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GTS Primary Hip Stem

Surgical Technique

BIOMET®

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GTS Primary Hip Stem Surgical Technique

Introduction

The Global Tissue Sparing (GTS) implant is a modern primary cementless stem which was developed by Prof. Grappiolo in close collaboration with Biomet. The stem incorporates new features to address the growing demand for bone conserving, tissue sparing total hip arthroplasty.

The objective of bone preservation is attained through:

- Preservation of the greater trochanter
- Limited invasion of the femoral canal

The optimal implant stability is achieved in 3 different ways:

- Metaphyseal press-fit obtained by the tapered wedge design and femoral bone compaction
- Rotational stability thanks to the elliptic-octagonal stem cross-section
- Enhanced rotational stability achieved by the longitudinal anterior and posterior bone compression fins

The standard (133º CDD angle) and varized (122º CCD angle) GTS stems offer a wide range of offset options to accurately restore the hip anatomy and biomechanics.

Operative Technique

Step 1.0. Pre-operative Planning

The objectives of the pre-operative planning are to define:

- The pre-operative leg length,
- The acetabular component size and position
- The femoral component size
- The femoral offset and centre of rotation

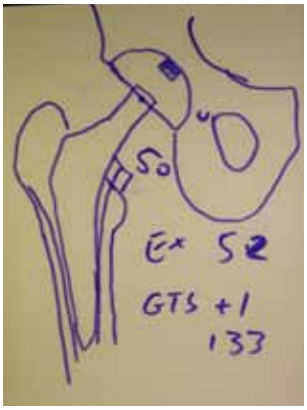
The GTS stem provides a comprehensive selection of femoral X-ray templates in 100%, 110% and 115% magnification.

Step 1.1. Manual Pre-operative Planning

Pre-operative planning can be easily performed with the GTS X-ray templates. It is recommended to use a radiographic marker to assess the X-ray magnification and select the appropriate template.

These templates are positioned over the AP X-rays to best decide the correct implant size and centre of rotation.

To ensure the optimal restoration of the hip joint, the GTS stem is available in 26 sizes, and two CCD angles (Standard stems:133º; Varized stems:122º). These implant options cover most patient anatomies.



Step 1.2. Digital Pre-operative Planning

The GTS digital templates are available through various digital template providers. Our software B-fits can also be used.

When using digital templating for a primary THR, it is necessary to use a magnification marker with a known dimension. This is required to calculate the correct magnification.

As soon as the correct magnification has been determined, the system can be used to best decide the correct implant size and centre of rotation.

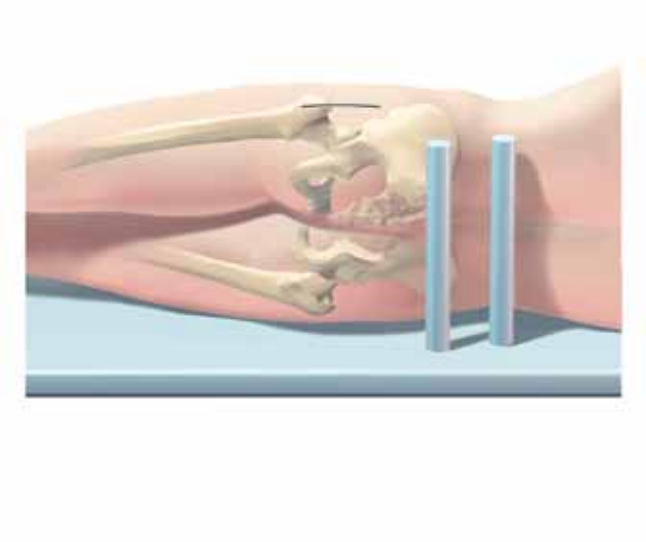
Patient Positioning/Surgical Exposure

Step 2.0 Patient Positioning / Surgical Exposure

The GTS femoral component can be implanted using any of the standard approaches for total hip replacement.

This surgical technique may be adapted to the surgeon's specific approach.

The aim of the approach selected is to provide optimal visualisation of both the acetabulum and proximal femur.



