Scorpio
Total Stabiliser
Revision Knee System

Surgical Protocol
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Scorpio Total Stabiliser
Revision Knee System

- Patented single axis design
- Improved ligament stability
- Varus/valgus stability
- Excellent rotational stability

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Introduction

Revision total knee arthroplasty can be a real challenge for any surgeon. The Scorpio Total Knee Arthroplasty System offers you as an orthopaedic surgeon a full range of possibilities going from a primary to a fully stemmed and augmented implant.

Failure of a primary arthroplasty may have many causes, including aseptic loosening, wear and osteolysis, infection, ligamentous instability, patellofemoral complications and arthrofibrosis.

One of the most important requirements in revision knee surgery is to identify the exact failure mode of the preceding arthroplasty. If this is not clearly understood, the revision procedure is less likely to succeed. A common reason for failure in a revision total knee arthroplasty is to repeat the errors which occurred at the previous TKA.

In approaching revision procedures, the surgeon must consider the planning of an incision in a previously operated site, the condition of the soft tissue, the function of the extensor mechanism, the extraction of the primary implant, and the conservation of bone stock.

The primary goals of a revision procedure include:

1. Restoration of anatomical alignment and functional stability
2. Fixation of the revision implants
3. Re-establishment of the joint line.

Surgical Technique

Three Key Points

1. Establish Tibial Platform
   The first goal is to establish a good and reliable tibial cut. This will provide a reference plane for evaluating the flexion and extension gaps.

2. Stabilise Knee in Flexion
   Next, the femoral component size that will stabilise the knee in flexion is chosen and, if needed, augmented to fit the femoral condylar bone. Posterior offset stems could decrease the flexion gap if necessary. Flexion gap kinematics are determined.

3. Stabilise Knee in Extension
   Finally, an acceptable joint line position is estimated. This will aid in the determination of the proper articulating surface thickness and the distal femoral position that will stabilise the knee in extension.

Instrument Design Rationale

The Scorpio Total Stabiliser (TS) is a unique, comprehensive revision TKA system with intramedullary-based instrumentation for the tibia and the femur. All femoral and tibial cuts are based from stems located within the medullary canal and in this way, the instruments reference one of the remaining reliable landmarks of the deformed knee. Extramedullary alignment checks throughout the procedure are always possible.

The Femoral Cutting Guides serve a double function: as guides to perform the augmentation cuts, as well as provisional components to facilitate trial reductions before and after bone resection.

Several instrument options exist to restore the anatomical joint line: Reference guides to the epicondylar axis of the femur, the tibial tubercle and the patella are available.

A Strong Commitment to Your Total Preparation

Stryker understands the unexpected challenges facing the orthopaedic surgeon during revision knee surgery. That is why we are committed to providing the finest, most comprehensive system of implants and instruments available – a system uniquely designed to enable the orthopaedic surgeon to be prepared for any situation that may be encountered during complex primary and revision surgery.
Implant Design Rationale

The Scorpio Total Stabiliser Femoral Component is intended for use in patients who require additional prosthetic stabilisation due to inadequate mediolateral, anteroposterior, and rotational ligament function.

The Scorpio TS Femoral Component can also be used in conjunction with the PS tibial insert in cases where the use of a femoral augment or stem extension is needed due to poor bone stock, but adequate ligament stability is present. The use of this PS insert results in less constraint.

Due to the patented Single Radius Design, the Scorpio TS offers the same advantages as the primary femoral component with better patellofemoral kinematics, often necessary in revision with an impaired extensor mechanism or shallow patellae. The second advantage is increased midflexion stability, often difficult to achieve during revision surgery.

The femoral offset system allows for exact anteroposterior positioning of the femoral component which helps to avoid patello femoral overstuffing and to increase the posterior condylar offset.

The tibial component offers two inserts with a PS and a TS design depending on the amount of constraint estimated necessary by the surgeon. Scorpio TS allows up to 10° of internal/external rotation without comprising constraint. This is significantly reducing rotational constraints on the PE and on the tibial baseplate fixation.

A wide variety of wedges and augments are available. This system offers a tibial offset system (4, 6 and 8 mm) at the baseplate level with less metaphyseal impingement and a full 360° freedom of tibial tray positioning.

Cemented and uncemented stem options are available in chrome-cobalt and titanium, with or without flutes.

The tibial cut is made at 0° of slope but a 4° slope in the poly will avoid posterior impingement and allow for good flexion.
The Surgical Procedure

1. Surgical Approach

Many patients who present for revision total knee arthroplasty have several incision scars present. Incisions that are horizontal or short-oblique in nature usually present no difficulties. However, if multiple parallel incisions are present and raising the question as to the viability of the soft tissues following the use of one of the incisions, a consultation with a plastic surgeon should be considered.

Once the knee is opened, difficulty in eversion of the patella and in obtaining proper exposure, may necessitate a quadriceps snip or, a tibial tubercle osteotomy. Every care must be taken to avoid avulsion of the patella tendon or an injury that disrupts the extensor mechanism.

Hint: Consider quadriceps release/tubercle osteotomy after soft tissue release and poly removal.

Hint: A K-wire or pin driven through the patella tendon into the tibial tubercle will help prevent avulsion.

