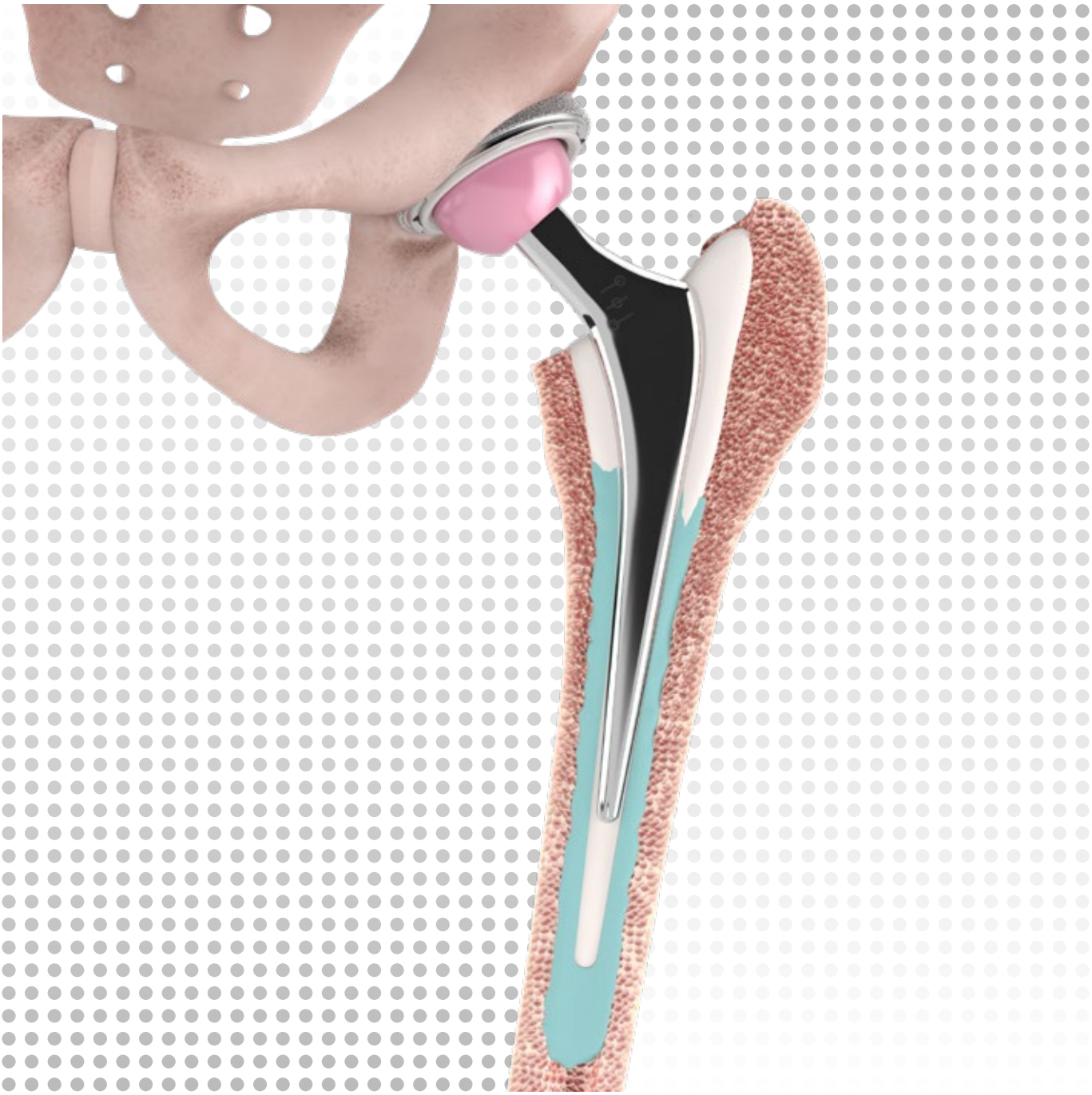
C-STEM® AMT

Triple Tapered Stabilised Hip

InCement Revision Surgical Technique



DePuy Synthes

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InCement Revision Introduction

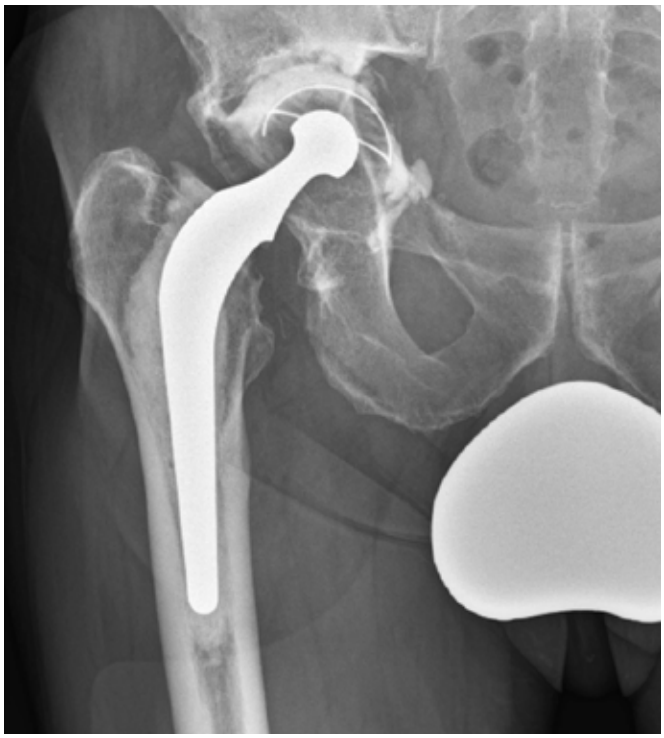


Figure 1. Pre-op x-ray

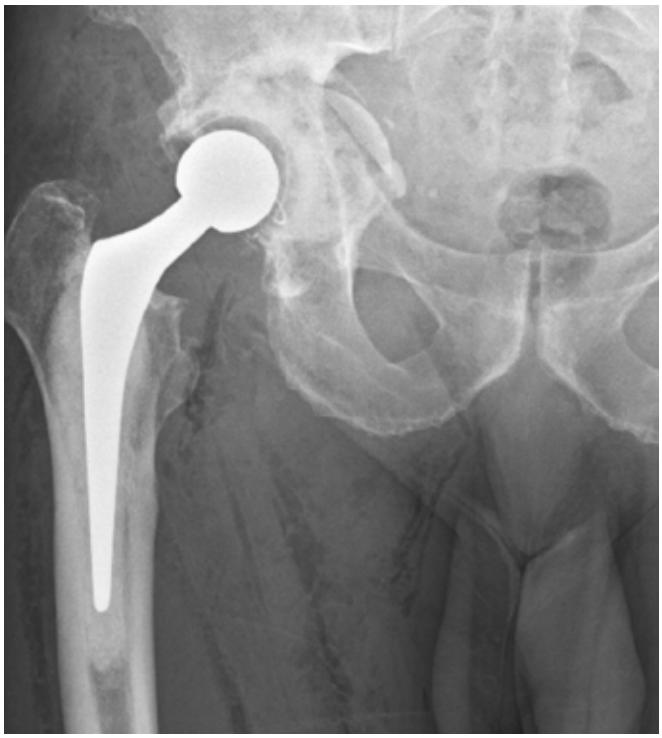


Figure 2. Post InCement revision x-ray

'InCement' Revision is a modification of conventional methods for revising a cemented stem where a proportion of the existing cement mantle is left in situ during revision surgery.

Leaving a portion of the cement mantle can result in significant reduction in bone loss and reduce the duration of the revision surgery to a time comparable to primary surgery.[1,2]

InCement revision has been shown to be a clinically successful procedure both with C-STEM AMT and other polished cemented stems.[3] This surgical technique is intended to provide guidance for InCement / cement-within-cement surgical techniques with C-STEM AMT.

Generally InCement revision may be considered for revision of well fixed stems, either for biomechanical correction, bearing exchange or to provide clearance during shell revision.

