Indications

Paprosky defect type 3A

Paprosky defect type 3B

Key Features

- Designed by Professor Wroblewski to deal with loss of proximal femoral bone stock.
- The cemented stem is designed as a continuous taper to evenly transfer load to the remaining femoral bone.
- The design utilises a range of collars to allow variable extra-femoral positioning.
- A choice of collars fit the stem, positionable at 5 mm intervals to give resistance to subsidence as well as to load the remaining femoral bone.
- For patients where trochanteric re-attachment is not possible, a perforated abductor ring can be used for attachment of the soft tissues.
- Manufactured from Ortron 90° stainless steel.

Implant Range

The stem is available in two lengths, 200 mm and 250 mm, which allow up to 100 mm and 150 mm of stem, respectively, to be left unsupported proximally. A trial stem with an adjustable collar provides the opportunity for intra-operative measurement and trial reduction to check stability.

Case Studies

Pre-op
Revision of failed cemented primary THR with significant proximal bone loss.

Post-op
Stem centrally aligned in well contained/pressurised cement. Ring seated on reliable bone. Muscle tension restored by attachment of abductors to ring. Leg length restored.

Pre-op
Failed cementless revision. Loss of proximal bone combined with poor quality bone in the diaphysis.

Post-op
Extensive lysis and destruction of bone stock. Stem stable within a collar supported on remaining bone. Leg length restored. Stable joint and greatly improved function/ROM.

Reference

Indications

Key Features

- The ULTIMA® Ring facilitates reconstruction of the acetabular roof for both primary and secondary revision indications.
- The ring helps restore the hip’s centre of rotation while gaining secure fixation to host or allograft bone through superior rim fixation and support.
- The creation of a stable acetabular socket enables a polyethylene cup to be securely cemented in place.
- The ULTIMA® Ring is manufactured from commercially pure titanium with a bead-blasted surface to encourage bone apposition and keying of cement.
- Each ring has a peripheral flange to gain host bone support.
- The screw holes are designed to provide an optimum arc for greater screw placement range.
- Cancellous bone screws reduce the load deformation of the acetabulum, minimising the potential for loosening.

Implant Range

Each ULTIMA® Ring has an internal dimension ranging from 36 mm to 58 mm, increasing in 2 mm increments. This dimension should be taken into account when selecting the acetabular cup and desired cement mantle. Roof pile screws range from 20 mm to 60 mm in length, increasing in 5 mm increments.

Surgical Summary

- Fill the defects and holes within the acetabulum with bone graft. Impact the ULTIMA® Ring into position in the prepared acetabulum where living bone provides peripheral support.
- Secure the ring by inserting screws into the dome and the ilium of the acetabulum. Drill the first hole in a superior direction into the ilium.
- Determine the depth of the screw hole with the depth gauge, and select a screw of the appropriate length.
- Insert the domed head roof pile screw with the universal screwdriver. Once the desired number of screws are inserted, tighten each screw to ensure even loading.

References:
Indications

Key Features

- The S-ROM® design establishes mechanical fixation within the metaphyseal cavity.
- The conical, stepped shape of the proximal sleeve, combined with an extended triangle is designed to fill the metaphysis and deliver compressive load to the proximal femur.
- The design of the stem sleeve, in conjunction with the flutes on the distal stem, provides resistance to torsional forces.
- Independent selection of the proximal and distal components allows the surgeon to achieve a tight implant ‘fit and fill’ within both the metaphysis and diaphysis of the femur – despite wide ranging anatomic differences and mismatches created by bone defects.
- The polished surface of the distal stem helps to prevent osteointegration.
- An independent sleeve and stem allows infinite version and the ability to load in the region of most viable host bone.
- To restore bio-mechanics, S-ROM® necks are available in both lateralised and calcar replacement options.
- Results in revision cases: "86% survivorship at 6 years in patients with an average of 2 previous hip replacements",² "92.2% radiographically stable at a minimum of 4 years".³

Implant Range

A choice of over 8000 potential implant options includes 11/13 and 12/14 taper stems in DDH, standard, long, x-long and xx-long, with standard, lateral and calcar necks. ZTT®, SPA, oversize and HA coated proximal sleeves are available in a wide number of size options. Cobalt chrome and Alumina femoral heads are available in 22,225, 26, 28 and 32 mm diameters with offsets ranging from +0 to +12.