Wide exposure is gained by a combination of eversion of the patella, flexion of the knee, and external rotation of the tibia. The medial collateral ligament may, if required, be released back to the posterio-medial corner up to the semi-membranosis tendon insertion on the tibia, in order to gain proper exposure. Remember, the three most important steps in revision surgery are: Exposure, Exposure, and Exposure!

The tibia is now dislocated forward of the femur and the modular polyethylene insert (if present) is removed. This gives more working room and easier exposure. The total knee arthroplasty components are removed, working at the prosthesis-cement interface or prosthesis-bone interface, using thin or flexible osteotomes and small, short oscillating saws.

Care must be taken to remove as little host bone as possible. Once the implants are removed, the bone ends are debrided of all cement, fibrous tissue and debris. Bony defects on the femur, including distal and posterior regions, and those on the tibia, including loss of the medial or lateral plateau surface, are assessed. The intramedullary canals are opened and cleansed using long cement curettes and all debris is removed. If there is any question of possible infection, based upon evaluation of the soft tissues and bone quality, revision should be abandoned in favour of debridement and insertion of an antibiotic-impregnated cement spacer. Re-implantation would then be done at a later date, when infection could be more definitely excluded.

While the components removed can be utilised to give an approximate size of the implants needed for revision, remember that the previous surgeon may not have chosen the appropriate sizes for this patient. We must not make assumptions on these important issues. In addition, since there is always an inevitable loss of bone, it is an attractive option to downsize, especially on the femur, to provide a more intimate fit with host bone. However, we must remember that downsizing on the femur will increase the flexion gap, potentially resulting in joint laxity and instability. The joint line and relative size of the joint should be restored, if possible.

This is precisely why the Scorpio® and Scorpio® TS systems offer an extraordinary array of augments, intramedullary stems, offsets, sizes, and levels of constraint – to provide for any eventuality the surgeon may encounter, from simple primary to complex revision.
The Surgical Procedure

2. Analysis of Failed Implant

Before removing the failed implant an analysis and reflection about the signs of failure could be useful. Especially looking at femoral and tibial rotation will avoid to repeat the same mistakes.

Reference of the joint line to several landmarks is possible. With the knee in extension the following landmarks could be used:

- 12-16 mm distal to the femoral PCL attachment
- 28 mm distal to the medial epicondyle and 25 mm distal to the lateral epicondyle
- 14 mm distal to the inferior pole of the patella
- level with the old meniscal scar
- review of the preoperative roentgenogram
- 32mm top to the TTA
- Analysis of failed implant review of the preop Rx

3. Removal of Failed Implant

Perform a synovectomy when indicated to remove cement or wear debris.

Remove the failed tibial and femoral components, compromising remaining bone as little as possible. Special flexible osteotomes and various extraction devices are included. Remove all cement and debride all bone surfaces down to good bone quality.

The patellar component should be inspected for wear and loosening. Often removal of the meniscal tissue is necessary. If wear is present, remove the patellar prosthesis. If the patellar component is not worn and is well fixed, decide whether the design is compatible with the Scorpio TS patellar groove. If the design is compatible, it may be more appropriate to leave the previous patellar component and avoid damage to the patellar bone. If the design is not compatible, replace the patellar component.
Reconstruction

Step 1 - Tibial Canal Preparation

Open the tibial medullary canal in the centre of the tibial axis. Locate the medullary canal from preoperative radiographic planning and confirm this at the time of surgery by the location of the tibial crest. The entry point for the drill should be over the midpoint of the isthmus of the tibial canal, this is not necessarily the midpoint of the proximal tibia. This is particularly important if an offset stem is anticipated.

Progressive reaming is carried out by hand until cortical contact is achieved. The depth of the reaming is determined by the surgeon’s choice of stem length. Scorpio TS templates can be used to decide length and positioning. The more bone loss at the proximal tibia, the longer the stem needed. An 80 mm or 155 mm stem extension is available. A reamer depth stop can be used. It takes into account the length of the stem (40*, 80 or 155 mm), the length of the offset adapter (20 mm) and the tibial implant stem boss (40 mm) (Figure 2).

**Hint: Use depth stop on first and last reamer**

The tibial boss/offset reamer is sunk to the depth of the ‘bone groove’ on the reamer shaft only if the stem diameter chosen is less than 15 mm (Figure 1).

When assessing the final ‘fit’ and ‘fill’ of the intramedullary stem, note that the trial stem is 0.5 mm smaller in diameter than the definitive implant. Host bone quality should be taken into account when assessing the final diameter of reaming. In hard bone, one may elect to ream line-to-line, while in soft bone, under-reaming may be considered.

After reaming the last size, insert the stem provisional and adapter into the reamed canal.

**Note: Reaming is best performed manually to avoid over-reaming or to create fractures**

**Note: A shorter, possibly larger diameter, stem may be desired. Preparation for this stem is accomplished after the tibia is cut by further reaming to the shorter depth with the required diameter reamers.**

*40mm stems are cemented stems only

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Figure 1

Figure 1A

Bone Groove

Reamer Depth Stop

8200-0045 80mm stem
8200-0046 155mm stem
8200-0047 80mm stem with offset
8200-0048 155mm stem with offset

*40mm stems are cemented stems only
Reconstruction

Step 2 - Proximal Tibial Resection

Restoring the anatomical joint line height of the tibia is an important factor in revision surgery. It avoids femoral and tibial size mismatch (The system allows for one up or down size interchangability between femur and tibia), avoids cortical stem impingement and the use of thick polyethylenes.