InCement revision may not be considered suitable for loose stems or patients with significant peri-prosthetic osteolysis (see Planning, page 10)

Removal of the cement mantle of a well-fixed femoral component can result in substantial blood loss, femoral perforation, femoral fracture,[4] loss of bone stock and a substantial increase in operation time.[5]

Abstracts from Relevant Clinical Papers

The procedure is well established and there are sufficient clinical data to demonstrate its safety and effectiveness in correctly selected patients:

Relevant clinical papers and highlights

Cement in Cement Revision of the Femoral Component Using a Collarless Triple Taper: A Midterm Clinical and Radiographic Assessment
Stefanovich-Lawbuary NS, et al.[3]

This study describes the midterm clinical and radiological results of the cement in cement technique for the femur using a collarless triple taper. Radiographic assessment was made retrospectively from 44 patients at two time points. Clinical outcomes included the Oxford Hip Score, EQ5D and Self Reported Patient Satisfaction Scale. Implant and patient survival were also recorded. The mean clinical follow up period was 5 years 3 months and the radiological follow up 2 years 10 months. The mean OHS was 34, the mean EQ5D 0.814 and the mean SAPS 94. Kaplan–Meier survival with revision, as the end point was 95.2% at 11 years with a survivorship of 76.5% with death as the end point. Cement in cement revision using a collarless triple tapered stem demonstrates promising results both clinically and radiologically at midterm follow up.

Revision of the cemented femoral stem using a cement-in-cement technique. A five- to 15-year review.
Duncan WW, et al.[2]

The removal of well-fixed bone cement from the femoral canal during revision of a total hip replacement (THR) can be difficult and risks the loss of excessive bone stock and perforation or fracture of the femoral shaft. Retaining the cement mantle is attractive, yet the technique of cement-in-cement revision is not widely practised. We have used this procedure at our hospital since 1989. The stems were removed to gain a better exposure for acetabular revision, to alter version or leg length, or for component incompatibility.

We studied 136 hips in 134 patients and followed them up for a mean of eight years (5 to 15). A further revision was required in 35 hips (25.7%), for acetabular loosening in 26 (19.1%), sepsis in four, instability in three, femoral fracture in one and stem fracture in one. No femoral stem needed to be re-revised for aseptic loosening.

A cement-in-cement revision of the femoral stem is a reliable technique in the medium term. It also reduces the risk of perforation or fracture of the femoral shaft.

In-cement technique for revision hip arthroplasty
Quinlan JF, et al.[6]

The in-cement technique for revision hip arthroplasty involves retaining the original cement-bone interface. This has been proven to be a biomechanically stronger method than recementing after complete removal of the original cement mantle.

This study reviewed a series of 54 consecutive revision hip arthroplasty procedures, using the in-cement technique, between November 1999 and November 2003. Clinical and radiological follow-up included functional assessment.

There were 54 procedures performed in 51 patients, whose mean age at surgery was 70.3 years (45 to 85).

A total of 42 were available at a mean follow-up of 29.2 months (6 to 51).

There was no radiological evidence of loosening. Functional assessments were available for 40 patients who had a mean Harris hip score of 85.2 (51.9 to 98.5), a mean Oxford hip score of 19.6 (12 to 41), a mean UCLA activity profile score of 5.9 (3 to 8) and a mean SF-36 score of 78.0 (31.6 to 100).

The in-cement technique provides consistent, high functional outcomes and should be considered in appropriately selected cases.

Gentamicin release from old cement during revision hip arthroplasty
Powles JW, et al.[7]

Bone cement containing gentamicin may release antibiotic when fractured during revision operations. Tissue samples taken during surgery may be contaminated by gentamicin and give inaccurate microbiological assessment.

We studied five patients in whom cement containing gentamicin had been used in the primary procedure. During revision hip replacement, samples of joint fluid, tissues and cement were taken both before and after disruption of the cement.

With the exception of one sample of joint fluid, low concentrations of gentamicin were recorded in the samples taken before the cement was disrupted, but after disruption the specimens contained gentamicin at concentrations high enough to inhibit or prevent growth of sensitive organisms. The cement contained very high levels up to ten years after insertion.

Our findings suggest that no reliance can be placed on the microbiological assessment of specimens taken once cement splitting has started and that specimens should therefore be taken as early as possible.

Preservation of the original femoral cement mantle during the management of infected cemented total hip replacement by two-stage revision

Morley JR, et al.[4]

The removal of all prosthetic material and a two-stage revision procedure is the established standard management of an infected total hip replacement (THR). However, the removal of well-fixed femoral cement is time-consuming and can result in significant loss of bone stock and femoral shaft perforation or fracture. We report our results of two-stage revision THR for treating infection, with retention of the original well-fixed femoral cement mantle in 15 patients, who were treated between 1989 and 2002. Following partial excision arthroplasty, patients received local and systemic antibiotics and underwent reconstruction and re-implantation at a second-stage procedure, when the infection had resolved.

The mean follow-up of these 15 patients was 82 months (60 to 192). Two patients had positive microbiology at the second stage and were treated with six weeks of appropriate antibiotics; one of these developed recurrent infection requiring further revision. Successful eradication of infection was achieved in the remaining 14 patients.

We conclude that when two-stage revision is used for the treatment of peri-prosthetic infection involving a THR, a well-fixed femoral cement mantle can be safely left in situ, without compromising the treatment of infection. Advantages of this technique include a shorter operating time, reduced loss of bone stock and a technically more straightforward second-stage procedure.

Berstock Results

In order to maximise the flexibility to cover revision of as many stems as possible it is important to know whether the chosen implant will fit and how much adjustment (leg length, femoral version) will be available. Berstock et al.[5] performed a study comparing the interchangeability and adjustment available when revising from and to several sizes (typically size 1 and 2) of CHARNLEY®, C-STEM (9/10 taper), Exeter (Stryker) and CPT (Zimmer Biomet) implants. They generated cement mantles with each stem and measured the compatibility and range of adjustment when each of the other stems was inserted into the prepared mantle. The Berstock paper was performed using a C-STEM 9/10 stem; if you have cleared the lateral shoulder this data remains valid for C-STEM AMT.

Stem compatibility for cement-in-cement femoral revision: an in vitro study
Berstock JR, Torrie PAG, Smith JRA, Webb JC, Baker RP.[5]

Cement-in-cement femoral component revision is a useful and commonly practised technique. Onerous and hazardous re-shaping of the original cement mantle is required if the new stem does not seat easily. Furthermore, without removing the entirety of the original cement mantle, the freedom to alter anteversion or leg length is difficult to predict pre-operatively. We present data from in vitro experiments testing the compatibility of the top cemented stems according to UK registry figures (NJR 2013). This data augments pre-operative planning by indicating which revision stems require minimal or no cement reshaping when being inserted into another stem's mantle. We also present the maximum shortening and anteversion that can be achieved without reshaping the original cement mantle.

Revision Stem Compatibility - Stem Heights (mm)

Tables adapted from Berstock et al.[5]

InCement Revision C-STEM Size	Prosthesis to Revise From																						
	Exeter 37.5						Exeter 44						C-STEM					CPT				CHARNLEY®		
	CDH	0	1	2	3	4	0	1	2	3	4	5	1	2	3	5	6	1	2	3	4	FB45	FB40	RB45
1	19.8	-	9.4	0.8	-5.5	-6.0	-	-1.9	-1.9	0.0	-7.8	-14.0	0.0	-2.1	-13.3	-11.2	-15.3	-	10.4	9.3	-1.6	16.3	17.2	1.9
2	-	-	11.7	4.1	0.0	-2.6	-	9.5	10.1	11.4	2.2	-4.1	-	0.0	-10.2	-6.7	-11.6	-	16.3	-	6.1	-	-	10.1
3	-	-	-	18.6	20.0	1.7	-	-	-	-	15.1	10.4	-	17.4	0.0	-3.6	-7.3	-	-	-	-	-	-	-
4	-	-	-	-	-	11.0	-	-	-	-	-	-	-	-	7.4	0.0	-0.5	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.3	11.1	0.0	-	-	-	-	-	-	-

Stem may seat easily with some cement removal (new stem sits proud by 0.1 – 10 mm).
Restoration of original stem height (0 mm).
Revision stem seats easily (new stem height < 0 mm).
- Stem would not seat within 20 mm of original height.

Revision Stem Compatibility - Additional Stem Anteversion (°)

InCement Revision C-STEM Size	Prosthesis to Revise From																						
	Exeter 37.5						Exeter 44						C-STEM					CPT				CHARNLEY®		
	CDH	0	1	2	3	4	0	1	2	3	4	5	1	2	3	5	6	1	2	3	4	FB45	FB40	RB45
1	-	-	13.0	1.0	21.0	17.0	-	5.0	7.0	2.0	13.2	24.0	0.0	3.0	15.0	12.0	17.0	-	-	1.0	6.0	-	-	5.0
2	-	-	-	4.0	7.0	7.0	-	7.0	-	1.0	8.0	13.0	-	0.0	13.0	10.0	18.0	-	-	-	0.0	6.0	-	-
3	-	-	-	-	-	6.0	-	-	-	-	-	-	-	-	0.0	4.0	4.0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.0	0.0	4.0	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-

Limited change in anteversion (-2° to +2°).
Small increase in anteversion (3° to 4°).
Large increase in anteversion (>5°).
- Anteversion not assessed – stem would not seat within 10mm of original height.

