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Introduction

A double-tapered stem with a highly polished surface (and thus “unbonded” stem/cement interface) allows the component to settle in the cement mantle as the cement creeps. This produces radial compressive forces which push the cement against and into the bone, thus reducing the cement mantle and bone-cement interface stresses. Simultaneously, loading is transferred to the proximal femoral bone. The design rationale of the CPS-PLUS[®] is consequently based on these interfering conditions.

Stem fixation is enhanced by subsidence as the taper is engaged. The polished surface seals the interface and limits the amount of debris generated at the interface. The ability of the component to subside within the cement mantle further protects the bone-cement interface fixation.

This stem design of the CPS-PLUS thus optimizes load transfer to the proximal femur, reduces cement mantle and interface stresses and so provides a durable fixation.

CPS-PLUS[◇] Primary Stem



The CPS-PLUS (Cemented Polished Stem) is a cemented stem with a highly polished surface, which minimizes bonding between the bone cement and the implant. The rationale for a highly polished double-tapered stem is well established. Subsidence of the stem is accompanied by radial expansion of the cement which presses against and intrudes into the surrounding bone. This reduces the shear at the bone-cement interface and enhances fixation. In addition, the tension in the bone cement is reduced, while the bone is loaded proximally to distally.

The highly polished surface minimises wear between the cement and the implant. Mathematical models were used to refine the design to optimize both fixation and stability of the stem. The mediolateral dimension and lateral flare provide excellent rotational stability.

Indications

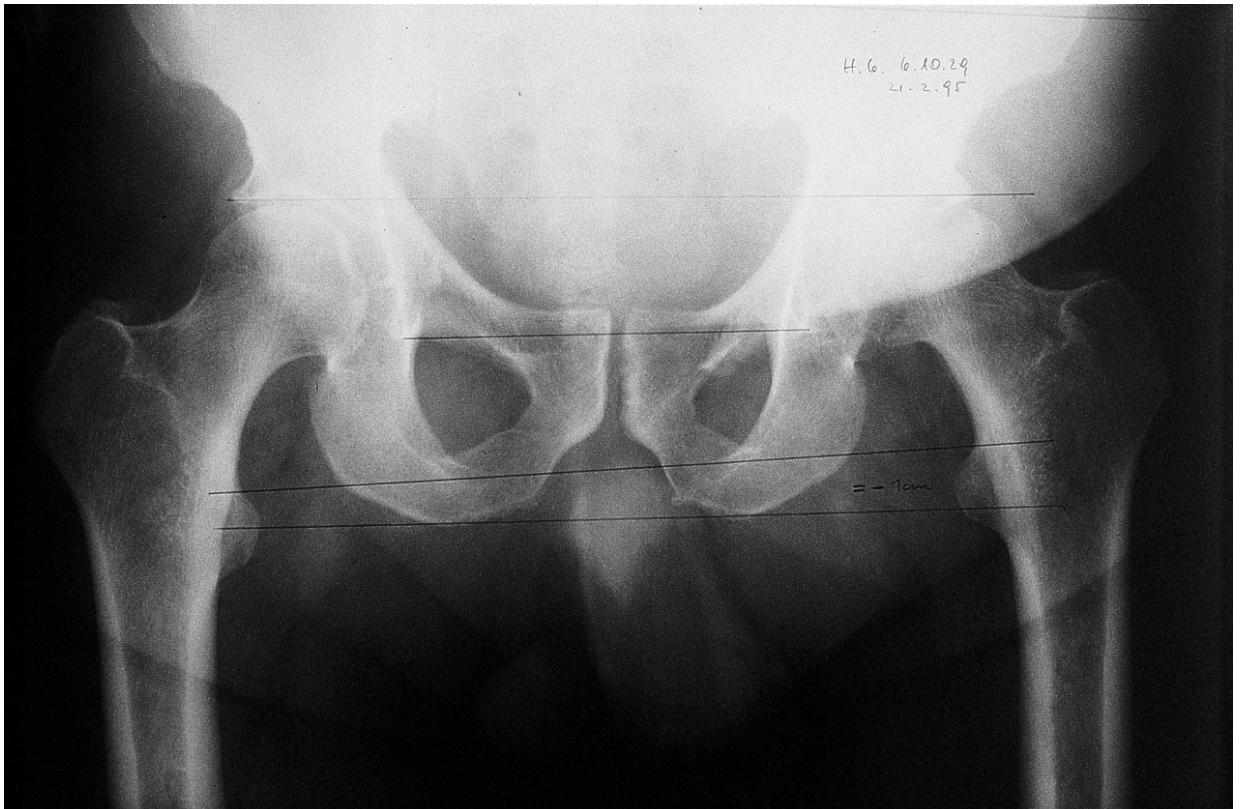
The CPS-PLUS is indicated for patients where cemented implantation is deemed appropriate. It can also be used where poor compliance or physical infirmity prevents protected weight-bearing. The CPS-PLUS stem may be coupled with cemented or cementless acetabular components (hybrid system).