Case Study

Pre-op

The patient was first operated on for osteo-arthritis in 1979. The first revision was in 1990, and the second revision was in 1995. The proximal cortical bone was in very poor condition. The third revision was performed using the S-ROM®.

Post-op

Proximal femoral allograft and autograft were used in conjunction with a straight long stem and cerclage wire. The patient is pain free.

References:

Indications

- Paprosky defect type 1
- Paprosky defect type 2
- Paprosky defect type 3A
- Paprosky defect type 3B

Key Features

- Developed to address problems encountered during revision surgery from mild to severe bone loss.
- Femoral stem design is based upon over 20 years of clinical experience with the AML® extensively coated implants. The Solution System™ has been in clinical use for over 15 years.
- Dedicated revision system.
- Stems are designed to achieve strong cortical interlock in the mid-diaphysis of the femur.
- Mechanically stable when just 4 - 6 cm of cortical contact is achieved in the diaphysis.
- Extensively coated Porocoat® stems provide proven, long-term biological fixation.
- Results achieved using the Solution System™ are comparable with those reported for primary surgery.
- Results using the Solution System™:
  - 95% survivorship at a mean follow up of 13.2 years.
  - 96% survivorship at a mean follow up of 14.2 years.

Implant Range

The extensive range of cobalt chrome stems ensures that the anatomic requirements of each patient are met. The range includes: 6” (150 mm) and 8” (200 mm) straight stems, 8” (200 mm) and 10” (250 mm) bowed stems, 7” (180 mm) and 9” (230 mm) bowed calcar replacement stems. The femoral head options include: 12/14 Articul/eze® self-locking taper, 22.225, 26, 28 and 32 mm cobalt chrome femoral heads, 28 mm and 32 mm Alumina heads.

Case Study

Pre-op

This patient presented pre-operatively with a loose cemented implant and severe bone loss in the metaphysis. Part of the diaphysis is also non-supportive due to bone loss.

Post-op

An 8” (200 mm) Solution System™ stem was used to obtain distal fixation below the level of the defect. Strut grafts and Control Cable were used to provide metaphyseal support. At 10 years the patient remains satisfied with the revision arthroplasty.

References

Femoral Revision

REEF™ DISTALLY INTERLOCKED MODULAR FEMORAL RECONSTRUCTION PROSTHESIS

DePuy
a Johnson & Johnson company
**Indications**

- Paprosky defect type 3A
- Paprosky defect type 3B
- Paprosky defect type 4

**Key Features**

- Modularity enables assembly of the implant during surgery.
- Choice of length, diameter and anteversion ensures complete match to patient.
- Interlocking augments distal fixation in intact diaphyseal bone, preventing subsidence and rotation.
- Bone on-growth on hydroxyapatite coating further encourages implant stability.
- The implants are made of forged titanium alloy, combining excellent bio-compatibility and high fatigue strength.
- Indicated for management of major femoral deficiencies including:
  - Treatment of peri-prosthetic fractures requiring revision and anchorage in the shaft.
  - Tumour surgery requiring anchorage in the shaft following resection.
  - Extensive proximal femoral bone loss requiring anchorage in the shaft.

**Implant Range**

Choice of two trochanteric components permits optimum fill of the metaphysis and restoration of limb length. The stem, trochanteric component, wing and screws are engineered in forged titanium alloy. Heads are available in Alumina ceramic (28 mm and 32 mm) and cobalt chrome (22.225 mm, 28 mm and 32 mm).

**Case Study**

**Pre-op**

This patient underwent revision surgery with a long HA coated stem but subsequently suffered a peri-prosthetic fracture. Surgery was performed in 1995 using a Reef™ stem with an extended transfemoral osteotomy to remove the well osteointegrated implant.

**Post-op**

Two years post-operatively the patient is pain free and has recovered normal function. The X-ray shows a stable implant with normal bone appearance and good consolidation of the femoral flap.