Given the slight variation in shoulders between C-STEM and C-STEM AMT it may be necessary to clear some bone cement from the proximal area of Gruen zone 1 for the tables to be relevant for C-STEM AMT.

Centralisers and End Caps

The use of centralisers and end caps in primary hip surgery whilst using polished stems assists in ensuring that there is adequate cement around the tip of the stem as well as providing an area in which the stem can sink through controlled subsidence. However, during InCement Revision the use of these is unclear as to their effect on the outcome of the surgery. The literature, anecdotal evidence and the opinion of the surgeon community, is mixed on the subject and no robust evidence exists to support the use of a void centraliser for InCement. Stefanovic-Lawbuary et al[3] and Duncan et al[2] provide evidence that InCement can be successful without a centraliser and therefore it is suggested that surgeon choice prevails.

■ *"The place for a hollow distal centralizer in cement-within-cement exchange is unclear. In primary hip arthroplasty, centralizers assist in ensuring adequate cement mantle thickness and stem alignment.[8] Hollow centralizers are thought to enhance controlled subsidence of a polished taper stem in cement, but their value in cement-within-cement stem exchange is uncertain, and the limited number of cases available in this study did not enable investigation of this."*

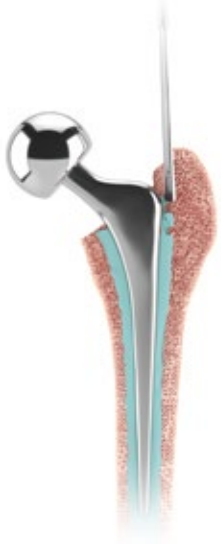
From "Cement-Within-Cement Stem Exchange Using the Collarless Polished Double-Taper Stem" Mandziak et al.[9]

■ **Note:** Trial stems do not take centralisers into consideration; should you want to use one please consider this whilst cleaning and clearing the distal space.

Figure 3. C-STEM AMT with end cap

Key Surgical Steps

1

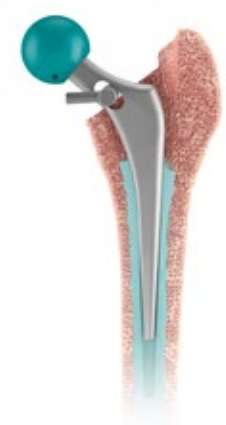


Stem Removal

2

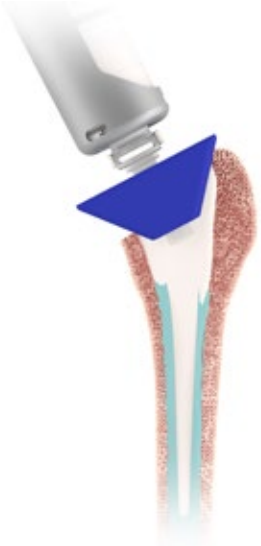
Check Cement Integrity

3



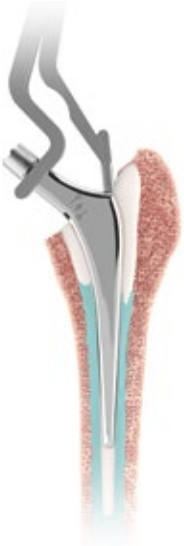
Trialling

4



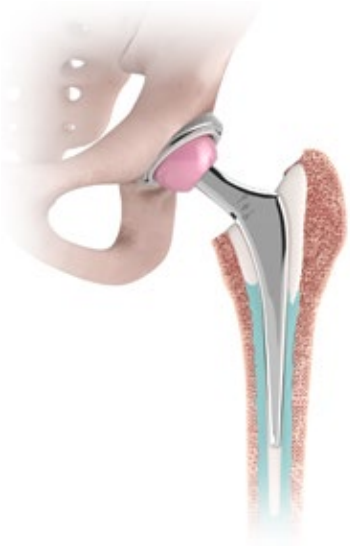
Cementation

5



C-STEM AMT Introduction

6



Final Reduction

Planning

The following patient selection algorithm is recommended:

1. **Reasons for performing InCement revision:**
- To correct stem offset, leg length or, to a limited extent, version
- To replace damaged heads, necks or trunnions
- To facilitate acetabular revision

2. **Patient selection criteria:**
- Pre-operative templating is recommended to evaluate compatibility, leg length and offset between the new C-STEM AMT implant and the existing stem

3. **A patient should have:**
- An intact and stable distal cement mantle (distal to and including the lesser trochanter)
- No evidence of osteolysis in Gruen zones in any zone other than 7, 8 and 14 (Figure 4)
- Barrack grades A or B (Table 3)

■ *Quinlan et al.[6] - "This technique can also be employed.. ...in exceptional circumstances, in the presence of infection where there is complete osseo integration of the femoral cement bone interface."*

■ *Morley et al.[4] "The technique is only appropriate for use in infected cases under strict selection criteria"*

■ **Note:** The conclusion of the design team was that the use of this technique in the presence of infection should be limited to:
- Patients where single stage revision is appropriate
- The organism has been cultured and positively identified
- The cultured organism is sensitive to the antibiotic cement in use
- In this case, burring of the existing mantle is recommended[7]

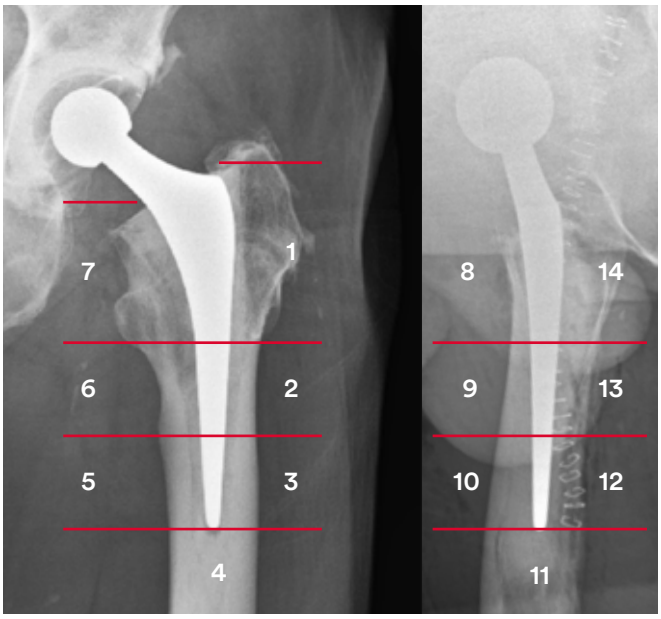


Figure 4. Gruen zones

Grading	Radiographic characteristics
A	Complete filling of the medullary canal, without radiolucent lines between the cement and the bone (white-out)
B	Radiolucent line covering up to 50% of the bone–cement interface
C	Radiolucent line covering between 50% and 99% of the cement–bone interface or incomplete cement mantle.
D	Complete radiolucent line (100%) at the cement–bone interface and/or absence of cement distally to the end of the stem

Table 3. Barrack grades (Barrack et al. 1992).[10]

Pre-operative Planning

Make a thorough radiographic examination of the contralateral side, using both A/P and M/L projections, taking into consideration any anatomical anomalies, dysplasia or previous osteotomy. The radiographs should be at 120% magnification and the hips internally rotated to 15°. They should clearly demonstrate the acetabular configuration, the endosteal and the periosteal contours of the femoral head, neck and proximal femur.

Templating Femoral Implant Size

The C-STEM AMT implant system offers a complete range of femoral templates. When the approximate size template is selected, overlay the outline above an A/P radiograph of the femur with the implant's centre line in line with the long axis of the femur. Position the template so that the centre of the central depth marking is level with the proposed neck resection and the cement mantle outline fills the proximal femoral canal. With the template positioned accurately, the centre of rotation of the head should overlay the centre of the femoral head or be providing the offset required for the revision procedure (Figure 5).

If the patient has a higher than normal offset, consider the equivalent size high offset template. With C-STEM AMT this distance is increased by either 6 mm or 8 mm depending on size. The high offset option can also be used during surgery to optimise abductor tension.

Limb Length Adjustment

Raise or lower the implant outline along the long axis of the femur to increase or decrease leg length, without adjusting the offset. Use the middle slot or hole in the template to mark the neck resection level.