Step 3.0 Femoral Neck Resection

Once the femoral head has been dislocated from the acetabulum, the femoral neck can be resected parallel to the intertrochanteric line, 1 or 2 cm above it (Figure 1). The femoral osteotomy is defined by the pre-operative planning.

The aim of the GTS Stem surgical technique is to preserve the cortical ring of the femoral neck. The convervation of the metaphyseal bone stock can improve the implant torsional stability[1,2] and is likely to improve recovery of functions.[3] The correct positioning of the acetabulum is one of the most critical parts of a total hip arthroplasty. For this reason, it is advisable to use the "Femur First" technique which takes into consideration the combined anteversion of the cup and stem.[4]

The "Femur First" technique aims at obtaining an optimal acetabular cup positioning in order to reduce the risk of wear debris generation, maximise the postoperative range of motion and minimise the risk of impingement. The correct positioning of the acetabular components is assessed in relation to the position of the femoral rasp, trial neck and trial heads.

The appropriate rasp, trial neck and trial head are selected and implanted to reproduce the normal hip anatomy and restore the physiologic centre of rotation. By means of a trial reduction, the equatorial surface of the trial cup should be perpendicular to the axis of the femoral neck.

Once the appropriate trial cup orientation is achieved (40-45º abduction; 15-20º anteversion), the correct trial cup position can be marked with a surgical marker pen or cauterising marker. This can ease the future positioning of the final acetabular implant.

Figure 1

Step 4.0 Femoral Canal Opening

The femoral canal is opened with the femoral starter (Figure 2a). Care must be taken to conserve as much cancellous bone as possible. The femoral starter is introduced at the centre of the femoral neck (Figure 2b). If the cancellous bone is particularly hard, gently rotate the femoral starter to ease the insertion. Once the femoral starter penetrates the femoral canal, the starter should be used with a linear motion, following the axis of the femoral neck.

Figure 2a

Figure 2b

Should it be necessary to correct the version, the femoral starter can be orientated as per the appropriate correction angle, which will predetermine the alignment of the successive femoral compaction rasps.

Step 5.0 Femoral Canal Preparation

Once the femoral canal has been prepared with the femoral starter, rasping can begin. The smallest compaction rasp is attached to the rasp handle. The anteversion guide must be threaded onto the shaft of the rasp handle. Sequentially larger compaction rasps are used (Figure 3) until complete stability is achieved. The final compaction rasp used should match the pre-operatively templated implant size. The top teeth of the final compaction rasp should be aligned with the resected bone.

During the femoral preparation, it is important to ensure that the anteversion guide is parallel to the medial/ lateral axis of the femoral neck, as this will determine the version of the final implant.

The anchorage of the GTS stem is mainly metaphyseal, in the inter-trochanteric region. The compaction rasps and corresponding implants are not inserted straight into the femoral canal but following the curve of the femoral medial wall (Figure 4).

The femoral compaction rasps have been designed to compact the cancellous bone without removing it. This technique optimises the initial stability of the implant.[5] A 0.8mm interference fit between the teeth of the compaction rasps and the final implant facilitates the proximal bone fixation. The tapered elliptic-octagonal cross-section of the compaction rasps and implants provides excellent rotational stability.

In order to attain a strong anterior /posterior fins press-fit and proximal lateral press-fit, the lateral and A/P sides of the compaction rasps are smooth (Figure 5).

Once the femoral preparation is completed, the final compaction rasps stays in situ. The compaction rasp handle can be removed.

Figure 3

Figure 4

Figure 5

Step 6.0 Preparation of the Acetabulum

When complete visualisation of the acetabulum is achieved, preparation of the acetabulum must be carried out as instructed in the appropriate surgical technique.

Step 7.0 Trial Reduction

With the final compaction rasp in place, the appropriate trial neck (standard 133º, varized 122º) can be selected and attached onto the rasp (Figure 6). The trial necks are identified by the stem/rasps size:

-6, -5 to 0, +1, +2, +3, +4/+5, +6.

The appropriate trial head size is then selected and positioned onto the trial neck (Figure 7).

The combination of the compaction rasps, trial necks and various trial head sizes, allows an extremely precise offset restoration.

