caudal rim of the acetabulum.

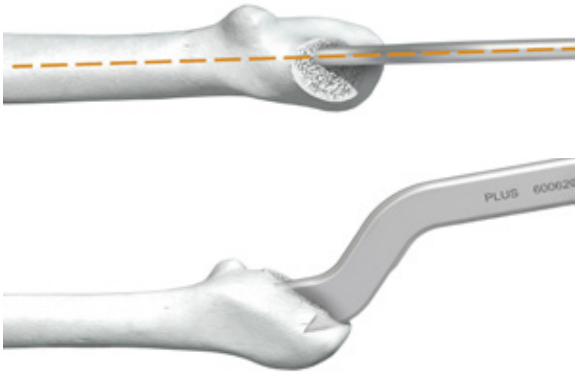
## Shaft preparation




The leg is hyperextended and adducted approx. 30°– 40°, and placed in 90° of external rotation, with the operative leg positioned under the opposite leg, in the «Figure 4» position.

In very muscular or obese patients, patients with a valgus femoral neck, or in cases where the proximal femur sits deep to the skin surface, further release of the posterior capsule or release of the piriformis tendon may be necessary to allow adequate mobilization of the femur prior to preparation of the implantation site.

## Entry into the medullary cavity



With the lower thigh kept in a horizontal position, the box chisel is placed close to the posterior cortex at the resection level. The box chisel has to be introduced along the femoral axis and a small square block of bone is removed. If the box chisel is not used to clear hard bone from the osteotomy site, fracture of the trochanter may occur during rasp insertion.

Driving the box chisel below the level of the resected bony surface should also be avoided.

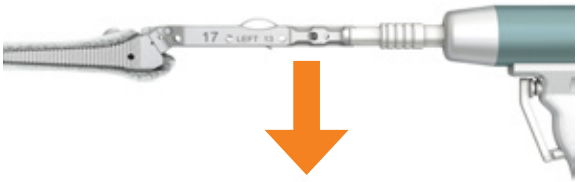
The curved rasp facilitates opening of the diaphyseal IM canal.

Further opening of the diaphyseal medullary cavity and probing of the diaphysis with corresponding awl is recommended.


To prepare the bone bed up to size 4, start with the rasp size 01. From size 5 onwards, preparation can be started with rasp size 1. Connect the rasp with the offset adapter, which is available in a variety of different designs.

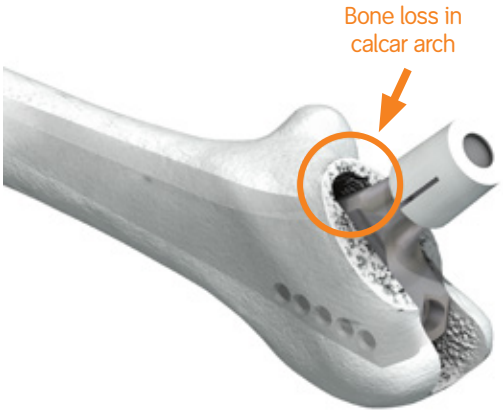
**Important**

The first rasp determines the position of all the following rasps. This is why its orientation is important for an exact positioning of the stem.



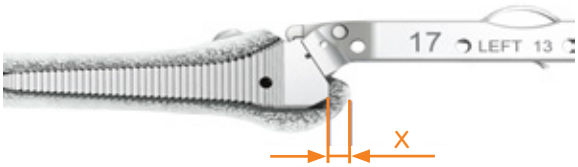
Rasping is carried out using the slap hammer or the rasping machine. The weight of these instruments helps to ensure the longitudinal alignment of the rasp within the femur. It is important that a lateral force is continuously applied to the rasping machine to ensure that the rasp moves in line with the axis of the canal and does not seat in a varus position.


Attention should be paid to the anteversion and varus/valgus alignment of the rasping machine with respect to the femoral axis. Insertion of the rasps or the stem in a varus inclination increases the risk of perforation and fracture of the lateral cortex of the femur.