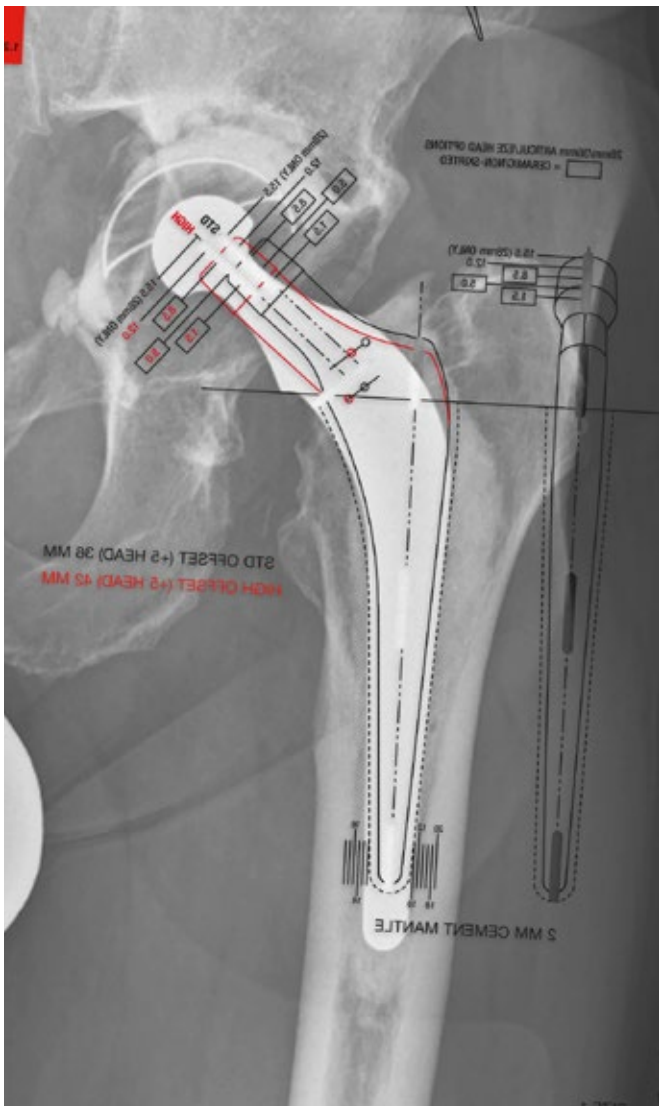


Figure 5. C-STEM AMT X-ray templating

Stem Extraction

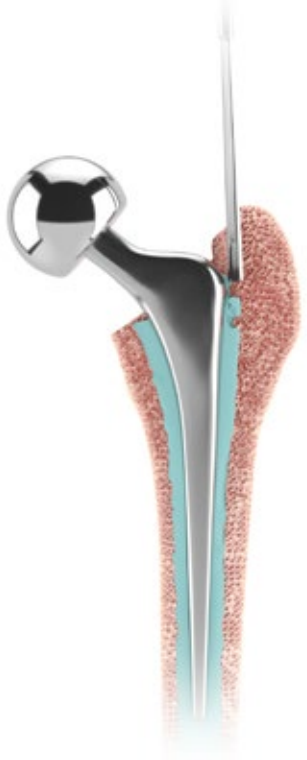


Figure 6. Remove cement from lateral shoulder.

Stem exposure and removal

Once the femoral stem and head have been exposed remove cement around the lateral shoulder using a burr or osteotome whilst utilising your favoured technique (Figure 6). Your technique should first involve the removal of enough proximolateral cement with a burr or osteotome to allow stem removal as the overhanging cement prevents a straight line removal.

Remove the stem using a slap hammer and appropriate adaptor on the end, taking care not to damage the proximal bone or intact proximal cement (Figure 7).

■ **Note:** a stem removal loop is available in the InCement revision kit but you may use your own stem removal instruments.

■ **Note:** to remove a stem where the slap hammer does not engage distal to the taper, consider using a burr to create a small notch.

Figure 7. Remove the stem using a slap hammer

Check Cement Integrity

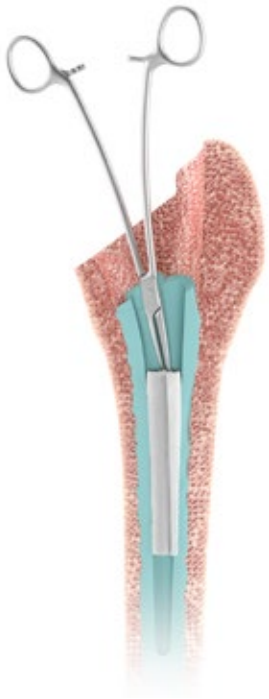


Figure 8. Block distal cavity

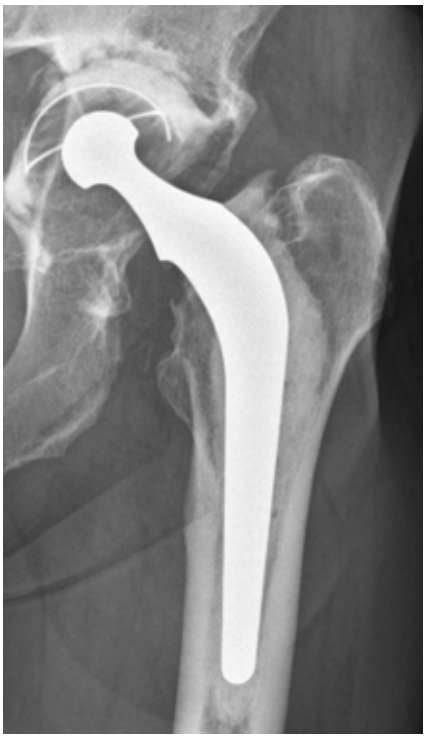


Figure 9. Check cement mantle

Figure 10. Remove loose cement

Check cement integrity

With the stem removed, check the integrity of the canal and then block the distal cavity with a gauze roll or equivalent (Figure 8). Check the remaining cement mantle for integrity and stability whilst utilising pre-operative x-rays to determine areas of radiolucency (Figure 9). Loose cement or membrane should be removed to ensure good fixation; the cement can be removed to a level just proximal to the lesser trochanter (check) whilst still allowing an InCement revision to be possible (Figure 10).

■ **Note:** The femoral neck may be re-cut if necessary to allow the cement-bone interface to be inspected.

■ **Note:** The aim of the gauze is to prevent debris from entering and being lodged in the cavity which could prevent stem seating. Remove the gauze just prior to stem trialling.

Trialling

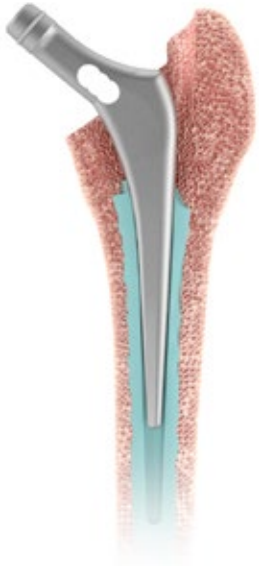


Figure 11. Assess size and fit

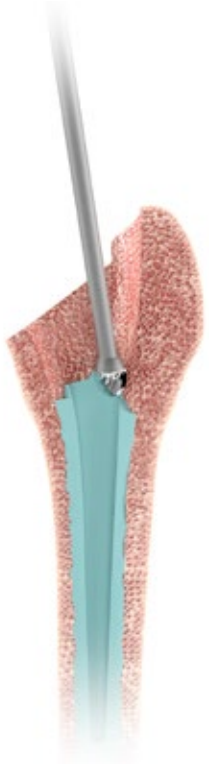


Figure 12. Remove additional cement

Stem trialling and assessment

Utilising the trial stem and trial head, assess the size and fit that provides appropriate hip mechanics, leg length and stem anteversion (Figure 11). Where necessary utilise a swab to pack the space between the trial stem and mantle as required to stabilize the construct; this can be achieved by wrapping the gauze around the trial. If the trial stem doesn't appropriately fit the space, replace the gauze in the distal space and remove additional cement as required utilising either an osteotome or a high speed burr until the trial fits (Figure 12).

■ **Note:** Whilst upsizing and downsizing please be aware of how this may affect available offset. Where possible utilise the comparator chart in Table 4.

■ **Note:** A long drill or long burr may be used down the canal to ensure there is enough distal space where the new stem is longer than the revised stem or where the surgeon would like to utilise a cement spacer.