This system offers two tibial referencing systems for the joint line height. One joint line scale refers to the most proximal part of the tibial tubercle and should be an average of 32 mm from the tibial plateau. A second scale can be used in extension and should reference the inferior pole of the patella 14 mm from the plateau (Figure 2). When using these landmarks simple resection of bone to the lowest point to restore a flat surface is less considered and bone grafts and augments are more often used.

The appropriate size trial stem (related to last reamer or one size down) is threaded onto the resection guide tower. The trial reference collar is assembled, sliding it from anterior to posterior. The support rod assembly is placed onto the guide tower and the tibial resection guide is then assembled onto the support rod assembly (Figure 3). The tibial resection guide is secured to the uppermost portion of the support rod assembly by tightening the locking screw. The tibial resection guides are clearly marked left and right.

Figure 2

Figure 3

Tibial Reference Collar
8200-0023
8200-0027
8200-0031

Tibial Resection Guide
8200-0033 (Left)
8200-0032 (Right)

Support Rod Assembly
8200-0034

Resection Guide Tower
6633-9-428

Trial Stem
Catalogue information for trial stem is on page 28
The construct is then placed within the intramedullary canal with the reference collar placement ensuring a 2 mm clean-up cut when using the neutral slot (Figure 4).

**Hint:** Tibial resection can be done with the entire guide tower in place when bone stock is poor.

Despite that the tibial cut has no slope, rotation of the tibial cutting guide is important (especially in preparation for wedges). A tibial alignment handle, with its alignment rod can be assembled onto the tibial resection guide. Orient the cutting guide so it cuts directly from the front to the back of the tibia. Align it with the medial third of the tuberosity or the tibial crest. Varus/valgus orientation is equally important. Palpate the malleoli and note the midpoint. The cutting guide should be positioned so that the alignment rod follows the anterior tibial crest and points about 7mm -10mm medial to the midpoint between the malleoli. The tibialis anterior tendon can also be used to check the varus / valgus position of the cutting guide. The distal end of the Alignment Rod should be in line with the tendon. This will help confirm that the resected surface will be 90 degrees to the mechanical axis. Consider extra-articular deformity and stem impingement if correct alignment can not be achieved.
Reconstruction
Step 2 - Proximal Tibial Resection (continued)

After proper rotation and varus/valgus orientation has been achieved, determine the appropriate depth of resection by taking into consideration the depth of any defects that are present. This should be a minimal resection. The purpose of this cut is to create a flat surface only. Minimal bone removal is recommended. It is not necessary to resect below all defects. Relatively small defects can be grafted and others filled with cement or augments.

The upper slot, marked ‘N’ for neutral, will provide a 2 mm ‘freshen up’ resection when the guide is resting against the stop on the proximal portion of the resection guide tower (Figure 5).

The Tibial Resection Guide provides for 5 and 10mm tibial augments. These tibial augments are available to compensate for bone loss on the medial and/or lateral side.

Note: If an offset stem is anticipated then the tibial augment cuts should be deferred and made off the proximal tibial template after the trial stem and trial offset are chosen. (see page 12)
Use of an Offset Stem

The easiest way to determine whether an offset stem will be necessary is to insert the properly sized tibial trial stem with the stem extender shaft (Figure 6) into the tibial canal. The proximal tibial template of approximately the correct size to be used is placed over the stem extender shaft and onto the tibial surface.

**Hint:** The proximal tibial template in the A/P plane is wider than the actual tibial tray. The extra width on the proximal tibial template is to accommodate the anterior pin holes and alignment handle.

If a tibial augment is necessary, it should be attached to the undersurface of the proximal tibial template. The offset bushing guide is then applied to the proximal tibial template (Figure 7). If the stem extender shaft falls directly in the centre of that guide, and the baseplate trial satisfactorily covers the tibial surface, then no offset will be needed. If the stem extender shaft is off centre within the offset bushing guide and proximal tibial baseplate trial, then an offset stem will be necessary.
Reconstruction

Step 2 - Proximal Tibial Resection (continued)

Use of an Offset Stem (continued)

Once the trial stem shaft is seated in the canal, any one of the offset bushings should be applied to the offset bushing guide. Four-millimetre, 6mm, and 8mm offset bushings are available. The use of Scorpio® TS templates will assist in the pre-operative planning for the required offset. Select the appropriate offset bushing which allows for the best cortical coverage of the proximal tibia with the proximal tibial template. This is best done by alternatively moving the proximal tibial template to the position that allows the best coverage, or rotating the bushing to check the coverage of the tibia. Each offset size (4, 6, or 8mm) should be trialed as needed. Once the optimal position and offset is determined, the reading from the offset bushing guide should be recorded (Figure 8). The proximal tibial template should be pinned at this point to secure its position.

Hint: Use the two medial/lateral pinholes to secure baseplate first. This stops posterior displacement of the template.

Alignment is then checked using the alignment handle and the alignment rod in both the coronal and sagittal plane.

If the surgeon has not prepared previously for tibia augments this step may be taken prior to final keel punching.