Preoperative Planning

Templating should define the reaming required for the restoration of the center of rotation of the cup, while the height and angle of the neck resection determine the optimal length and offset. This is especially important in patients with unequal leg length (where apparent leg length discrepancy must be differentiated from real differences in leg length).

Preoperative planning requires:

- Radiographs
- Templates for the acetabular component and the stem

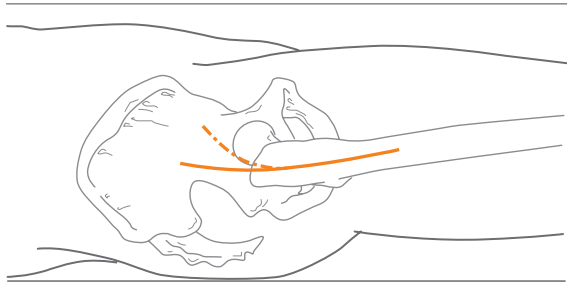


Standardized a/p and lateral radiographs are essential to ensure accurate planning. The femur must be positioned in neutral rotation to produce an orientation that matches the template. An adequate length of the femoral diaphysis should be included on the radiographs. Templating allows the correct size of acetabular component to be selected along with a stem that restores leg length and offset.

Determining stem size

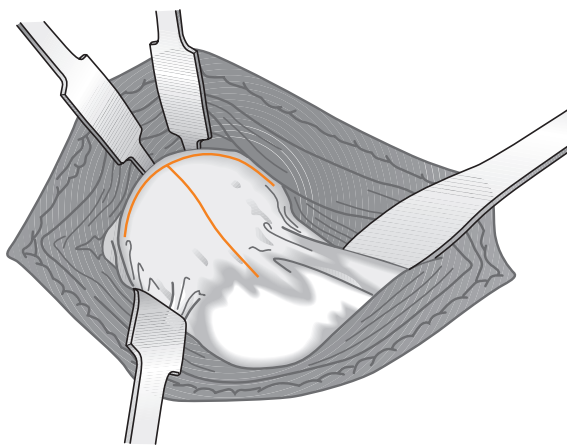
The correct stem size is determined by laying the stem template over the X-ray and selecting the optimum fit of the stem (the stippled cement line is adjusted as closely as possible to cover the inner border of cortical bone). When in doubt, the smaller size should be chosen. The center of rotation of the femoral head is matched by selecting the appropriate neck length. The level of resection is shown by the template.

Surgical Technique



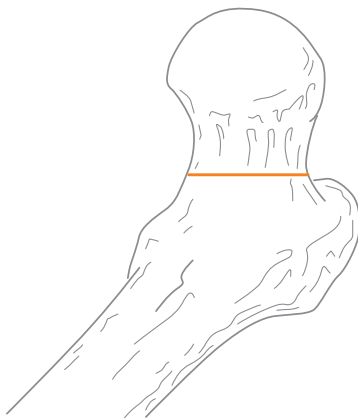
Total hip arthroplasty can be performed through the anterolateral, lateral, posterolateral and posterior approach. The surgeon's preference will dictate which approach is used.