Size	Offset with head (mm)		
	+1.5	+5	+8.5
1 Standard	33	35.5	38.5
1 HO	39	41.5	44.5
2 Standard	35	37.5	40.5
2 HO	41	43.5	46.5

Table 4. C-STEM AMT head offsets
(a complete chart may be found on page 28).

Trialling

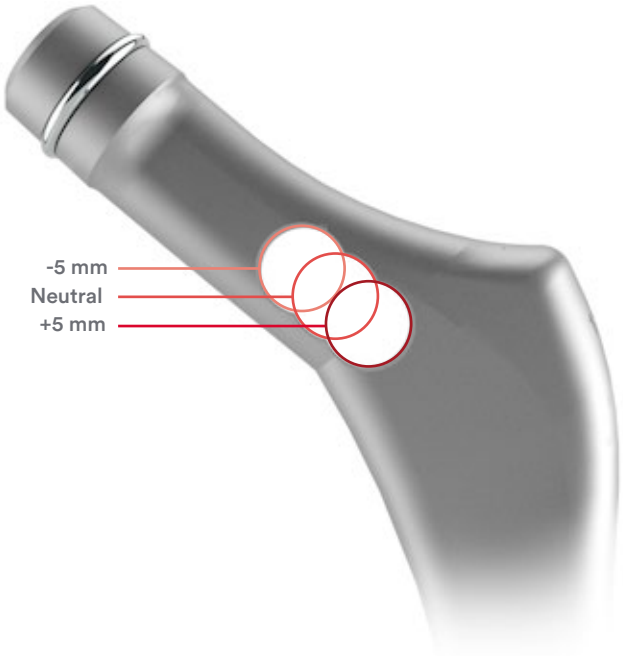


Figure 13. Trialling

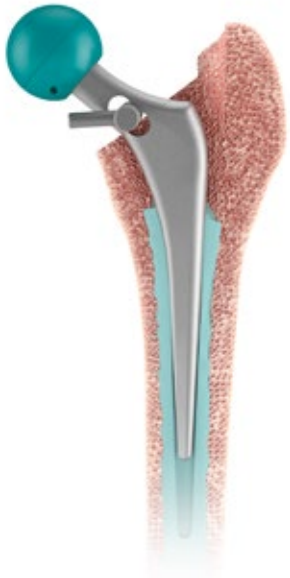


Figure 14. Trialling

Using the peg during trialling

The trial stem has three holes positioned to match the three positions indicated by the implant markings on the template and stem (Figure 13). Select the appropriate trial stem and locate the trial stem peg in the central hole, holding the trial stem in the neutral position (or in the hole which matches the level noted during pre-operative templating) and introducing the trial stem into the femur. Place the trial head on the neck of the trial stem (Figure 14), reduce the hip and assess joint stability, range of motion and leg length.

Cementing Technique

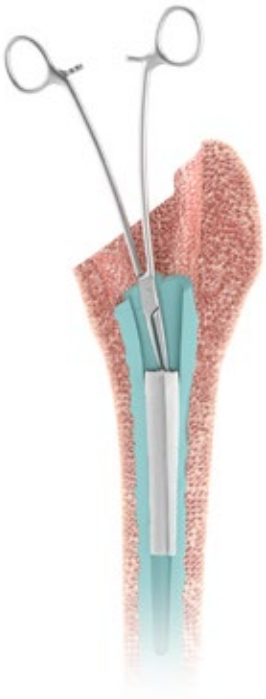


Figure 15. Dry and remove debris

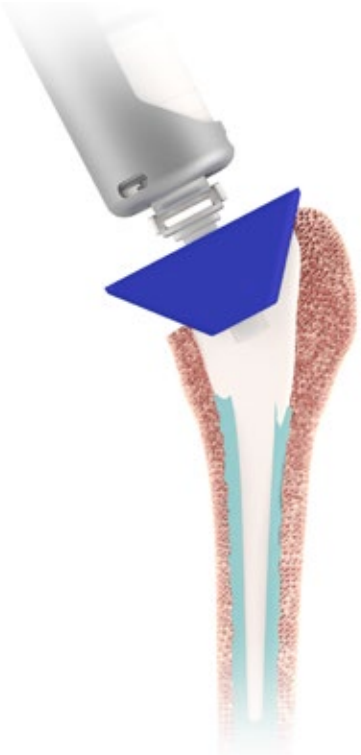


Figure 16. Cement pressurisation

Canal preparation

Once the mantle has been prepared utilise pulsatile lavage to clear the femoral canal of debris and open the interstices of the bone now visible due to cement removal. Pass a swab down the femoral canal to help dry and remove any remaining debris (Figure 15).

■ **Note:** Ensure any gauze used has been removed prior to pulse lavage and cementing.

Cementing the cavity

Fill cavity using cement in a low viscosity state (Figure 16). Start at the distal part of the femoral canal and inject the cement in a retrograde fashion, allowing the cement to push the nozzle gently back, until the canal is completely filled and the distal tip of the nozzle is clear of the canal and insert stem.

■ **Note:** A narrow nozzle is recommended; whilst using these be careful not to over pressurise the nozzle as this may lead to leakage and pressure loss.

Stem Introduction

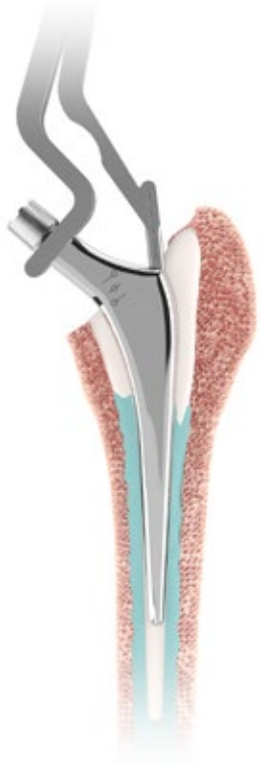


Figure 17. Stem introduction

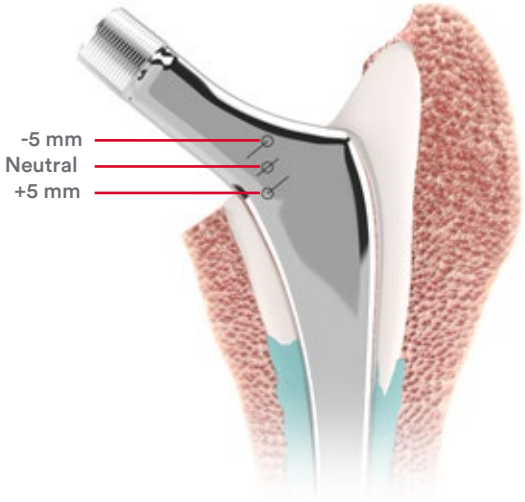


Figure 18. Stem depth markings

Femoral stem implantation

To assemble the introducer to the stem, compress the lever and carefully locate the two forks behind the taper on the neck of the implant. Then insert the prong into the dimple on the lateral shoulder of the implant and then gently release the lever. The stem should now be securely attached to the introducer. **DO NOT IMPACT THE INTRODUCER.**

Introduce the implant in line with the long axis of the femur. Its entry point should be lateral, close to the greater trochanter. During stem insertion maintain thumb pressure on the cement at the medial femoral neck ensuring the stem is in the middle of the prepared cavity (Figure 17).

In terms of implantation depth, the stem is “neutrally” seated when the middle marking on the stem is level with the neck resection (Figure 18). The additonal lines allow the implant to be raised or lowered; to increase or decrease leg length, without adjusting the offset.

Remove excess cement with a curette. Maintain the position of the stem until the cement has completely polymerized.

To remove the alternative introducer (2522-00-503) from the stem, compress the lever slightly whilst gently pulling the instrument away from the implant taking care not to disturb the cement whilst it is curing.

Note: Due to the larger cross sectional area of the alternative introducer (2522-00-503) (Figure 17) there is an increased risk of soft tissue impingement. In cases where there is concern that the alternative introducer may impinge with soft tissue it is recommended that the original stem introducer (2522-00-502) is used.

Tip: As well as the retained inserter there is also a straight, non-retaining introducer and a curved, non-retaining introducer.