The system allows for 5 and 10mm tibial augments to be cut directly from the proximal tibial template (Figure 9). Tibial wedge cuts for angled wedge (5°) and a tibial full wedge can be made by assembling the tibial wedge cutting guide onto the proximal tibial baseplate (Figure 9) at this point the augment cutting guide can be applied and cuts may be made through the slots as necessary, with the stem extension and assembly in place for stability (Figure 9). Completion of the cuts may be carried out once the guides are removed.

Hint: The shaft on the slap hammer can be inserted into the hole on the trial stem shaft to aid in extraction.

Hint: It is common for the offset reamer to not make bone contact in revision scenarios, where there is severe bone loss.
Before removing the proximal tibial template, seat the tibial boss/offset reamer guide into the proximal baseplate. Insert the tibial boss/offset reamer into the guide and ream to the appropriate depth, as indicated by markings on the reamer (Figure 10). Assemble punch tower assembly to the tibial template and punch to final depth, employing progressive punching (note that the delta keel punch must be loaded in a retrograde fashion through the undersurface of the punch tower) (Figure 11). The punch should be driven to its final depth. If the bone is too sclerotic or if the proximal tibial template begins to migrate, consider using a cutting tool to remove the sclerotic bone. Be sure that the tibial implant is not oversized.

**Hint:** Prepare for augmentation prior to doing keel punch.

**Hint:** “If sclerotic bone is present, consider using 1/8” drill bit, osteotome, or sagittal saw as preliminary prep for punching.” Drs. Mahoney & Masini

**Hint:** It is very important to ensure all cement is removed prior to punching.

**Hint:** “If you recognise that a full wedge is necessary it is best not to pin the regular cutting guide as the pins are in a different location.” Dr. Masini
Reconstruction
Step 3 - Tibial Offset Stem Assembly

The following procedure is the same sequence for both trial and definitive implantation.

If a tibial offset adapter was used, assembling the augments should be deferred until the offset adapter and stem is assembled to the baseplate. The tibial baseplate is placed on its superior surface with the stem boss pointing towards the ceiling. The offset fixture, a circular device with recordings from 0 to 360° is placed over the stem and secured by hand-tightening the thumb screws (Figure 12). The offset adapter is then prepared for assembly. The appropriate stem extension is threaded onto the offset adapter. For final implantation (not required for trialing), the stem must be torqued between 120 to 180lbs. This is done with the offset counter wrench and the adapter to the torque wrench.

The hexagonally-shaped offset adapter jam nut is positioned flush with the offset adapter (Figure 13). At this point, assemble the stem and offset adapter construct onto the tibial baseplate.

*Hint: Assembly can take between 3-5 minutes and cement mixing should begin after all components are assembled.

*Hint: The offset adapter should be fixed to the stem first using the tibial offset adapter. Then assemble blocks/wedges as previously determined.
Reconstruction
Step 3 - Tibial Offset Stem Assembly (continued)

The following procedure takes some coordination to assure proper position of the offset stem. The position of the stem has already been determined and recorded at the time of tibial preparation (see Figure 9).

With the offset counter wrench in one hand, the pin is slid all the way to the standard markings. The scribe line on the wrench should be aligned with the scribe line on the offset adapter (Figures 14 and 15). The pin in the slot of the counter wrench is placed into the proper designated hole based upon the position noted at the time of tibial preparation. The offset adapter is then rotated counterclockwise until the scribe lines are aligned and the offset adapter body (the conical rounded portion) fits into the wrench. The hexagonal jam nut is then hand-tightened against the tibial baseplate (not the conical portion of the offset adapter). The all-in-one wrench is applied to the hexagonal jam nut. The torque adapter is then used for final assembly of the definitive implant components. The all-in-one wrench is used to lock the hexagonal jam nut in place by turning clockwise. Once this is secured, the offset fixture is removed and appropriate augments are secured by hand to the under-surface of the tibial trial baseplate.

Figure 14

Figure 15

Scribe Line

Scribe Line
Finding the intramedullary canal and entry hole is in general not so difficult in revision surgery after femoral component removal.

Begin with the 9mm intramedullary reamer and progressively ream the femoral canal.

Care should be taken so that the reamer is passed in line with the centre of the femoral shaft both in the A/P and M/L planes. Eccentric reaming of the femoral shaft should be avoided. The appropriate size of the final reamer should be estimated in preoperative planning, and is confirmed when cortical bone contact is made. Remember that the trial stem is 0.5 mm smaller than the final implant.

The length of the stem should be related to the bone loss. Two lengths are available, 80 mm and 155 mm.

**Hint:** Ream a few mm more proximal in the shaft to accommodate for the distal femur resection

**Note:** Reaming is best performed manually to avoid over-reaming or to create fractures

**Note:** If it is impossible to ream for a long stem the 8 x 255 mm IM rod can be used for IM referencing.
Reconstruction
Step 5 - Distal Femoral Resection

When the proper diameter and length of the trial stem has been determined, the resection guide tower is threaded onto the proper trial stem (related to the last reamer or one size down). The support rod assembly and distal femoral resection cutting guide are assembled.

The construct is inserted into the femoral canal and the epicondyles are referenced. The ‘M/E’ scribe line on the distal femoral resection cutting guide is positioned over a presumed line joining the epicondyles when viewed from the anterior femur.

The joint line is located approximately 28 mm distal to the medial epicondyle. When the guide is secured with pins (1/8”) the distal femur can be resected. Use of the neutral slot results in a 2 mm clean up cut.