The skin incision and muscle detachment will depend on whether the approach is anterior, lateral or posterior. For the purpose of this description the lateral approach will be used.



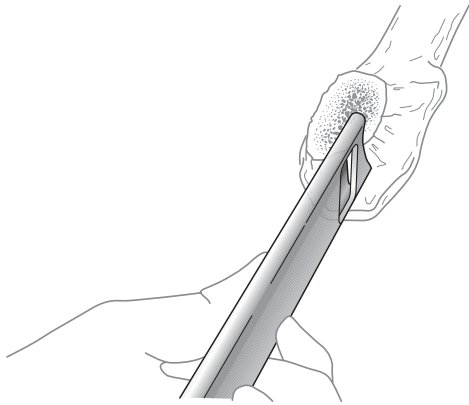
The capsule is exposed and opened with a T or cruciate incision. The hip is then dislocated anteriorly.

Care should be taken not to apply excessive rotational force to the femur to achieve dislocation.



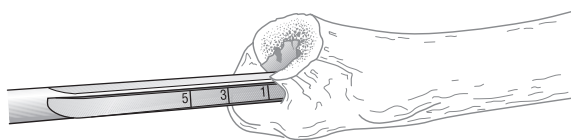
The femoral neck is resected at 45° to the long axis of the femur. Laterally, the osteotomy commences at the level of the tip of the greater trochanter, while medially it is approximately a finger breadth above the lesser trochanter. The height of neck resection may be modified in the presence of abnormal anatomy as determined by preoperative templating. Always make the first cut too long rather than too short. The osteotomy can be performed before or after dislocation of the femoral head.

The acetabulum is replaced in the routine manner with or without cement. Care should be taken to restore the center of rotation in both the vertical and horizontal planes.

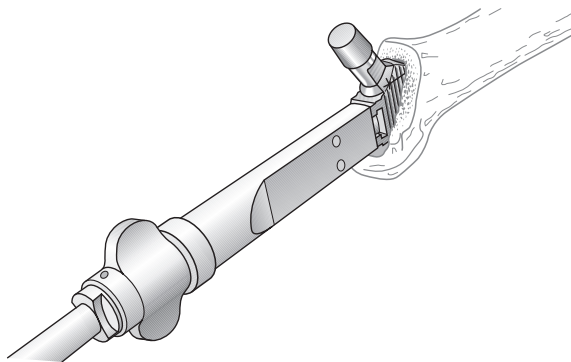


When a transtrochanteric approach has been used it is easy to access the direct line down the medullary cavity. However, with all other approaches it is important to resect the posterolateral cortex of the resected neck with a box chisel. This allows direct access to the medullary cavity through the floor of the piriform fossa. Achieving adequate lateral access is essential for correct component alignment.

Using the taper pin reamer, the medullary cavity is then entered through the base of the piriform fossa. Having entered the medullary cavity, the access hole is enlarged mediolaterally by elliptical excursion of the reamer.



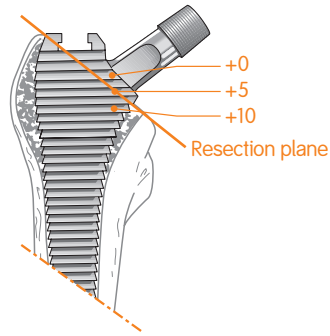
The marks on the taper reamer refer to the planned size of the stem and have to be advanced to the level of the tip of the greater trochanter.



Broaching with the detachable rasps is commenced starting with the smallest rasp size. The rasps are attached to an adapter, which can either be connected to an impactation handle, a slap hammer or a power-driven impactor, like the “Woodpecker.” Serial broaching is then continued with sequentially larger rasps up to the planned size, until the appropriate rasp has been fully seated. In order to avoid a varus malalignment, it is essential that the rasp is fully seated, engaging the greater trochanter laterally.

Remark

Where the medullary cavity is narrow, the special size 01 rasp is recommended. In combination with the smallest stem size 1, the thickness of the cement mantle is partially reduced without jeopardizing adequate cement mantle thickness and the functional anchorage for proper primary stability. For CDH stems, a CDH detachable rasp is supplied.