Head Impaction and Closure

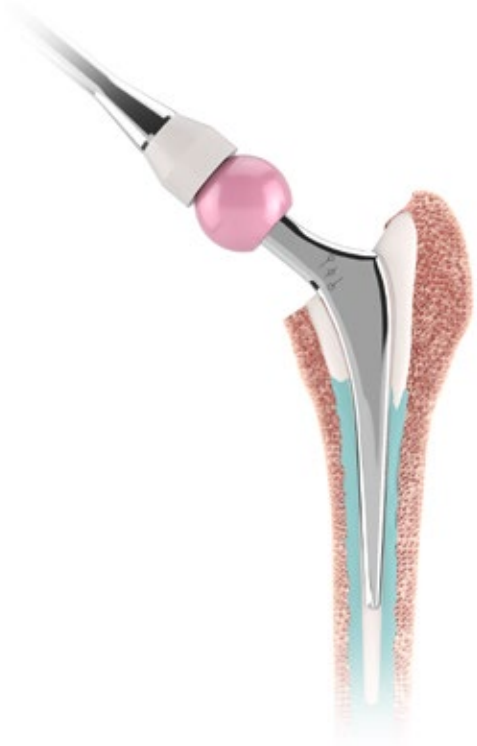


Figure 19. Head impaction

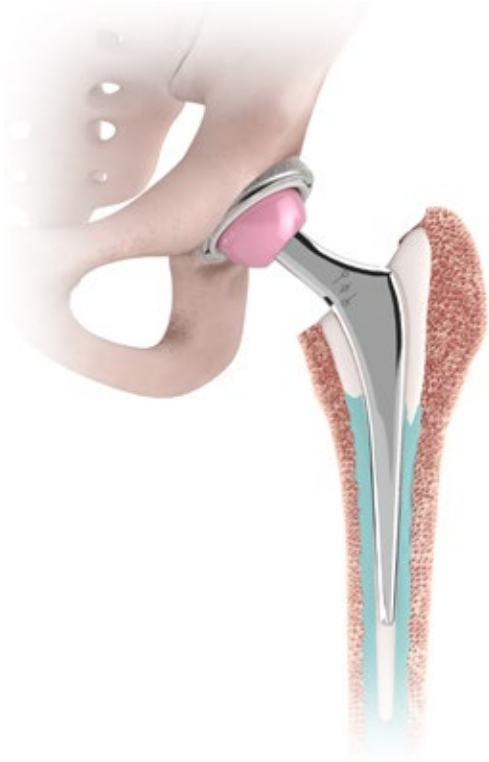


Figure 20. Final reduction

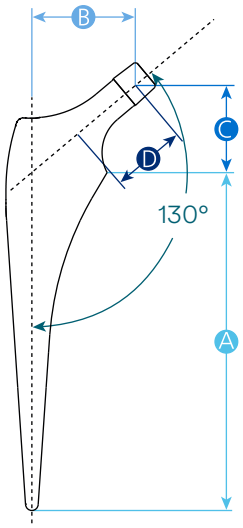
Head impaction

Once the cement has completely set, place the trial head on the implant and perform a final trial reduction. Remove the trial head then irrigate, thoroughly clean and dry the taper to remove any fluid or particulate debris. Twist and push the definitive head onto the taper using the head taper, then impact firmly with head impactor (Figure 19). Reduce the hip to carry out a final assessment of joint mechanics and stability.

Closure

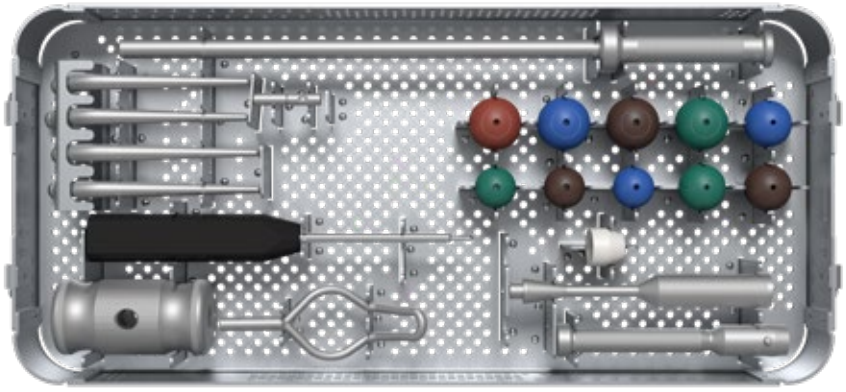
Closure is based on the surgeon's preference and the individual case. The repair should be tested throughout the hip range of motion.

Technical Specifications



Size	A = Stem Length (mm)	B = Offset with head (mm)					C = Leg Adjustment Length with head (mm)					D = Neck Length with head (mm)				
		-2	+1.5	+5	+8.5	+12	-2	+1.5	+5	+8.5	+12	-2	+1.5	+5	+8.5	+12
1 Standard	106	30.5	33	35.5	38.5	41	22	24	26.5	28.5	31	23.5	27	30.5	34	37.5
1 HO	106	36.5	39	41.5	44.5	47	22	24	26.5	28.5	31	27.5	31	34.5	38	41.5
2 Standard	110.5	32.5	35	37.5	40.5	43	23.5	26	28	30.5	32.5	25	28.5	32	35.5	39
2 HO	110.5	38.5	41	43.5	46.5	49	23.5	26	28	30.5	32.5	29	32.5	36	39.5	43
3 Standard	115	32.5	35	37.5	40.5	43	25	27.5	29.5	32	34	25	28.5	32	35.5	39
3 HO	115	38.5	41	43.5	46.5	49	25	27.5	29.5	32	34	29	32.5	36	39.5	43
4 Standard	119.5	34.5	37	39.5	42.5	45	27.5	29.5	32	34	36.5	27	30.5	34	37.5	41
4 HO	119.5	42.5	45	47.5	50.5	53	27.5	29.5	32	34	36.5	32.5	36	39.5	43	46.5
5 Standard	124	34.5	37	39.5	42.5	45	28.5	31	33	35.5	37.5	27	30.5	34	37.5	41
5 HO	124	42.5	45	47.5	50.5	53	28.5	31	33	35.5	37.5	32.5	36	39.5	43	46.5
6 Standard	128.5	36.5	39	41.5	44.5	47	30.5	33	35	37.5	39.5	29	32.5	36	39.5	43
6 HO	128.5	44.5	47	49.5	52.5	55	30.5	33	35	37.5	39.5	34	37.5	41	44.5	48
7 Standard	133	36.5	39	41.5	44.5	47	31.5	34	36	38.5	40.5	29	32.5	36	39.5	43
7 HO	133	44.5	47	49.5	52.5	55	31.5	34	36	38.5	40.5	34	37.5	41	44.5	48
8 Standard	137.5	38.5	41	43.5	46.5	49	33.5	35.5	38	40	42.5	31	34.5	38	41.5	45
8 HO	137.5	46.5	49	51.5	54.5	57	33.5	35.5	38	40	42.5	36	39.5	43	46.5	50

Ordering Information



C-STEM AMT InCement Kit

2580-00-150	C-STEM AMT InCement Tray
2580-01-085	C-STEM AMT Stem Trial Sz 1 Std
2580-02-085	C-STEM AMT Stem Trial Size 1 HO
2580-01-086	C-STEM AMT Stem Trial Size 2 Std
2580-02-086	C-STEM AMT Stem Trial Size 2 HO
2709-04-001	Flexible Osteotome Handle
9611-88-000	C-STEM AMT Peg Trial Pin
2522-00-502	ELITE™ Stem Introducer
2001-65-000	Femoral Head Impactor
2530-81-000	ARTICUL/EZE™ 28 mm Trial Head +1.5
2530-82-000	ARTICUL/EZE 28 mm Trial Head +5
2530-83-000	ARTICUL/EZE 28 mm Trial Head +8.5
2530-91-000	ARTICUL/EZE 32 mm Trial Head +1
2530-92-000	ARTICUL/EZE 32 mm Trial Head +5
2530-93-000	ARTICUL/EZE 32 mm Trial Head +9
2531-51-000	ARTICUL/EZE 36 mm Trial Head +1.5
2531-52-000	ARTICUL/EZE 36 mm Trial Head +5
2531-53-000	ARTICUL/EZE 36 mm Trial Head +8.5
2531-50-000	ARTICUL/EZE 36 mm Trial Head -2
531205	Slide Hammer Weight
531206	Slide Hammer Shaft
534400	Stem Extractor Loop

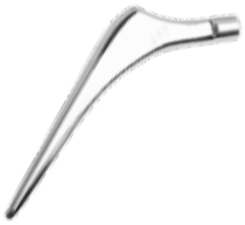
Options

2522-00-503	C-STEM AMT Curved Stem Introducer
2522-00-504	C-STEM AMT Stem Introducer