A fixed distal femoral valgus angle is used with the Scorpio TS system of 6°. If another valgus angle was chosen in the primary implant this could result in slightly more bone resection on the medial distal surface.

If the Revision IM Guide sits flush on the cut distal femur, 6 degrees of valgus alignment exists between the orientation of the medullary canal and the distal cut.

*Note: If the femoral collar is not in contact with the distal bone a distal femoral augment could be useful*

Distal Augmentation

If no distal bone is contacted, then distal augments must be used. Combinations of 5, 10 and 15 mm distal augments are provided. Cuts can be made with the femoral resection guide. Alternatives are allograft bone, cement, or synthetic bone void fillers.

```
Support Rod Assembly
8200-0034
Distal Femoral Resection Cutting Guide
8200-0064
Resection Guide Tower
6633-9-428

Blade Runner
7551-0000
Trial Stem
Catalogue information for trial stem is on page 28
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Reconstruction
Step 6 - Evaluate Femoral Size

There are several ways to estimate the appropriate femoral size. The following techniques should be used in conjunction with templating to determine an approximate femoral size. The final size will ultimately be selected during evaluation of the Flexion Gap and Stability.

Underestimating the femoral size will result in less posterior condylar offset, flexion instability and the use of bigger polyethylenes. This will result in undesirable proximal displacement of the joint line to equally balance the extension gap.

Femoral Sizing Templates

Templates to measure the AP dimensions of the femur are available. Don’t forget that osteolysis and debridement of the bone will result in AP undersizing.

Size of the Previous Prosthesis

The template can also be used to compare the Scorpio size to the extracted primary implant. Be careful to evaluate the X-ray and check for posterior condyles overresection.

Epicondylar Width

The epicondylar width of the femur aids in selecting the appropriate femoral size. This system offers templates to determine the right size.
Reconstruction
Step 7 - Establish Femoral Rotation

Attach the correct sized stem to the Femoral Cutting Block that corresponds to the femoral component size chosen. Be sure that the proper “Right” or “Left” indication is facing toward you on the cutting block (see Figure 22). The cutting block should be flush against the distal femur and the flange should rest on the anterior femoral cortex. Since bone is most often lost on the posterior condyles and since often internal rotation has to be corrected, the posterior condyles should not be followed. The epicondylar axis (cutting guide handles parallel to axis) and the proximal tibial cut are probably the most reliable for rotational alignment.

Note: A posterolateral augment is often necessary to correct for internal femoral rotation

Component Placement

It is important to optimise the A/P and M/L position of the Femoral Cutting Block on the distal femur. If it appears that the prosthesis will not be properly positioned on the distal femur, an offset stem should be used. To prepare for the offset stem, use the Femoral Offset Bushing. Insert the Femoral Offset Bushing with the numbers facing out. (see page 20 - figure 26)

Rotate the bushing within the guide until an optimal position is found.

This allows you to bring the femoral component down, bringing it flush to the anterior cortex. Therefore the patellofemoral joint won’t be overstuffed and it will necessitate less posterior bone resection. The necessity for anterior bone resection will result, but careful not to notch the anterior cortex. Especially on the lateral side, since some degree of external rotation will be present. Note the orientation of the Femoral Offset Bushing by observing the numbers and marks on the bushing relative to the etched line on the posterior face of the Cutting Block, this reference will be needed later in the assembled femoral component procedure.

When the position of the Femoral Cutting Block has been established, confirm appropriate external rotation and pin the block in place.

Anterior and posterior clean-up may be necessary due to optimal femoral guide rotation and placement from previous steps. Use an oscillating saw to cut the anterior and posterior condyles.

If additional adjustments to the amount of external rotation are necessary, return to the beginning of this section
Offset Stem

Insert the blade runner into the anterior slot and use the 4 mm ball hex driver to position the femoral cutting guide for optimal placement with respect to the femoral canal. Be sure that the correct femoral rotation is present to avoid notching of the lateral cortex. Two offset options are available 2 mm and 4 mm.

**Note:** Offset on smallest component is sometimes difficult

**Hint:** If larger offset is necessary there are two options:
1. Assess the next larger femoral size
2. Down size the stem and put the femoral component in slight flexion
Reconstruction

Step 8 - Anterior, Posterior & Chamfer Cuts

Assemble the appropriate stem/valgus adaptor to appropriate size femoral all-in-one cutting guide. If distal augment cuts were made the corresponding provisionals can be assembled to the cutting guide to increase stability. Align the guide for femoral rotation and pin the cutting guide. Perform the cuts in the following sequence:

1. Anterior and posterior cut
2. Anterior and posterior chamfers
3. Posterior augments

Note: The posterior neutral cut is an uncaptured cut.

Posterior Augments

A 5 mm and 10 mm augment cut are available. The anterior and posterior chamfers can be cut now. If the reamed diameter is less than 16 mm the offset reamer should be used to prepare for the implant boss.

Step 9 - Prepare the TS Box

Follow the box guides with a small saw blade from anterior to posterior to mark the edges. After removal of the stem the bone cuts can be completed.
Reconstruction
Step 10 - Assembly of Trial Components