At the start of the rasping process, the rasp must not be inserted below the level of the estimated final position of the implant. It is extremely important to understand that the femoral osteotomy has no relationship to the final position. There is a tendency for surgeons to implant the starting smaller size rasps too deeply into the femur. This will result in an excessive enlargement of the implantation site and lead to gaps around the medial aspect of the final implant position.


The subsequent rasp is introduced into the cavity until the broach makes contact with the bone. The rasp is then driven into the femur with lateral and distal pressure using the slap hammer or the rasping machine. Then go to the next larger rasp in sequence until the appropriate size is reached.




The shoulder of the rasp corresponds to the height of the implant measured at the shoulder of the prosthesis and should correspond to the preoperatively determined distance to the greater trochanter (marked X).


The aim is to achieve a long cortical batch with a large surface area. As the IM canal is expanded in increments the contact of the cortex increases and thus also the resistance when rasping. The rasp starts to broach the edges of the shaft, i.e. the rectangular shape from the cortex. As soon as the rasp is fully working on the cortex the pitch is higher and there are signs of the yellow cortex on the edge of the rasp. The ultimate check to ensure that the size is correct is preoperative planning with the X-ray image.

In rare situations, the prosthesis size determined intraoperatively is in disagreement with the size derived from preoperative templating. If this difference is two sizes or more, the rasp may not have reached the necessary depth because of incorrect angulation or the presence of an obstacle within the canal. In such cases, the implanted prosthesis is too small to provide stable long-term fixation. In these situations, intraoperative fluoroscopy or an intraoperative radiograph should be obtained to evaluate the obstruction.

The offset adapter is removed from the detachable rasp.

**Trial reposition**

The neck module is manually set onto the broach.

The trial ball-head can be attached to the modular neck in advance or in situ.

In each case, there is a standard modular neck for the detachable rasps of sizes 01–0, 1–6 and 7–12. The «lateral» modular necks are available to suit the detachable rasps of sizes 1–6 and 7–12.

Care should be taken that the modular neck is correctly seated on matching surface of the detachable rasp and engages properly.

The joint is repositioned and leg length, soft-tissue tension, and range of motion are checked.

If necessary the trial ball-head and/or the modular neck (standard or lateral) are changed until the results are satisfactory.

The modular neck can either be removed from the rasp manually or with a bone clamp.

The offset adapter is connected to the detachable rasp. The detachable rasp is removed from the canal using the slap hammer or the rasping machine.

## Implantation of the stem

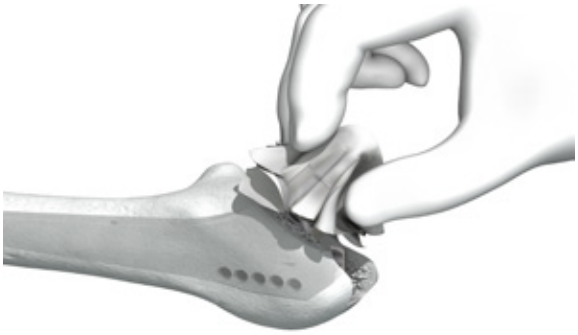
The correct size SL-PLUS◇ stem is introduced manually as deep as possible into the canal, and is then seated with the impactor, using appropriately measured strokes to minimize the risk of fracture of the femur.

**Important**

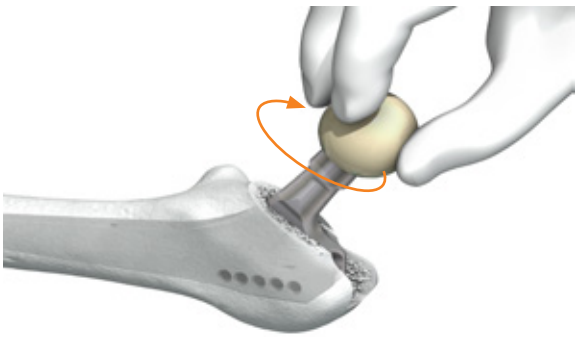
Pressing the stem in solely by hand is inadequate.

During impact, the protective cover remains positioned on the cone.

Once the stem is firmly seated, attempts to drive it further down the canal or to adjust its alignment within the femur cannot be performed without fracturing the bone.