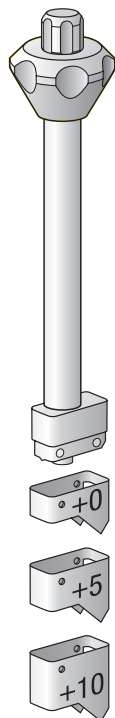
For subsequent adjustment of leg length and offset, note the position of the trial broach by checking the marking on the broach (+0/+5/+10) at the level of the resection plane.

A trial reduction is then carried out with the appropriate neck length.

It is important to test the stability of the hip in full flexion plus adduction, internal rotation and external rotation. The leg is then checked for leg length equality. The length can be adjusted by changing the neck length of the ball head, or if the limb is too long, by further resection of the femoral neck.

It should be noted that in assessing leg length, the addition of two neck lengths equates to axial lengthening equivalent to the distance between two adjustment marks on the stem. The offset can be adjusted by further seating of the broach (\pm further resection of the femur) and applying a longer neck length (increased offset) or by leaving the broach proud and applying a shorter neck length (decreased offset). After confirming that a stable reduction and equal leg length have been demonstrated at trial reduction, the trial broach is removed and a cement restrictor is introduced to the appropriate depth.

The medullary cavity is then cleaned with a brush and a water pick and dried with a swab soaked in hydrogen peroxide or an adrenalin solution.



The appropriate box positioner (+0/+5/+10), determined by the marking at the resection line on the trial broach (+0/+5/+10), is then attached to the inserter. The correct positioning of the assembly is obtained by ensuring, that the lateral marks on the positioner match the lateral marks on the inserter.

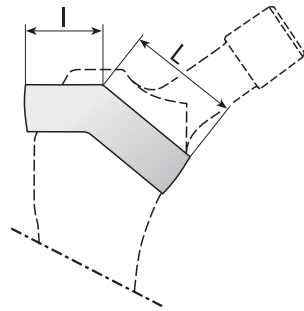
Distal centralizer

The correct size of the distal centralizer is determined by inserting the IM probe (110138) into the intramedullary canal to the appropriate depth, which corresponds to the length of the selected stem.

The double-ended IM probe has two sizes. The small size is marked with three lines, the large size is marked with “Ø14.”

Select the appropriate size of the distal centraliser according to the following table:

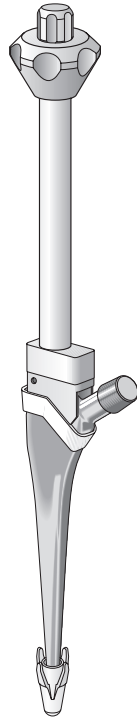
Small sizer (III)	Large sizer (Ø14)	Distal centraliser size
Does not fit	Does not fit	Small break off wings
Fits	Does not fit	Small
Fits loosely	Fits	Large



Attachement of the centralizers

The definitive components are then attached to the inserter. Slip the chosen proximal centralizer over the stem (shorter limb is placed laterally). The centralizer should be in contact with the positioner over its full length.

Using a +5 or a +10 positioner, the proximal centralizer will be flush on the lateral side of the stem, while leaving a small gap medially between centralizer and stem.



The correct positioning is obtained by approximating the proximal centralizer in contact with the positioner. The definitive components are then attached to the inserter. The proximal centralizer is slipped over the stem so that the shorter limb is placed laterally. When a +5 or a +10 box positioner is used, the proximal centralizer will be flush on the lateral side of the stem, while leaving a small gap medially between the centralizer and the stem.

The correct positioning is obtained by approximating the proximal centralizer in contact with the positioner. The centralizer should be in contact with the positioner over its full length. Finally the distal centralizer is attached to the tip of the implant.