Insert Trials
Trials can be snapped on the tibial baseplate. If TS constraint is not desired a PS insert can be used.

When mixing size 5/7 and 9/11 the 'bridging inserts' should be used. (See Compatibility Chart below).

<table>
<thead>
<tr>
<th>Femoral Components</th>
<th>Tibial Baseplates*</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Size 3 77-4003</td>
</tr>
<tr>
<td>Size 3 76-4103</td>
<td>72-4-03xx</td>
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<td>Size 13 76-4113</td>
<td>72-4-11xx</td>
</tr>
</tbody>
</table>
Reconstruction

Step 10 - Assembly of Trial Components

(continued)

Femoral Component Trial Reduction

The appropriately-sized femoral trial component is assembled with augment trials, trial offset adapter and trial stem if required. (Figure 31)

Femoral Offset Adapter Assembly

The following procedure is the same sequence for both trial implantation and definitive implantation.

The appropriate size trial stem is threaded into the offset adapter. (For the final implantation, the stem must be secured by applying from between 120 to 180lbs. of torque, using the torque wrench; this is not required for the trial portion.) The femoral counter wrench and adapter to the all-in-one wrench should be used only when necessary.

The hexagonally-shaped offset adapter locking nut is positioned flush with the offset adapter (Figure 29). The trial stem and offset adapter assembly is then threaded completely onto the femoral component. At this point, the line on the offset adapter trial must be aligned to the appropriate line on the femoral component, at exactly the same position that was recorded during the femoral preparation (Figure 30) (see Figure 26).
Reconstruction

Step 11 - Establish Flexion Gap & Stability

Determine the ability of the selected Femoral Provisional to fill the flexion gap and create stability in flexion.

Make an early assessment of the need for posterior augmentation through the posterior augment cutting slots in the cutting guide. If a gap larger than 10mm exists, consider choosing the next smaller femoral component.

**Note:** The Posterior Augments may be inserted into the femoral provisionally to provide added stability in flexion.

Begin by inserting the thinnest trial polyethylene indicated on the tibial plate and femoral trial component.

If the thinnest articular surface cannot be inserted, one of two solutions should be explored.

First, the femoral can be downsized. Each femoral component size is 4mm different in the A/P dimension. The selection of the next smallest component will result in an additional 4mm in flexion space. If this does not allow the thinnest polyethylene to be inserted, then the tibial plateau will have to be lowered. Use the 2mm Tibial Recutter to obtain an additional 2mm in both flexion and extension spaces. If the tibia has additional bone resected it will be necessary to recheck the tibial size.

Insert progressively thicker polyethylene until adequate stability is obtained. If the knee is still loose in flexion after trailing the thickest articular surface, consider one of the following options:

1. Augment the tibial component, adding 5mm or 10mm blocks to the medial and lateral sides
2. Select the next larger femoral component.
3. Use a femoral offset stem and increase the posterior condylar offset which will make the flexion gap smaller.

Full Gap Spacer Blocks
- 8200-0180
- 8200-0260
- 8200-0200
- 8200-0290
- 8200-0220
- 8200-0320
- 8200-0240

Half Spacers (for Gap Blocks)
- 6633-9-805  5mm
- 6633-9-810  10mm
- 6633-9-815  15mm

Figure 32

Figure 33
**Reconstruction**

**Step 12 - Establish Extension Gap & Stability**

After achieving appropriate stability in flexion, leave the final polyethylene in place and bring the knee to full extension. Assess the overall limb alignment. Bring the Femoral Component out to meet the tibial surface and create stability in extension.

**Note:** The Distal Augments may be used as spacers to create added stability in extension.

**Joint Line**

Assess the joint line. The true joint line in the average knee, in full extension, can be approximated by referencing several landmarks. These landmarks include: one finger breadth distal to the inferior pole of the patella; one finger breadth above the fibular head; 12mm-16mm distal to the femoral PCL attachment; and 28mm distal to the medial epicondyle.

If desired, use the Patella Joint Line Gauge to assess the position of the patella.

The epicondyles also provide a starting point for distal positioning of the femoral component. The distal joint line averages 30mm from the epicondyles. This is very similar to the average distance to the posterior joint line and this distance may be used to check femoral component size.

Avoid hyperextension. If hyperextension exists, move the femoral trial more distally.

Evaluate the resultant space between the femoral component and distal femur. If the gap exceeds the maximum augment available, 10mm, then evaluate the next smaller femoral component size. This will allow the use of a thicker articular surface and will necessitate a return to reassess the flexion gap.

**Balance Soft Tissue**

While the knee is in extension, perform necessary ligament releases to achieve symmetric and adequate tension. In rare cases, ligament advances may be appropriate. Ligament release should be performed in a manner which is conceptually similar to that in primary arthroplasty. Selectively release the ligaments on the concave or contracted side of the knee until symmetric ligament balance or tension is observed on the medial and lateral sides of the knee with the limb in neutral mechanical alignment. In revision surgery, however, the specific ligamentous structures which may be identified in the primary total knee are likely to be scarred fibrous tissue sleeves that are more difficult to identify and/or release. In general, they are more amenable to treatment as medial or lateral sleeves of undifferentiated ligamentous tissue.