Before repositioning the original ball-head the tapered trunnion conus is carefully cleaned by hand.



The ball-head is then attached to the trunnion with a slight turning motion and permanently fixed with a blow delivered with the plastic hammer.

Metal objects must never be used to deliver is used, a plastic coupling or the head impactor must be used to protect the head from direct contact with the hammer.

**Important**

Pressing the prosthetic head onto the trunnion solely by hand provides inadequate fixation.

Each femoral stem has a standard 12/14 trunnion to allow coupling with OXINIUM®, ceramic or metal heads supplied by Smith&Nephew Orthopaedics AG resp. Smith & Nephew Inc.

## Postoperative Treatment

Postoperative rehabilitation should be completed in accordance with each hospital's own practices.

## Explantation of the SL-PLUS Stem


The SL-PLUS stem can be removed using the extraction screw M8.

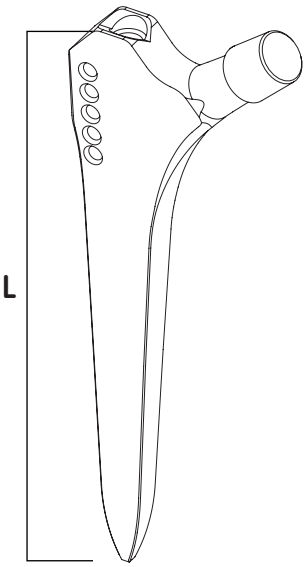
If this causes difficulties, the extraction block can be used.

**Important**

It is important to insert the extraction screw axially.

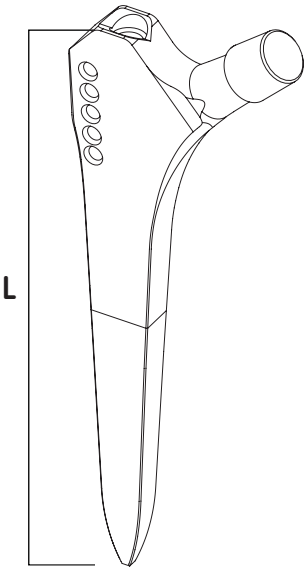
# Standard Implants

| Item No. | SAP No. | Size | Length (L) |
|---|---|---|---|
| 11420S | 75002717 | 01 | 128 mm |
| 11421S | 75002719 | 0 | 132 mm |
| 11401S | 75002695 | 1 | 136 mm |
| 11402S | 75002697 | 2 | 140 mm |
| 11403S | 75002699 | 3 | 145 mm |
| 11404S | 75002701 | 4 | 150 mm |
| 11405S | 75002703 | 5 | 154 mm |
| 11406S | 75002705 | 6 | 158 mm |
| 11407S | 75002707 | 7 | 163 mm |
| 11408S | 75002709 | 8 | 168 mm |
| 11409S | 75002711 | 9 | 173 mm |
| 11410S | 75002713 | 10 | 178 mm |
| 11411S | 75002714 | 11 | 183 mm |
| 11412S | 75002715 | 12 | 188 mm |



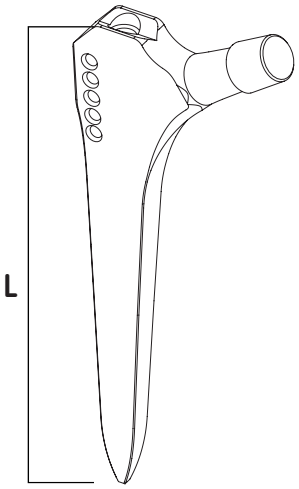

All sizes also available with Integration-PLUS◇ Ti-Plasma hydroxyapatite coating:

| Item No. | SAP No. | Size | Length (L) |
|---|---|---|---|
| 11459 | 75002720 | 01 | 128 mm |
| 11460 | 75002722 | 0 | 132 mm |
| 11461 | 75002723 | 1 | 136 mm |
| 11462 | 75002724 | 2 | 140 mm |
| 11463 | 75002725 | 3 | 145 mm |
| 11464 | 75002726 | 4 | 150 mm |
| 11465 | 75002727 | 5 | 154 mm |
| 11466 | 75002728 | 6 | 158 mm |
| 11467 | 75002729 | 7 | 163 mm |
| 11468 | 75002730 | 8 | 168 mm |
| 11469 | 75002731 | 9 | 173 mm |
| 11470 | 75002732 | 10 | 178 mm |
| 11471 | 75002733 | 11 | 183 mm |
| 11472 | 75002734 | 12 | 188 mm |