**References**

Acetabular Revision

PROTRUSIO CAGE
Indications

- Paprosky defect type 2B
- Paprosky defect type 2C
- Paprosky defect type 3A
- Paprosky defect type 3B

Key Features

- The Protrusio Cage enhances cemented acetabular reconstruction when traditional biologic fixation with a hemispherical porous-coated acetabular component is not indicated.
- Aids the surgeon in restoring the hip’s centre of rotation while gaining secure fixation to host or allograft bone through iliac and ischial fixation.
- Commercially pure titanium allows the implant to be shaped to fit patient anatomy.
- For cage insertion, a Duraloc® Cup impactor can be attached to the Protrusio Cage apical hole.
- Multiple screw holes allow adjunct fixation in the acetabular dome, ilium or ischium.
- Protrusio Cage trials and insertion instrumentation help facilitate contouring and implantation.
- Contoured iliac flange for increased anatomic apposition to bony structures and reduced intra-operative bending.
- Backside grit blasting enhances bony on-growth.

Implant Range

Sizing options are available in right and left implants, including 48, 52, 56, 60, 64, 68 and 72 mm external diameters. Roof pile screws range from 20 mm to 60 mm in length, increasing in 5 mm increments. Protusio instruments include locking pliers, impactor shaft, impactor tip and a 70 mm straight depth gauge.

Surgical Summary

- Ream the acetabulum to determine exact sizing of the cage necessary to bridge the defect.
- Place the malleable Protrusio Cage trial into position and evaluate it for structural support. Determine the final size and contour the definitive implant using the cage trial.
- Upon final impaction, the Protrusio Cage implant ischial wing may be impacted into the ischium. While maintaining upward dome pressure, use 6.5 mm roof pile screws to secure the dome region. Alternatively, where the ischial wing blade plate technique is not used, 6.5 mm roof pile screw fixation in the dome, ischium and ilium is recommended.

References:

**Indications**

Paprosky defect type 1

Paprosky defect type 2

**Key Features**

- Impaction bone grafting successfully turns a revision procedure into a new primary procedure.

- Designed and developed specifically for use with Charnley®, Elite Plus™ and C-Stem™ implants.

- Bone graft is obtained from a range of sources such as morselised allografts or freeze dried bone.

- Defects in the femur and the acetabulum can be corrected using wire mesh and cerclage wire.

- IBG increases both the quality and quantity of bone available for cement interdigitation, reducing the likelihood of early component loosening.

- Templates and instruments enable preparation of femoral and acetabular sites with a bone and cement mantle which will support long-term fixation.

- Seven different sizes of cement restrictor accommodate variations in the width of the medullary canal.

- Dedicated templates and instrument trays for each implant.

- Survivorship of 91% at a mean of 4 years following impaction bone grafting using freeze-dried allograft in revision hip arthroplasty (Charnley®, and Elite Plus™).

**Implant Range**

Primary II™ instruments supplied for impaction bone grafting include guide wires, cement restrictors, in-line broach handle, acetabular packers, and a range of dedicated proximal and distal packers for either Charnley®, Elite Plus™ or C-Stem™ implants.

**Case Studies**

Pre-op 6 Weeks Post-op 5 Years Post-op

Pre-op 2 Months Post-op 3 Years Post-op

Reference


Indications

Paprosky defect type 3A

Paprosky defect type 3B

Key Features

• A unique cementless acetabular revision system that allows reconstruction of a severely eroded acetabulum

• System comprises three modular components: an outer ring, a hemispherical shell and inner polyethylene liner

• Titanium structure can be shaped to restore patient’s normal anatomy, enabling accurate positioning and alignment of the cup

• The three fixation legs can be adjusted into position to align the ring and provide secure peripheral fixation. The legs are positioned to gain reliable, initial mechanical stability

• HA spray coating on the outer shell encourages bone on-growth and accelerates incorporation of surrounding graft for long-term biological fixation

• Five screw holes in the shell hemisphere allow uncemented bone grafts to be compressed into the host bone, making the cup mechanically stable

• Liners fit tightly within the shell. Notches in the shell and liner provide alignment reference points

• 15° hooded liner lateralises the centre of rotation of the head by 2.8 mm and increases head coverage posteriorly and superiorly

• Soft tissues are balanced and tensioned to assure joint stability through a full range of movement

Implant Range

2 diameters of left and right acetabular ring are available - 50 mm and 55 mm. The ‘Octopus™ ring long’ has 4 holes in the superior iliac leg. The shell is available in 50 mm and 55 mm diameters. All bone screws are 6.5 mm in diameter. The length ranges from 15 mm to 65 mm increasing in 5 mm increments.