A trial reduction can take place using the head impactor. The trial reduction helps verify the correct position/ orientation of the acetabular components as described in the “Femur First” technique (page 4). The range of motion, joint stability and leg length can be assessed. The trial reduction procedure is repeated with different head offsets until joint stability and desired leg length have been achieved.

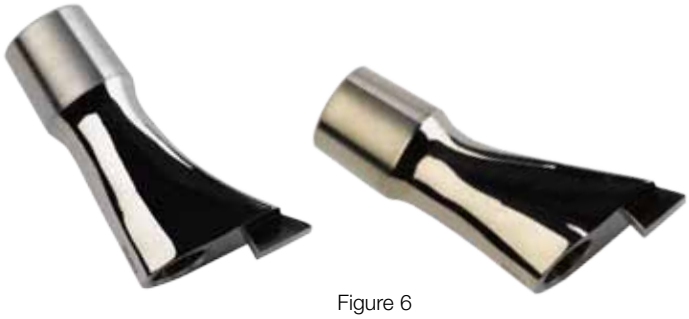


Figure 6

Figure 7

Step 8.0 Femoral implant Insertion

Before removing the compaction rasp, it is advisable to mark the rasp position on the medial femoral neck. This will help identify the future position of the definitive implant. After removal of the rasp and trial components, the desired GTS implant size is selected. The size of the definitive implant should be the same size as the last compaction rasp implanted.

The definitive implant is carefully introduced by hand as deep as possible into the prepared femur. Care must be taken to control the version of the stem. The sliding "fork" positioner can be fitted onto the impactor to control the version of the stem (Figure 8a).

The implant should not be inserted straight into the femoral canal. The angle of insertion should follow the curve of the medial femoral wall. This can be achieved by impacting the femoral stem laterally with the stem impactor (Figure 8b). It is important to adjust the force of impaction according to the bone quality. The impaction should stop as soon as the tone of impaction changes, indicative of cortical contact.

If desired, a further trial reduction can be completed after implantation of the definitive femoral stem. Once again, the range of motion, joint stability and leg length can be assessed.

Figure 8a

Figure 8b

Figure 9

Step 9.0 Modular Head Impaction

Once the trial head is removed, carefully clean and dry the taper of the stem. The final modular head can now be placed onto the stem taper with hand pressure. The modular head is finally seated in position by means of a gentle tap utilising the femoral head pusher and mallet (Figure 10).

Modular heads should never be heavily impacted onto the trunnion as this may cause damage to the surface of the modular head.

Once the correct modular femoral head has been attached to the femoral device, the hip joint can be reduced.

Wound closure is carried out according to the specific technique and approach used.

Figure 10

Step 10.0. Component Removal

Should a GTS stem require removal, only the specific extraction instruments should be used. The rasp extraction adapter is threaded onto the slide hammer (Figure 11). The assembly is then attached onto the GTS stem (Figure 12).

The same procedure can be followed for removal of a well fixed compaction rasp during femoral preparation.

Figure 11

Figure 12

Implant Codes

GTS Standard		
Product	**Description**	**Part number**
	GTS STANDARD STEM SIZE -6	PS129GM6
	GTS STANDARD STEM SIZE -5	PS129GM5
	GTS STANDARD STEM SIZE -4	PS129GM4
	GTS STANDARD STEM SIZE -3	PS129GM3
	GTS STANDARD STEM SIZE -2	PS129GM2
	GTS STANDARD STEM SIZE -1	PS129GM1
	GTS STANDARD STEM SIZE 0	PS129G00
	GTS STANDARD STEM SIZE +1	PS129GP1
	GTS STANDARD STEM SIZE +2	PS129GP2
	GTS STANDARD STEM SIZE +3	PS129GP3
	GTS STANDARD STEM SIZE +4	PS129GP4
	GTS STANDARD STEM SIZE +5	PS129GP5
	GTS STANDARD STEM SIZE +6	PS129GP6