If the knee is well balanced in extension but has significant imbalance in flexion, there may be a rotational problem with the femoral component. Internal or excessive external rotation of this component may cause substantial lateral or medial laxity in flexion. If so, evaluate the rotational alignment of the femoral component.

If the femoral component rotation is appropriate and the joint line has been re-established the knee should be stable in both flexion and extension. If it is not stable, there is a mismatch between the extension and flexion gaps. Understanding how the size and position of the components affect the flexion and the extension gaps is essential to problem solving in total knee arthroplasty. These principles are thoroughly reviewed in Appendix B of this technique under the heading “BALANCING FLEXION/EXTENSION GAP”.

When the extension gap has been balanced with the previously determined flexion gap, and the limb alignment and joint line have been judged to be accurate trial with a provisional femur.

Perform a trial range of motion and confirm that the soft tissue tension, balance, and joint line are appropriate.
Reconstruction
Step 13 - Femoral Implant Assembly

Note: If femoral stem/offset is used to be used remove stem end-cap with 4mm hex wrench

Assemble stem to offset adapter if needed. Torque to 120-180lbs (not required for trialing). Use offset counter wrench and appropriate adapter to torque wrench

- Ensure locking nut is flush with the offset adapter
- Thread stem/offset assembly into femoral component completely
- Align etch mark on offset adapter trial to the appropriate etch mark on the box of the femoral component (Figure 34)
- Hand tighten the locking nut against the femoral component (not the stem) no more than one complete turn
- Insert femoral counter wrench between anterior flange and the femoral boss (Figure 34)
- Lock all in one wrench together with torque wrench. Locking nut should be tighten to 120-180lbs (not required for trialing)
- Assemble femoral augments as necessary by utilizing the 4-mm ball hex driver. Hand tighten only (Figure 35)

Implant Components

- Implant tibial component by assembling to the tibial impactor/extractor
- Implant femoral component by assembling the femur to the femoral impactor/extractor
- Implant the tibial insert into the tibial tray by tapping the insert with the tibial impactor and a mallet

Figure 34

Figure 35

etch mark

Catalogue information for trial stem is on page 28
Reconstruction
Step 14 - The Patella

If an in-situ patellar component is loose, malpositioned, or overly thick, revision may be considered. The patellar component is removed by working at the implant-cement interface, or if the implant is uncemented, at the implant-bone interface. A stacked-osteotome method is successful at removing the implant. If it is determined that there would be insufficient host bone after the removal of the patella, or the in situ patella is well fixed, consideration should be given to keeping the existing implant. Once the implant is removed, all cement and debris should be debrided. Prior to attempting to remove the implant, the thickness of the component composite should be measured. If removing the implant would leave less than 12mm of bone, thought should be given to retaining the implant, if possible. After the implant is removed, the remaining bone is measured. A thin oscillating saw can also be used to dislodge the implant especially if the composite is overly thick. At least 12mm should be retained. Patellar implantation is per the operating techniques of the Passport Patella Reaming System (LSPK27 Rev. 3) and X-Celerate™ Total Knee System Surgical Protocol (713210LI & 713205LI).

If the trial patella component has any tendency to sublux, or tilt is encountered, a lateral retinacular release should be considered. A further reduction to assist component position and alignment is then made. The patella must track well, and if a lateral release is not sufficient, then the surgeon should consider tibial tubercle transfer and/or proximal muscle realignment.

*Hint: Consider extra-articular lateral release for best balancing.*

If the in-situ patella prosthesis must be removed and bone stock is poor, with osteopenia, cystic lesions, or an overly thin bony remnant (less than 12mm), then the surgeon can also consider a salvage patelloplasty. This involves debriding the host patella bone, removing osteophytes and debris, and leaving it *in situ* to articulate with the femoral component as best as possible. While not ideal, this has been shown to provide satisfactory function compared to a patellectomy or patella fracture. The remnant must track satisfactorily.
Reconstruction
Step 14 - Implantation

Once satisfied with joint line restoration, prosthetic stability, joint range of motion and stability, as well as patellar tracking, the tourniquet should be deflated to insure satisfactory hemostasis. In most cases, the removal and debridement process precludes re-implantation within the safe tourniquet time, so tourniquet deflation is often mandatory.

The tibial component is assembled onto the tibial impactor, and the femoral component is assembled onto the femoral extractor/impactor.

Use the tibial baseplate impactor to insert the component. Make sure that the correct rotation is present from the start since the un cemented stem will engage the bone and rotational correction will no longer be possible.

The femoral impactor will guide the component until the distal surface is matched. Correction rotation is very important to obtain a flush anterior fit and to avoid damage to the posterior condyles.

The insert with the correct height for flexion stability and full extension is chosen. Fixation is assured with the locking pin.

- Insert the locking pin into insert post "barbed" end up
  (Figure 30)
- Tap down below anterior surface

Note: Stabilizer pin is packaged with the insert (Figure 36)

Closure
Appendix A
Crossover Technique