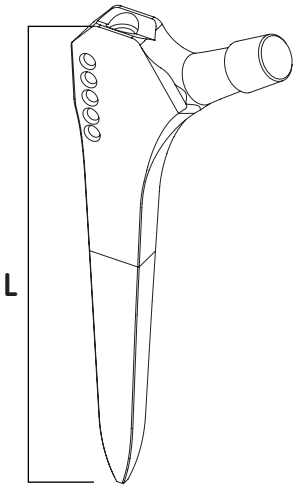
# Lateral Implants

| Item No. | SAP No. | Size | Length (L) |
|---|---|---|---|
| 11531S | 75002748 | 1 | 136 mm |
| 11532S | 75002750 | 2 | 140 mm |
| 11533S | 75002752 | 3 | 145 mm |
| 11534S | 75002756 | 4 | 150 mm |
| 11535S | 75002758 | 5 | 154 mm |
| 11536S | 75002760 | 6 | 158 mm |
| 11537S | 75002762 | 7 | 163 mm |
| 11538S | 75002764 | 8 | 168 mm |
| 11539S | 75002766 | 9 | 173 mm |
| 11540S | 75002768 | 10 | 178 mm |
| 11541S | 75002769 | 11 | 183 mm |
| 11542S | 75002770 | 12 | 188 mm |




All sizes also available with Integration-PLUS◇ Ti-Plasma hydroxyapatite coating:

| Item No. | SAP No. | Size | Length (L) |
|---|---|---|---|
| 11569 | 75002773 | 1 | 136 mm |
| 11570 | 75002777 | 2 | 140 mm |
| 11571 | 75002778 | 3 | 145 mm |
| 11572 | 75002779 | 4 | 150 mm |
| 11573 | 75002780 | 5 | 154 mm |
| 11574 | 75002781 | 6 | 158 mm |
| 11575 | 75002782 | 7 | 163 mm |
| 11576 | 75002783 | 8 | 168 mm |
| 11577 | 75002784 | 9 | 173 mm |
| 11578 | 75002785 | 10 | 178 mm |
| 11579 | 75002786 | 11 | 183 mm |
| 11580 | 75002787 | 12 | 188 mm |