GTS Varized		
Product	**Description**	**Part number**
	GTS VARIZED STEM SIZE -6	PV129GM6
	GTS VARIZED STEM SIZE -5	PV129GM5
	GTS VARIZED STEM SIZE -4	PV129GM4
	GTS VARIZED STEM SIZE -3	PV129GM3
	GTS VARIZED STEM SIZE -2	PV129GM2
	GTS VARIZED STEM SIZE -1	PV129GM1
	GTS VARIZED STEM SIZE 0	PV129G00
	GTS VARIZED STEM SIZE +1	PV129GP1
	GTS VARIZED STEM SIZE +2	PV129GP2
	GTS VARIZED STEM SIZE +3	PV129GP3
	GTS VARIZED STEM SIZE +4	PV129GP4
	GTS VARIZED STEM SIZE +5	PV129GP5
	GTS VARIZED STEM SIZE +6	PV129GP6

Instrument Codes

GTS INSTRUMENTATION SET		A0900170
Product	**Description**	**Part number**
	GTS RASP SIZE -6	A46M0GM6
	GTS RASP SIZE -5	A46M0GM5
	GTS RASP SIZE -4	A46M0GM4
	GTS RASP SIZE -3	A46M0GM3
	GTS RASP SIZE -2	A46M0GM2
	GTS RASP SIZE -1	A46M0GM1
	GTS RASP SIZE 0	A46M0G00
	GTS RASP SIZE +1	A46M0GP1
	GTS RASP SIZE +2	A46M0GP2
	GTS RASP SIZE +3	A46M0GP3
	GTS RASP SIZE +4	A46M0GP4
	GTS RASP SIZE +5	A46M0GP5
	GTS RASP SIZE +6	A46M0GP6
	GTS STANDARD TRIAL NECK SIZE -6	A46S0GM6
	GTS STANDARD TRIAL NECK SIZE -5/-4/-3/-2/-1/0	A46SGM50
	GTS STANDARD TRIAL NECK SIZE +1	A46S0GP1
	GTS STANDARD TRIAL NECK SIZE +2	A46S0GP2
	GTS STANDARD TRIAL NECK SIZE +3	A46S0GP3
	GTS STANDARD TRIAL NECK SIZE +4/+5	A46SGP45
	GTS STANDARD TRIAL NECK SIZE +6	A46S0GP6
	GTS VARIZED TRIAL NECK SIZE-6	A46V0GM6
	GTS VARIZED TRIAL NECK SIZE -5/-4/-3/-2/-1/0	A46VGM50
	GTS VARIZED TRIAL NECK SIZE +1	A46V0GP1
	GTS VARIZED TRIAL NECK SIZE +2	A46V0GP2
	GTS VARIZED TRIAL NECK SIZE +3	A46V0GP3
	GTS VARIZED TRIAL NECK SIZE +4/+5	A46VGP45
	GTS VARIZED TRIAL NECK SIZE +6	A46V0GP6

Instrument Codes

GTS INSTRUMENTATION SET		A0900170
Product	**Description**	**Part number**
	FEMORAL STARTER	RA6161
	STRAIGHT EXACT BROACH HANDLE	31-555500
	FEMORAL STEM IMPACTOR*	A0104003
	FEMORAL STEM IMPACTOR POSITIONER*	A45M0001
	FEMORAL STEM IMPACTOR POSITIONER LINER*	A45M0002
	ANATOMIC IMPACTOR HEAD TIP	A0000149
	ANATOMICAL FEMORAL HEAD DRIVER	A0107003
	SLIDE HAMMER	31-600124
	RASP EXTRACTION ADAPTOR 3/8-16 UNC- M5	A47538M5
	RULE STAINLESS STEEL 30 CM	44.37.30
	GTS FEMORAL INSTRUMENTATION BASE 1	A45M0201
	GTS FEMORAL INSTRUMENTATION BASE 2	A45M0202
	GTS FEMORAL INSTRUMENTATION BASE LID	A45M0204
	GTS TRIAL NECKS TRAY INSERT	A45M0206
	CONT 600X300X210 ALU 1F REF B039	C01C0022