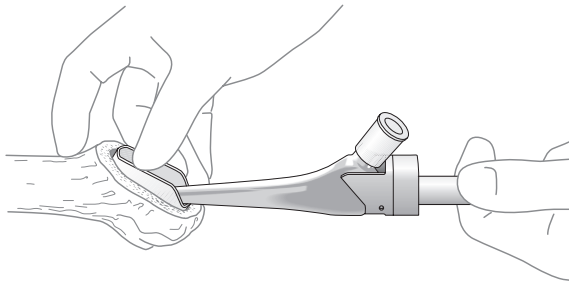
The preferred choice of cement is introduced retrogradely with distal venting and proximal pressurization.

Proximal centralizer

Six sizes are available.

Select the appropriate size of the proximal centralizer according to the following table:

Centraliser size	Primary stem size	Revision stem size
CDH	CDH	–
1	1	–
2	2	1
3	3	2
4	4	3
5	5	–

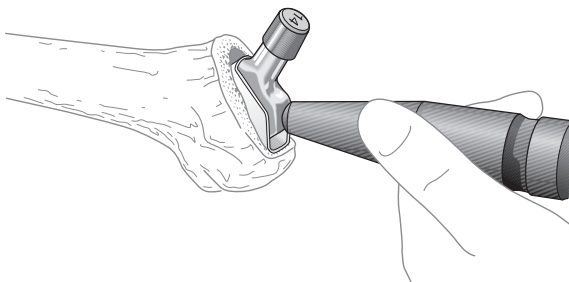


Inserting the femoral prosthesis

The surgeon uses the inserter to aim at the knee and guide the prosthesis along the correct axis during insertion. After the stem has been inserted approximately halfway, the proximal centraliser is seated at the margin of the resected bone. While the proximal centralizer is held in place with a finger placed medially over the resected collar, the stem is further inserted. During the final

insertion the positioner engages with the proximal centralizer. Stem and centralizer are simultaneously positioned such that the proximo medial surface of the centralizer is flush with the resection level. As the stem is then fully seated, the proximal centralizer ensures optimal pressurization of the proximal cement. As soon as the stem has been seated, the inserter is removed, thus preventing any further movement of the stem.

All excess cement is removed and no tendrils of cement should be allowed to come into contact with the surface of the calcar.



The stem pusher is then used to keep the stem in place and to apply constant gentle pressure.

The cement is allowed to harden completely and no further movement of the stem should occur. The stability of reduction is again checked with a trial head following which the definitive head is applied.

Before the definitive ball head is added, the cone trunion must be meticulously cleaned and dried.

CPS-PLUS[◇] Revision Stem



Preface

Revision hip arthroplasty constitutes a substantial demand upon hip surgeons. Indications include both septic and aseptic loosening. The bone stock of the proximal femur is frequently deficient, or the femur itself may have fractured. This necessitates consideration of longer stem variants.

The CPS-PLUS design has been successful in primary hip arthroplasty. Particular features include significant rotational stability due to the cross-sectional design of the proximal part of the implant. This is of major relevance in revision surgery.

The CPS-PLUS Revision Stems, available in lengths of 190 mm, 210 mm and 230 mm, will prove a useful adjunct to the methods available for stem revision following failed primary total hip arthroplasty.

Indications

The CPS-PLUS Revision Stem has been designed as a revision arthroplasty device.

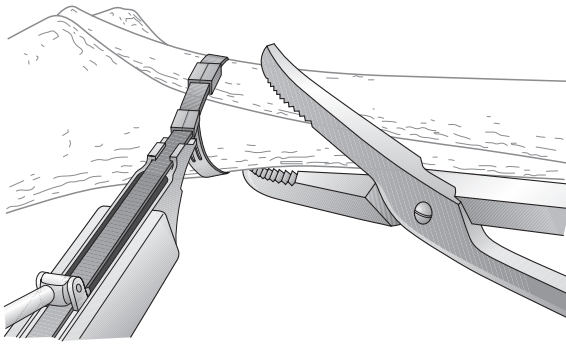
- Revision of a loosened cemented or cementless implant. In cases where the femur is found to be damaged in numerous areas and the cortex is thin, such weakened areas could be bypassed by the use of an appropriate stem length.
- Management of periprosthetic fractures, which sometimes occur in the presence of only minimal granuloma formation near the tip of the primary implant.
- Femoral splitting at the upper end of the bone in order to remove all the old implant and cement.