C-STEM AMT Femoral Implants

1570-04-070	C-STEM AMT Size 1 Standard Offset
1570-04-085	C-STEM AMT Size 2 Standard Offset
1570-04-090	C-STEM AMT Size 3 Standard Offset
1570-04-100	C-STEM AMT Size 4 Standard Offset
1570-04-110	C-STEM AMT Size 5 Standard Offset
1570-04-120	C-STEM AMT Size 6 Standard Offset
1570-04-135	C-STEM AMT Size 7 Standard Offset
1570-04-150	C-STEM AMT Size 8 Standard Offset

1570-14-070	C-STEM AMT Size 1 High Offset
1570-14-085	C-STEM AMT Size 2 High Offset
1570-14-090	C-STEM AMT Size 3 High Offset
1570-14-100	C-STEM AMT Size 4 High Offset
1570-14-110	C-STEM AMT Size 5 High Offset
1570-14-120	C-STEM AMT Size 6 High Offset
1570-14-135	C-STEM AMT Size 7 High Offset
1570-14-150	C-STEM AMT Size 8 High Offset



ARTICUL/EZE 12/14 BIOLOX® *delta* Head 28 mm

1365-28-310	28 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +1.5
1365-28-320	28 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +5
1365-28-330	28 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +8.5

ARTICUL/EZE 12/14 BIOLOX *delta* Head 32 mm

1365-32-310	32 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +1
1365-32-320	32 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +5
1365-32-330	32 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +9

ARTICUL/EZE 12/14 BIOLOX *delta* Head 36 mm

1365-36-310	36 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +1.5
1365-36-320	36 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +5
1365-36-330	36 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +8.5
1365-36-340	36 mm 12/14 ARTICUL/EZE BIOLOX *delta* Head Neck Length +12

ARTICUL/EZE 12/14 Cobalt Chrome Head 22.225 mm

136529000	ARTICUL/EZE Cobalt Chrome 22.225 mm Modular Head +4
136530000	ARTICUL/EZE Cobalt Chrome 22.225 mm Modular Head +7

ARTICUL/EZE 12/14 ULTAMET™ Head 28 mm

1365-11-500	28 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length +1.5
1365-12-500	28 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length +5
1365-13-500	28 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length +8.5

ARTICUL/EZE 12/14 Metal Head 32 mm

1365-21-000	32 mm 12/14 ARTICUL/EZE Metal Head Neck Length +1
1365-22-000	32 mm 12/14 ARTICUL/EZE Metal Head Neck Length +5
1365-23-000	32 mm 12/14 ARTICUL/EZE Metal Head Neck Length +9
1365-24-000	32 mm 12/14 ARTICUL/EZE Metal Head Neck Length +13 Skirted

ARTICUL/EZE 12/14 ULTAMET Head 36 mm

1365-50-000	36 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length -2
1365-51-000	36 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length +1.5
1365-52-000	36 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length +5
1365-53-000	36 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length +8.5
1365-54-000	36 mm 12/14 ARTICUL/EZE ULTAMET Head Neck Length +12

ARTICUL/EZE Ball 22.225 mm

9113-112	22.225 mm ARTICUL/EZE Ball +5
9113-113	22.225 mm ARTICUL/EZE Ball +9

ARTICUL/EZE Ball 28 mm

1365-11-000	28 mm ARTICUL/EZE Ball +1.5 GR
1365-12-000	28 mm ARTICUL/EZE Ball +5 BR
1365-13-000	28 mm ARTICUL/EZE Ball +8.5 BL
1365-14-000	28 mm ARTICUL/EZE Ball +12 BLK
1365-15-000	28 mm ARTICUL/EZE Ball +15.5 WH

ARTICUL/EZE Ball 32 mm

1365-21-000	32 mm ARTICUL/EZE Ball +1 GR
1365-22-000	32 mm ARTICUL/EZE Ball +5 BR
1365-23-000	32 mm ARTICUL/EZE Ball +9 BL
1365-24-000	32 mm ARTICUL/EZE Ball +13 BLK
1365-25-000	32 mm ARTICUL/EZE Ball +17 WH

Hip Ball BIOLOX 28 mm

9111-121	28 mm 12/14 Hip Ball BIOLOX +1.5
9111-122	28 mm 12/14 ARTICUL/EZE BIOLOX +5
9111-123	28 mm 12/14 ARTICUL/EZE BIOLOX +8.5

Hip Ball BIOLOX 32 mm

9111-131	32 mm 12/14 Hip Ball BIOLOX +1
9111-132	32 mm 12/14 Hip Ball BIOLOX +5
9111-133	32 mm 12/14 Hip Ball BIOLOX +9

C-STEM AMT Cement Restrictor Kit

5460-02-000	Cement Restrictor Inserter
5460-30-000	SS Cement Restrictor Trial 1
5460-32-000	SS Cement Restrictor Trial 2
5460-34-000	SS Cement Restrictor Trial 3
5460-36-000	SS Cement Restrictor Trial 4
5460-38-000	SS Cement Restrictor Trial 5
5460-40-000	SS Cement Restrictor Trial 6
5460-42-000	SS Cement Restrictor Trial 7

End Caps and Centralisers

9612-26-000	C-STEM End Cap (PMMA)
9612-46-000	C-STEM Centraliser

Void Centralisers

9612-10-500	C-STEM Void Centraliser Size 10
9612-12-500	C-STEM Void Centraliser Size 12
9612-14-500	C-STEM Void Centraliser Size 14
9612-16-500	C-STEM Void Centraliser Size 16
9612-18-500	C-STEM Void Centraliser Size 18
9612-20-500	C-STEM Void Centraliser Size 20

X-ray Templates

2580-00-056	C-STEM AMT X-ray Templates

Femoral Revision Kit

1	2709-01-001	Crochet Hook
2	2709-01-002	Flag Splitter
3	2709-01-003	V Splitter
4	2709-01-004	Straight Gouge
5	2709-01-005	Modified Angled Gouge
6	2709-01-006	Reverse Curette 6 mm x 432 mm
	2709-01-007	Reverse Curette 7 mm x 432 mm
7	2709-01-008	Chisel 8 mm x 432 mm
8	2709-01-010	7 mm "X" Osteotome
6	2709-01-011	Reverse Curette 11 mm x 432 mm
9	2709-01-012	Conical Tap 9 mm
	2709-01-013	Conical Tap 11 mm
	2709-01-014	Twist Drill 6.4 mm
	2709-01-015	Twist Drill 8 mm
10	2709-01-016	Rongeur with Serrated Teeth 300 mm
	2709-01-100	Femoral Delivery System

Acetabular Revision Kit

11	2709-02-001	Acetabular Gouge 48 mm x 13 mm
	2709-02-002	Acetabular Gouge 52 mm x 13 mm
	2709-02-003	Acetabular Gouge 56 mm x 13 mm
12	2709-02-004	Curved Acetabular Chisel
13	2709-02-005	Round Acetabular Cement Splitter
14	2709-02-006	Slotted Mallet with Delrin Cap
15	2709-02-007	Acetabular Component Gripper
16	2709-02-008	Acetabular Component Forceps
	2709-02-100	Acetabular Delivery System