During a primary procedure, the surgeon may determine that sufficient bone loss or soft tissue instability is present to warrant a stemmed femoral component. The Scorpio TS revision Instruments allow the surgeon to convert from primary implants to a stemmed TS implant intra-operatively. This crossover can be accomplished after the tibial preparation has been completed and all the femoral cuts have been made.

Appendix B
Balancing Flexion/Extension Gaps

After the flexion gap has been established and the appropriate size femoral component applied, extend the knee. A symmetrical and balanced extension gap should be created.

This is sometimes difficult as it often requires elevation or lowering of the joint line. The patella helps determine the appropriate position of the joint line.

It is important to remember that adjustments to the femoral side of the arthroplasty can affect the knee in either flexion or extension, while any change to the tibia affects both flexion and extension. This is part of the rationale for reconstructing the tibial side first. The following matrix (Fig. 74) suggests the nine situations that can occur during a trial reduction in a revision knee. It is worth reviewing these options and some of their potential solutions.

<table>
<thead>
<tr>
<th>Flexion</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tight</td>
<td>OK</td>
</tr>
<tr>
<td>Tight</td>
<td>1</td>
</tr>
<tr>
<td>OK</td>
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</tr>
<tr>
<td>Loose</td>
<td>7</td>
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</table>

1. If a knee is too tight in both flexion and extension, reducing the height of the polyethylene may be sufficient to balance the construct.
2. If the knee is tight in flexion but acceptable in extension, two options exist. An augment may be used with the distal femur. This will drop the joint line lower, and allow the use of a thinner tibial component.
   Another option is to use a smaller femoral component.
3. If the joint is loose in extension and tight in flexion, augmentation of the distal femur should provide a good arthroplasty with a thinner polyethylene component if the joint line is at its proper location. Another option is to use a smaller femoral component.
4. If the joint is acceptable in flexion but tight in extension, several options exist. One is to release the posterior capsule from the femur. Another alternative is to resect more distal femoral bone. This moves the femoral component proximally on the femur at the expense of elevating the joint line.
5. Obviously, if both components are acceptable, no further modification is necessary.
6. If the joint is acceptable in flexion and loose in extension, the probable solution is augmentation of the distal femur while using the same polyethylene component. This will drop the joint line and tighten the extension gap.
7. If the joint is loose in flexion and acceptable in extension, a larger femoral component, moved slightly proximal on the femur, may suffice. If the original component size was correct, a thicker polyethylene and a more proximal femoral position may be necessary.
8. If the joint is loose in flexion and acceptable in extension, one may choose to accept this situation if it is only of a mild degree, particularly in a highly constrained component. Increasing the femoral size or increasing the femoral posterior offset may equalise the gaps. Alternatively, moving the femoral component proximally and applying a thicker tibial articular surface will equalise the gaps.
9. If the joint is symmetrically loose in both flexion and extension, a thicker polyethylene will solve both problems.

Note: After applying one of these solutions, perform another trial reduction. This will identify any new problem or a variation of the initial problem that now may exist.
Appendix C
Technical Information Scorpio TS

Tibial Trays

<table>
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<th>M/L (mm)</th>
<th>Stem Boss Length* (mm)</th>
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<td>61</td>
<td>35</td>
</tr>
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<tr>
<td>13</td>
<td>58</td>
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*With end cap

Tibial Inserts

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<th>Post Width (mm)</th>
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## Appendix C (continued)

**Technical Information Scorpio TS**

### Femoral Components

**Scorpio® TS Femoral Components Specifications**

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*With end cap

### Stem Extenders

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</table>

- Tri-slots available in Titanium fluted stems only 11mm through 23mm diameters in 155mm length.
- Offset Adapters mate with all stems, Scorpio® TS Baseplates, and Scorpio® TS Femoral Components. Offset Adapters are available in 2mm, 4mm, 6mm, and 8mm configurations.
Appendix C (continued)

Technical Information Scorpio TS

L/R Tibial Half Block Trial Augment

- T75-3-0305 (L/R) #3 T75-3-0905 (L/R) #9
- T75-3-0310 (L/R) #3 T75-3-0910 (L/R) #9
- T75-3-0505 (L/R) #5 T75-3-1105 (L/R) #11
- T75-3-0510 (L/R) #5 T75-3-1305 (L/R) #13
- T75-3-0705 (L/R) #7 T75-3-1310 (L/R) #13

L/R Full Block Trial Augment (10mm thick)

- T75-4-0310 (L/R) #3 T75-4-0910 (L/R) #9
- T75-4-0510 (L/R) #5 T75-4-1110 (L/R) #11
- T75-4-0710 (L/R) #7 T75-4-1310 (L/R) #13

Tibial Full Wedge Angled Trial Augment

- T75-5-0305 (L/R) #3 T75-5-0905 (L/R) #9
- T75-5-0505 (L/R) #5 T75-5-1105 (L/R) #11
- T75-5-0705 (L/R) #7 T75-5-1305 (L/R) #13

L/R Distal Femoral Block

- T75-1-3705 (L/R) 3,5,7 5mm M/L T75-1-9305 (L/R) 9,11,13 5mm M/L
- T75-1-3710 (L/R) 3,5,7 10mm M/L T75-1-9310 (L/R) 9,11,13 10mm M/L
- T75-1-3715 (L/R) 3,5,7 15mm M/L T75-1-9315 (L/R) 9,11,13 15mm M/L

Posterior Femoral Block Trial

- T75-2-3705 (L/R) 3,5,7 5mm T75-2-9305 (L/R) 9,11,13 5mm
- T75-2-3710 (L/R) 3,5,7 10mm T75-2-9310 (L/R) 9,11,13 10mm

Femoral Distal Spacer

- 8200-0091
- 8200-0093
- 8200-0094

References

1. Revision Knee Arthroplasty Manual by Boogh R, Insall GN and Vince KJ.