Preoperative Planning

Where possible, appropriate preoperative planning should take place to estimate the stem size, to determine the optimal stem position and to restore leg length.

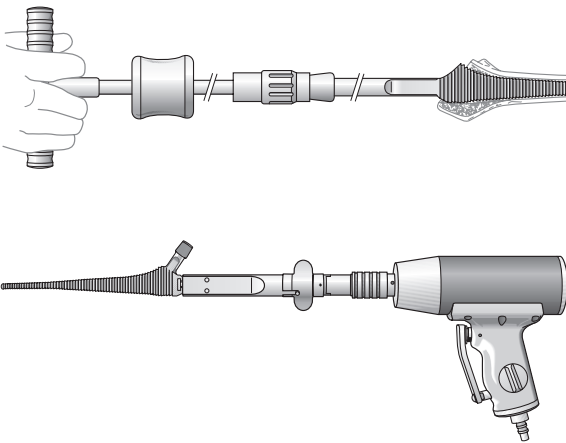
X-rays (AP and lateral of the affected hip) are required. Templates are available in enlargements of 15%. Preoperative templating of this kind is less reliable in revision cases than in primary cases, however (see also Preoperative Planning Primary Stem).

Surgical Technique



Removal of the previous implant and any remaining cement is required prior to the preparation of the canal.

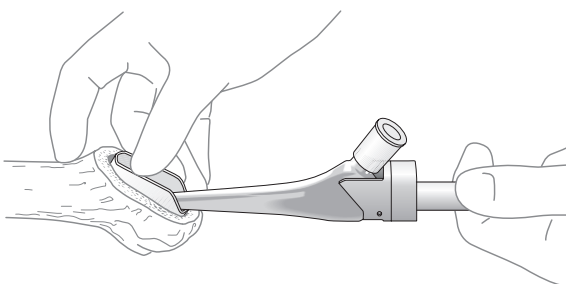
This may necessitate an extended lateral trochanteric osteotomy or upper femoral splitting in order to ensure that this is achieved. The lateral upper femur should then be re-wired in position using an appropriate cable grip system, e.g. CCG[®]. It is necessary to penetrate any distal cement plug or osseous pedestal within the medullary canal.



Standard preparation is then carried out using the rasps in combination with powered reamers if required or manual techniques until the bony cortex is exposed throughout the length of the bone (cf. Surgical Technique Standard Stem).

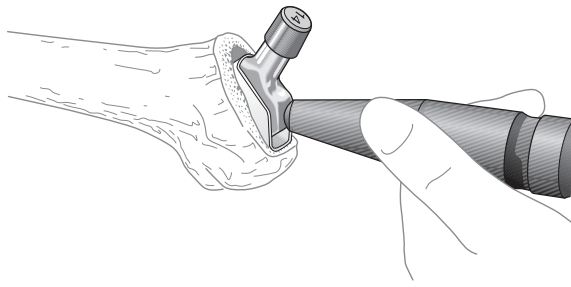
Note

A trial reduction may be performed with one of the shorter primary rasps inserted in the proximal femur in order to establish appropriate length. It is not essential to use the rasps for the longer stem options, since bowing of the femur may make insertion of such rasps problematic. It is, however, essential to ensure that the desired stem length (the true stem) will pass along the femur before cementing is initiated.



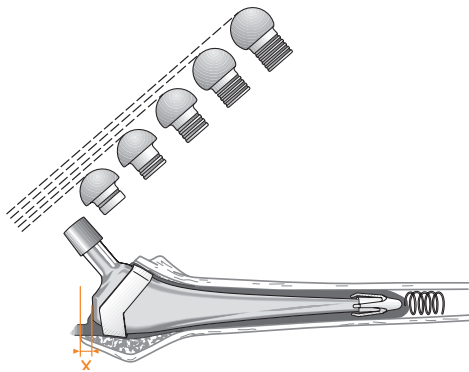
Standard preparation of the femur is then finished including lavage and brushing. A cement restrictor is inserted.