# Instrumentation

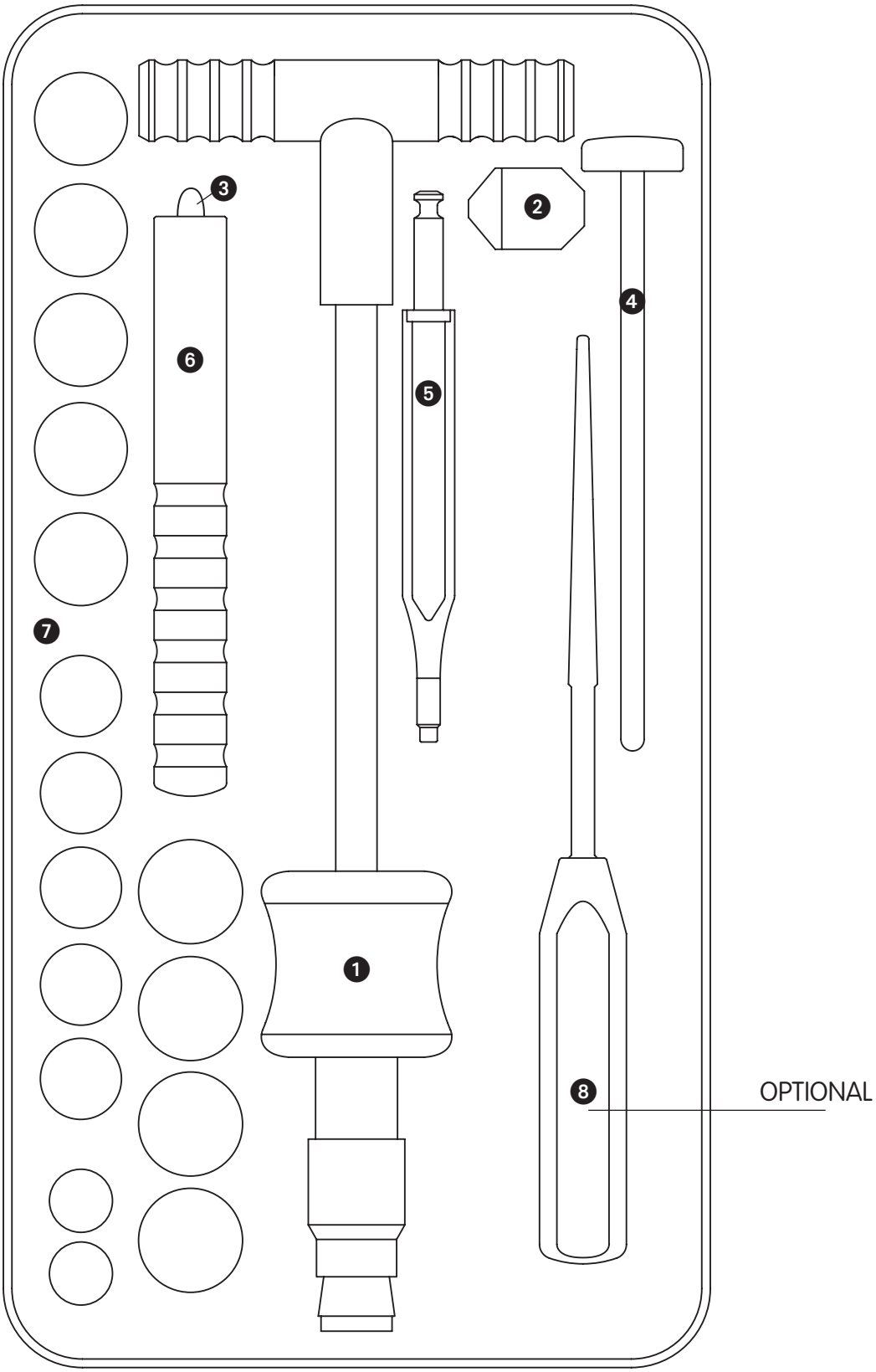
SL-PLUS®/SLR-PLUS® Basic Instrumentation
Set No. 0942000

| | Item No. | SAP No. | Description | | |
|---|---|---|---|---|---|
| | **110450** | **75002198** | **Case Basic Instruments 1/4** | | |
| | 990019 | 75007661 | Easy Tray Lid Plastic | | |
| 1 | 110901 | 75002319 | Slap Hammer | | |
| 2 | 110902 | 75002320 | Extractor Block | | |
| 3 | 110903 | 75002321 | Impactor | | |
| 4 | 110904 | 75002322 | Box Chisel | | |
| 5 | 110911 | 75002325 | Extraction Screw M8 | | |
| 6 | 110242 | 75002160 | Head Impactor | | |
| 7 | 75100839* | 75100839 | Trial Femoral Head | 22 | S/+0 |
| | 75100840 | 75100840 | Trial Femoral Head | 22 | M/+4 |
| | 75100841 | 75100841 | Trial Femoral Head | 22 | L/+8 |
| | 75100842* | 75100842 | Trial Femoral Head | 22 | XL/+12 |
| | 75100843* | 75100843 | Trial Femoral Head | 28 | XS/-3 |
| | 75100844 | 75100844 | Trial Femoral Head | 28 | S/+0 |
| | 75100845 | 75100845 | Trial Femoral Head | 28 | M/+4 |
| | 75100846 | 75100846 | Trial Femoral Head | 28 | L/+8 |
| | 75100847 | 75100847 | Trial Femoral Head | 28 | XL/+12 |
| | 75100848 | 75100848 | Trial Femoral Head | 28 | XXL/+16 |
| | 75100849* | 75100849 | Trial Femoral Head | 32 | XS/-3 |
| | 75100850 | 75100850 | Trial Femoral Head | 32 | S/+0 |
| | 75100851 | 75100851 | Trial Femoral Head | 32 | M/+4 |
| | 75100852 | 75100852 | Trial Femoral Head | 32 | L/+8 |
| | 75100853 | 75100853 | Trial Femoral Head | 32 | XL/+12 |
| | 75100854 | 75100854 | Trial Femoral Head | 32 | XXL/+16 |
| | 75100855* | 75100855 | Trial Femoral Head | 36 | XS/-3 |
| | 75100856 | 75100856 | Trial Femoral Head | 36 | S/+0 |
| | 75100857 | 75100857 | Trial Femoral Head | 36 | M/+4 |
| | 75100858 | 75100858 | Trial Femoral Head | 36 | L/+8 |
| | 75100859 | 75100859 | Trial Femoral Head | 36 | XL/+12 |