* Available from October 2011

Instrument Codes

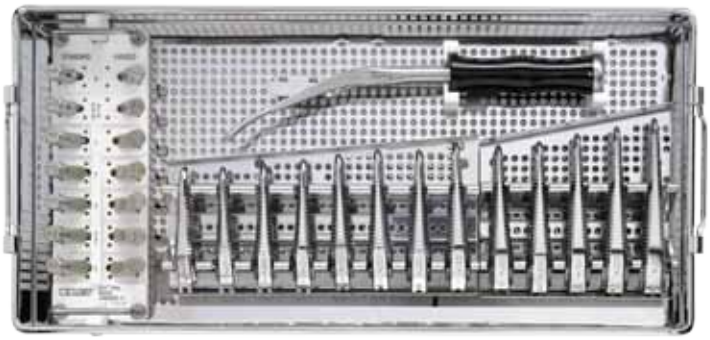
GTS TRIAL HEAD SET		A0900088
Product	**Description**	**Part Number**
	TRIAL HEAD ø 22.2 SMALL -2MM	A0107C22
	TRIAL HEAD ø 22.2 MEDIUM 0MM	A0107M22
	TRIAL HEAD ø 22.2 LARGE +2MM	A0107L22
	RETENTIVE TRIAL HEAD ø 28 XS -5MM	A01R7028
	RETENTIVE TRIAL HEAD ø 28 SMALL -3.5MM	A01R7C28
	FHP 4500 TRIAL HEAD ø 28 M 0MM	A01R7M28
	RETENTIVE TRIAL HEAD ø 28 LARGE +3.5MM	A01R7L28
	RETENTIVE TRIAL HEAD ø 28 XL +7MM	A01R7E28
	RETENTIVE TRIAL HEAD ø 32 XS -6MM	A01R7032
	RETENTIVE TRIAL HEAD ø 32 SMALL -4MM	A01R7C32
	RETENTIVE TRIAL HEAD ø 32 M 0MM	A01R7M32
	RETENTIVE TRIAL HEAD ø 32 LARGE +4MM	A01R7L32
	RETENTIVE TRIAL HEAD ø 32 XL +8MM	A01R7E32
	RETENTIVE TRIAL HEAD ø 36 SMALL -4MM	A01R7C36
	RETENTIVE TRIAL HEAD ø 36 MEDIUM 0MM	A01R7M36
	RETENTIVE TRIAL HEAD ø 36 LARGE +4MM	A01R7L36
	RETENTIVE TRIAL HEAD ø 36 XL +8MM	A01R7E36
	FEMORAL INSTRUMENTATION TRIAL HEADS BASE	A45M0203
	FEMORAL INSTRUMENTATION TRIAL HEADS LID	A45M0205

GTS X-RAY TEMPLATES		
Product	**Scale**	**Part Number**
GTS STANDARD STEM X-RAY TEMPLATES	100%	CA142
	110%	CA144
	115%	CA145
GTS VARIZED STEM X-RAY TEMPLATES	100%	CA152
	110%	CA154
	115%	CA155

Instrument Overview

GTS Rasps -6 to +6

A0900170 GTS Instrument Set



Acetabular Options

Integral to Biomet's Total System Approach, the highly versatile Exceed ABT multi-bearing acetabular system unites the technology developments in large diameter bearing design with clinically proven fixation methods.*

E1

The only polyethylene infused with vitamin E on the market to provide strength and oxidative protection without remelting.

BIOLOX *delta* Ceramic Femoral Head

Composed of aluminia matrix composite to provide improved wear resistance - available in 28, 32, 36 and 40mm heads.

Regenerex Ringloc + Acetabular Shell

Advanced porous metal technology coupled with next generation locking technology. Combine with E1 for the optimal combination of fixation and low wear.

Exceed ABT Taperfit Shell

E1 tapered bearing for the Exceed ABT Taperfit shell are available in articular diameters 28mm, 32mm and 36mm in standard and 10° liner options.

C2A Delta Ceramic on Ceramic Bearings

Provides improved wear resistance and mechanical strength.

* The GTS stem cannot be used in combination with the Biomet polyethylene high-wall Ringloc or high-wall Ringloc-X liners, in 22 or 28mm bearing diameters.

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Notes

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