Ordinarily, two or even three mixes of appropriate acrylic cement will be required. Additional antibiotics may be added to the cement in cases of revision for sepsis, although it should be remembered that these may cause some alteration in the mechanical properties of the cement.



The cement should be inserted using the retrograde filling technique with proximal pressurization if possible. The stem is then advanced using the standard introducer, the proximal centralizer is advanced after about half the stem has been inserted, and is then held in position while the stem is advanced to the desired length. This will assist in proximal femoral cement pressurization.

The table of appropriate proximal centralizer sizes can be found on page 10.



Trial reductions should then be performed with the various trial head lengths (S, M, L, XL, XXL) before the definitive head is applied.

Postoperative Management

Postoperative care will depend on the particular circumstances relating to the case.

The patient should be mobilized early if possible with removal of drains at 24–48 hours. Appropriate thromboprophylaxis should be considered. In addition, antibiotic prophylaxis appropriate to the case should be used. The patient may be kept non-weight-bearing or partial weight-bearing for the first 6 weeks depending on circumstances.

Follow-up X-rays should be taken at 6 weeks to ensure the integrity of any reincorporated lateral osteotomy or progression to union of any previous periprosthetic fracture.

Standard follow-up should then continue at intervals of 3, 5 and 10 years (or more frequently if indicated).

Implants

Material: Stainless steel according to ISO 5832-9, forged

Taper: Standard 12/14 taper

Art. No.	Description	Size
Primary Stems		
11148	CPS-PLUS [°] Primary Stem	CDH
11141	CPS-PLUS Primary Stem	1
11142	CPS-PLUS Primary Stem	2
11143	CPS-PLUS Primary Stem	3
11144	CPS-PLUS Primary Stem	4
11145	CPS-PLUS Primary Stem	5
Revision Stems		
11147	CPS-PLUS Revision Stem, L 190 mm	1**
11149	CPS-PLUS Revision Stem, L 210 mm	2**
11150	CPS-PLUS Revision Stem, L 230 mm	3**
Centralizers		
11188	Centraliser Set*	CDH
11181	Centraliser Set*	1
11182	Centraliser Set*	2
11183	Centraliser Set*	3
11184	Centraliser Set*	4
11185	Centraliser Set*	5

* All sets include 1 proximal and 2 different sized distal centralizers.

** These sizes correspond to the sizes of the primary stems in the proximal area according to the table on page 10.

Instrumentarium

Art. No.	Description	Size
110299	Taper Reamer	
1101149	Detachable rasp	CDH 00
110148	Detachable rasp	CDH
110139	Detachable rasp	01
110141	Detachable rasp	1
110142	Detachable rasp	2
110143	Detachable rasp	3
110144	Detachable rasp	4
110145	Detachable rasp	5
110288	Insertor	
110291	Positioner +0	
110292	Positioner +5	
110293	Positioner +10	
110289	Stem Pusher	
110242	Head Impactor	
110500	Adaptor	
110904	Box Chisel	
110911	Extraction Screw	
160001	Trial Ball Head	S
160002	Trial Ball Head	M
160003	Trial Ball Head	L
160004	Trial Ball Head	XL
160005	Trial Ball Head	XXL
110138	IM canal probe	

Option 1

110152	Handle for adaptor	
110151	Tray	

Option 2

110901	Slap Hammer	
110150	Tray	

Additional Instruments for Revision

110164	Tray for Revision Detachable Rasp	
110153	Handle Rasp Adaptor (new)	
110155	Revision Detachable Rasp	1
110156	Revision Detachable Rasp	2
110157	Revision Detachable Rasp	3

Sterilization

Implants

All the implants described in this Operating Technique are sterile when they are delivered by the manufacturer. Re-sterilisation 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 sterilised 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 sterilisation of products by the customer.

Notes

Notes

Notes

Manufacturer

Smith & Nephew Orthopaedics AG
Erlenstrasse 4a
6343 Rotkreuz
Switzerland

For further information please contact
our local sales office.
www.smith-nephew.com