Standard hooded and 15° re-orientation liners can be used with 22.225 mm, 28 mm and 32 mm diameter femoral heads.

An Octopus™ instrumentation set is also available.

Case Study

Pre-op

This patient underwent revision surgery for a type 3B loosening of a McKee Farrar total prosthesis.

Six Years Post-op

The patient is pain free. The hip joint is stable with radiographic evidence of good bone in-growth.

References:

Acetabular Revision

S-ROM®
OBLONG CUP
**Indications**

- The S-ROM® Oblong Cup is indicated where the acetabular defect has been created along the axis of the joint reactive forces, resulting in a significant superior defect.

- Where the superior-inferior defect is significant, the S-ROM® Oblong Cup provides excellent results - 96% survivorship at 5 years.2

- In AAOS type III defects, DeBoer and Christie obtained a 78% excellent rating and a Harris Hip Score of 91 at 4.5 years follow-up.3

**Key Features**

- The Poly-Dial® Constrained Liner is indicated for use in total hip cases where dislocation represents a significant post-operative concern.

- The Oblong Cup provides significant bone preservation when compared against other options, such as an oversized or jumbo cup.

- Poly-Dial® Constrained Liner has a titanium alloy locking ring that strengthens the complete construct by locking around the liner face and securing the head through stable axial capture.

- Minimum polyethylene thickness of 5 mm in all sizes.

- Augmented and lateralisized liners are also available for the S-ROM® Oblong Cup.

**Implant Range**

The Oblong Cup is available in the following sizes: 15 mm extension (E15 - neutral); 51, 54, 57, 60, 63 and 66 mm diameters, 25 mm extension (E25 - handed left and right); 51, 54, 57, 60, 63 and 66 mm diameters. The Poly-Dial® Constrained Liner is available in 28 mm head configurations from 48 mm to 66 mm and 32 mm head configurations from 54 mm to 75 mm.

**Case Study**

**Pre-op**

Migration of femoral head into the superior defect.

The patient has a high hip centre.

**Post-op**

Restoration of biomechanics. Void created by defect is filled with metal.

**References:**


MORELAND INSTRUMENTS
ALLOGRIP™ BONE VICE SYSTEM
NOVIOMAGUS BONE MILL™
Moreland Cement Removal Instrumentation

- Facilitates complete cement removal from the femoral canal and acetabulum.
- Femoral instrumentation includes various configurations of osteotomes, a stem extractor and multiple sizes of tamps and reverse curettes to remove distally fixed cement.
- Acetabular instrumentation includes curved osteotomes, punches and tamps to remove cemented metal-backed or all-polyethylene cups.

Moreland Cementless Removal Instrumentation

- Designed to disrupt biological fixation at the bone/implant interface.
- Femoral instrumentation includes flexible osteotomes, fixed stem extractors and trephines to disrupt distal biological ingrowth.
- Acetabular instrumentation includes multiple sizes of curved osteotomes, taps to remove modular polyethylene liners, shell extractors and screw trephines.

Allogrip™ Bone Vice System

- Allows safe and efficient preparation of bone, for use in grafting procedures.
- Holds the majority of femoral head sizes needed for graft reconstruction.

Noviomagus Bone Mill™

- Processes cortico-cancellous bone stock to a consistent particulate size for use in total joint arthroplasty.
- Simple to use, easy to disassemble for cleaning and sterilisation.
- Manually powered.
Indications

Key Features

• DePuy cemented revision long stems are available in the C-Stem™, Elite Plus™ and Charnley® range of stems.

• All of the DePuy cemented revision long stems are manufactured from Ortron 90®, which is up to three times tougher and more corrosion resistant than conventional stainless steels.²

C-Stem™

• The C-Stem™ concept of enhanced stability and sophisticated load transmission is carried through into revision surgery with a range of 6 dedicated revision implants.

Elite Plus™

• A range of 7 dedicated Elite Plus™ revision implants and trials are available. Primary broaches are used to create a metaphyseal cavity at least 1.5 mm greater than the implant on all surfaces.

The diaphysis is prepared by means of intramedullary reaming, resulting in a recommended 20 mm cement depth between the distal tip of the implant and the cement restrictor.

Charnley®

• The Charnley® revision range comprises of 3 long stems (10", 12" and 15") and a resection stem for use where bone is absent, eroded or resorbed.