* special size (optional)

Optional:

| | Art. No. | SAP No. | Description | |
|---|---|---|---|---|
| | 75210292 | 75210292 | SET 40 mm Trial Femoral Heads | XS/-4 to L/+8 |
| | 75210293 | 75210293 | SET 44 mm Trial Femoral Heads | XS/-4 to L/+8 |
| 8 | 21000138 | 75004495 | Curved Rasp | |
| | 600620 | 75007254 | MIS Offset Box Chisel (instead of 110904) | |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7
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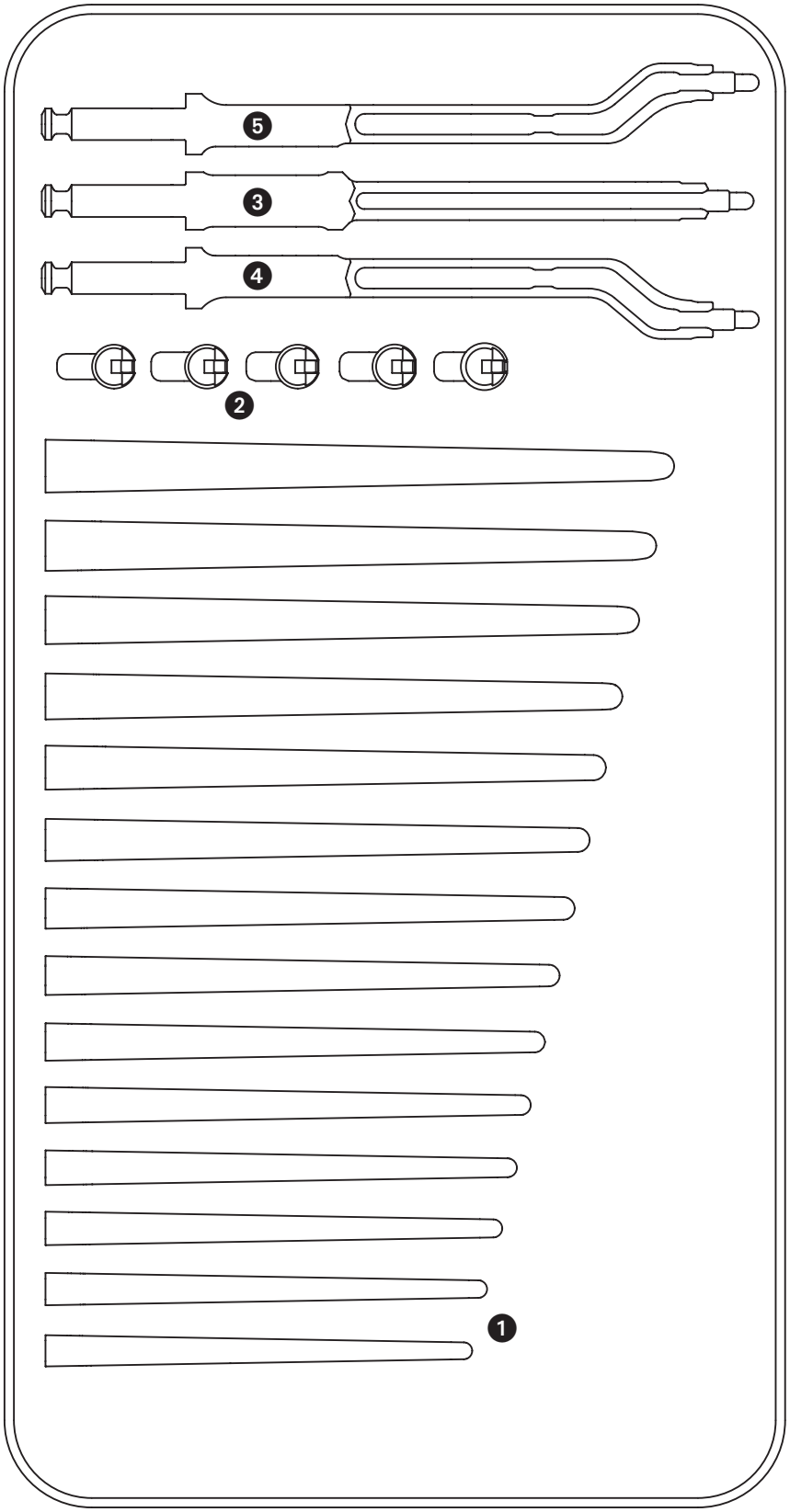
8
OPTIONAL