Hip Revision Extractor Kit

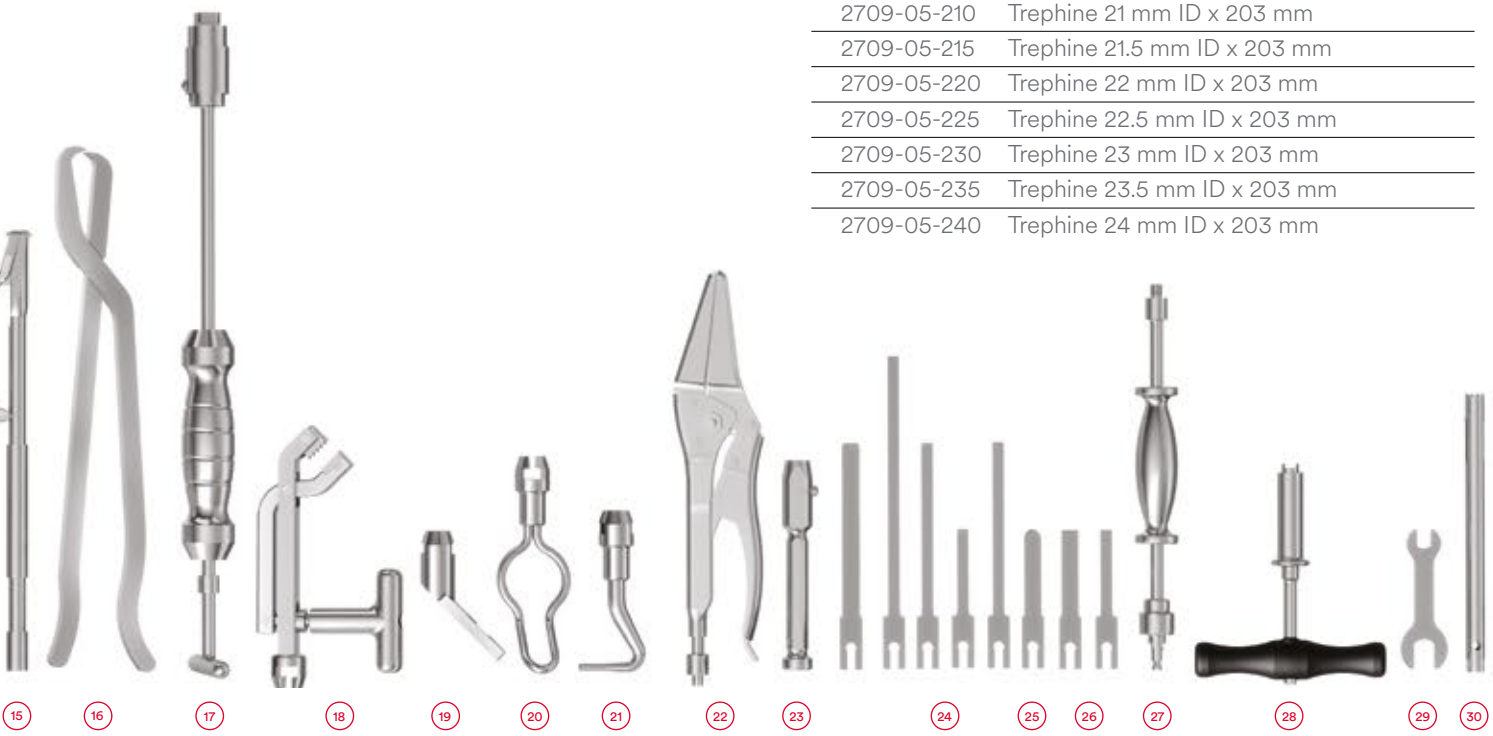
17	2709-03-001	Femoral Extractor Slap Hammer
18	2709-03-002	Universal Mod Stem Extractor
19	2709-03-003	One-Piece Stem Adapter
20	2709-03-004	Closed Looped Extractor
21	2709-03-005	Hook Stem Extractor
22	2709-03-006	Locking Pliers
	2709-03-007	Locking Pliers Slap Hammer Adapter

Flexible Osteotome Kit

23 2709-04-001	Handle with Quick-Couple End
2709-04-002	Small Slap Hammer
24 2709-04-004	Thin Osteotome 8 mm x 76 mm
2709-04-005	Thin Osteotome 10 mm x 76 mm
2709-04-006	Thin Osteotome 12 mm x 76 mm
2709-04-007	Thin Osteotome 20 mm x 76 mm
25 2709-04-008	Thin Osteotome Curved 12 mm
2709-04-009	Thin Osteotome Curved 20 mm
2709-04-010	Thin Osteotome 8 mm x 127 mm
2709-04-011	Thin Osteotome 10 mm x 127 mm
2709-04-012	Radial Osteotome 10 mm x 127 mm
2709-04-013	Radial Osteotome 12 mm x 127 mm
2709-04-014	Radial Osteotome 14 mm x 127 mm
2709-04-015	Radial Osteotome 16 mm x 127 mm
2709-04-016	Radial Osteotome 20 mm x 127 mm
2709-04-017	Extra Long Osteotome 8 mm x 229 mm
26 2709-04-018	Flex Chisel Blade 8 mm x 64 mm
2709-04-019	Flex Chisel Blade 10 mm x 64 mm
2709-04-020	Flex Chisel Blade 12 mm x 64 mm
2709-04-021	Flex Chisel Blade 20 mm x 64 mm
2709-04-022	Flex Chisel Blade 8 mm x 127 mm
2709-04-023	Flex Chisel Blade 10 mm x 127 mm
2709-04-024	Flex Chisel Blade 12 mm x 127 mm
2709-04-025	Flex Chisel Blade 20 mm x 127 mm
2709-04-100	Flex Osteotome Delivery System

Trephine set

27 2709-05-001	Slap Hammer Shaft
28 2709-05-002	Quick Connect T-Handle
2709-05-003	T-Bar Stem Extractor
29 2709-05-004	Wrench
2709-05-100	Trephine Delivery System
30 2709-05-110	Trephine 11 mm ID x 203 mm
2709-05-115	Trephine 11.5 mm ID x 203 mm
2709-05-120	Trephine 12 mm ID x 203 mm
2709-05-125	Trephine 12.5 mm ID x 203 mm
2709-05-130	Trephine 13 mm ID x 203 mm
2709-05-135	Trephine 13.5 mm ID x 203 mm
2709-05-140	Trephine 14 mm ID x 203 mm
2709-05-145	Trephine 14.5 mm ID x 203 mm
2709-05-150	Trephine 15 mm ID x 203 mm
2709-05-155	Trephine 15.5 mm ID x 203 mm
2709-05-160	Trephine 16 mm ID x 203 mm
2709-05-165	Trephine 16.5 mm ID x 203 mm
2709-05-170	Trephine 17 mm ID x 203 mm
2709-05-175	Trephine 17.5 mm ID x 203 mm
2709-05-180	Trephine 18 mm ID x 203 mm
2709-05-185	Trephine 18.5 mm ID x 203 mm
2709-05-190	Trephine 19 mm ID x 203 mm
2709-05-195	Trephine 19.5 mm ID x 203 mm
2709-05-200	Trephine 20 mm ID x 203 mm
2709-05-205	Trephine 20.5 mm ID x 203 mm
2709-05-210	Trephine 21 mm ID x 203 mm
2709-05-215	Trephine 21.5 mm ID x 203 mm
2709-05-220	Trephine 22 mm ID x 203 mm
2709-05-225	Trephine 22.5 mm ID x 203 mm
2709-05-230	Trephine 23 mm ID x 203 mm
2709-05-235	Trephine 23.5 mm ID x 203 mm
2709-05-240	Trephine 24 mm ID x 203 mm



References:

1. Holt G, Hook S, Hubble M. Revision total hip arthroplasty: the femoral side using cemented implants. Int Orthop. 2011 Feb;35(2):267-73.
2. Duncan WW, Hubble MJW, Howell JR, Whitehouse SL, Timperley AJ, Gie GA. Revision of the cemented femoral stem using a cement-in-cement technique. A five- to 15-year review. J Bone Joint Surg [Br] 2009;91-B:577-82.
3. Stefanovich-Lawbuary NS, Parry MC, Whitehouse MR, Blom AW. Cement in Cement Revision of the Femoral Component Using a Collarless Triple Taper: A Midterm Clinical and Radiographic Assessment. J Arthroplasty. 2014 Oct;29(10):2002-6.
4. Morley JR, Blake SM, Hubble MJW, Timperley AJ, Gie GA, Howell JR. Preservation of the original femoral cement mantle during the management of infected cemented total hip arthroplasty by two-stage revision. J Bone Joint Surg [Br]2012: 94B: 322-7.
5. James R. Berstock, Torrie PAG, Smith JRA, Webb JC, Baker RP. Stem compatibility for cement-in-cement femoral revision: an in vitro study. Hip Int. 2014 Sep-Oct;24(5):434-41.
6. Quinlan JF, O'Shea K, Doyle F, Brady OH. In-cement technique for revision hip arthroplasty. J Bone Joint Surg [Br] 2006;88-B:730-3.
7. Powles JW, Spencer RF, Lovering AM. Gentamicin release from old cement during revision hip arthroplasty. J Bone Joint Surg Br. 1998 Jul;80(4):607-10.
8. Goldberg BA, Al-Habbal G, Noble PC, Paravic M, Liebs TR, Tullos HS. Proximal and Distal Femoral Centralizers in Modern Cemented Hip Arthroplasty. Clinical Orthopaedics & Related Research: April 1998 - Volume 349 - Issue - pp 163-173
9. Mandziak DG, Howie DW, Neale SD, McGee MA. Cement-Within-Cement Stem Exchange Using the Collarless Polished Double-Taper Stem. The Journal of Arthroplasty Vol. 22 No. 7 2007.
10. Barrack RL, Mulroy Jr RD, Harris WH. Improved Cementing Techniques and Femoral Component Loosening in Young Patients with Hip Arthroplasty. J Bone Joint Surg [Br] 1992. Vol. 74-B No. 3 385-389.

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