SL-PLUS® Trial Broach with Adapter 25 mm
Set No. 0943001

| | Item No. | SAP No. | Description |
|---|---|---|---|
| | **600930** | **75007312** | **Instrument Case** |
| | 990019 | 75007661 | Easy Tray Lid Plastic |
| ❶ | 600899 | 75007293 | Trial Broach 01 |
| | 600900 | 75007294 | Trial Broach 0 |
| | 600901 | 75007295 | Trial Broach 1 |
| | 600902 | 75007296 | Trial Broach 2 |
| | 600903 | 75007297 | Trial Broach 3 |
| | 600904 | 75007298 | Trial Broach 4 |
| | 600905 | 75007299 | Trial Broach 5 |
| | 600906 | 75007300 | Trial Broach 6 |
| | 600907 | 75007301 | Trial Broach 7 |
| | 600908 | 75007302 | Trial Broach 8 |
| | 600909 | 75007303 | Trial Broach 9 |
| | 600910 | 75007304 | Trial Broach 10 |
| | 600911 | 75007305 | Trial Broach 11 |
| | 600912 | 75007306 | Trial Broach 12 |
| ❷ | 21000253 | 75004603 | Trial Neck Std 01–0 |
| | 21000254 | 75004604 | Trial Neck Std 1–6 |
| | 21000255 | 75004605 | Trial Neck Std 7–12 |
| | 21000256 | 75004606 | Trial Neck Lat. 1–6 |
| | 21000257 | 75004607 | Trial Neck Lat. 7–12 |
| ❸ | 600920 | 75007307 | Broach Handle 25 mm |
| ❹ | 600923 | 75007310 | Broach Handle Left 17/13 mm |
| ❺ | 600924 | 75007311 | Broach Handle Right 17/13 mm |

Optional:

| Item No. | SAP No. | Description |
|---|---|---|
| 600921 | 75007308 | Adapter 40 mm (Set No. 0943005) |
| 600922 | 75007309 | Adapter 10 mm (Set No. 0943000) |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3
4
2
1

# Sterilization

**Implants**

All the implants described in this Surgical Technique are sterile when they are delivered by the manufacturer. Resterilization is not allowed.

**Instruments**

System components and instruments are not sterile when they are delivered. Before use, they must be cleaned by the usual methods in accordance with internal hospital regulations and sterilized in an autoclave in accordance with the legal regulations and guidelines applicable in the relevant country. (For detailed information please refer to leaflet Lit. No. 1363.)

The correct settings are given in the instructions for use issued by the autoclave manufacturer. Instrument manufacturers and dealers accept no responsibility for sterilization of products by the customer.

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