Case Study

Pre-op

The patient, a 45 year old woman, was diagnosed with a metastatic lesion in the proximal femur - clearly seen on the MRI view. The primary source was Ca Breast.

Post-op

The objective was to bypass the proximal femur through the use of a cemented Elite Plus™ long stem.

A Posterior Lipped Augment Device (PLAD) was used on the acetabular cup to enhance head stability.

References:

**Indications**

- Paprosky defect type 1
- Paprosky defect type 2
- Paprosky defect type 3A

**Key Features**

- Developed from the successful Corail® primary hip implant specifically for revision surgery.
- Designed to achieve secure initial stability in the femur and long-term bio-mechanical fixation.
- Pronounced lateral flare and medial curve provide axial and rotational stability, aided by horizontal and vertical grooves around the circumference of the stem.
- Maximum load is transferred to the proximal femur, minimising stress shielding and thigh pain.
- Macro and micro-textural contours provide an extensive surface area to encourage bone on-growth and allow the HA coating to achieve strong apposition within weeks of surgery.
- A proximal collar prevents axial migration and is also used to compress and stabilise bone-allograft in the calcar region.
- Longer stem assists correct axial alignment.
- 98% survivorship and 0% aseptic loosening at 7 years.

**Implant Range**

Five sizes and length of femoral stem, with a standard 12/14 taper, compatible with 22.225 mm, 28 mm and 32 mm heads in cobalt chrome and Alumina ceramic.

**Case Study**

**Pre-op**
Revision of a loose cemented femoral stem (Paprosky Type 2) was performed in 1993.

**5 Years Post-op**
The patient is satisfied with the hip replacement. Good bone in-growth can be noted, with signs of endosteal bone formation and restoration of adequate cortical density. No radiolucency is observed.

Reference:
Femoral Defect Classification System

Appropriate pre-operative patient evaluation and radiographic analysis can assist with optimal implant selection. DePuy’s revision platform uses the Paprosky\(^1\) defect classification system, which allows the surgeon to identify the femoral and acetabular deficiencies, then select the most appropriate procedures and implant.

**Type 1**
- Calcar region is supportive.
- Minor anterior/posterior cancellous bone loss.
- Metaphysis is intact.
- Diaphysis is intact.

The following options are recommended: Charnley\(^{®}\), Elite Plus™ & C-Stem™ Primary™ IBG Prostheses, Charnley\(^{®}\), Elite Plus™ & C-Stem™ Long Stem Prostheses, Kar™, Solution System™ & S-ROM\(^{®}\).

**Type 2**
- Calcar region is non-supportive.
- Cancellous/cortical structural bone is absent.
- Metaphysis is not intact.
- Diaphysis has minimal damage.

The following options are recommended: Charnley\(^{®}\), Elite Plus™ & C-Stem™ Primary™ IBG Prostheses, Charnley\(^{®}\), Elite Plus™ & C-Stem™ Long Stem Prostheses, Kar™, Solution System™ & S-ROM\(^{®}\).

**Type 3A**
- Metaphysis is non-supportive.
- Diaphysis is non-supportive due to bone loss.
- Distal fixation over 4 cm can be achieved near the isthmus.

The following options are recommended: Kar™, Reef™, Solution System™ & S-ROM\(^{®}\).

**Type 3B**
- Metaphysis is non-supportive.
- Diaphysis is not intact due to severe bone loss.
- Distal fixation over 4 cm can be achieved at the isthmus.

The following options are recommended: Kar™, Reef™, Solution System™ & S-ROM\(^{®}\).

**Type 4**
- Extensive meta-diaphyseal damage exists.
- Cortices in the isthmus have been eroded.
- Alternative femoral fixation methods must be considered.

The Reef™ option is recommended.

Acetabular Defect Classification System

Type 1
- No superior migration of the failed head centre.
- Teardrop and ischium are intact.
- Minimal bone loss caused by small defects or localised osteolysis.

The following options are recommended:
Duraloc® or Charnley®, Elite Plus™ & Ogee® IBG cemented cup.

Type 2A
- Migration of the hip centre is present.
- Increasing loss of teardrop and destruction of the ischium.
- Anterior and posterior columns are intact.

The following options are recommended:
Duraloc® or Charnley®, Elite Plus™ & Ogee® IBG cemented cup.

Type 2B
- Migration approaching 3 cm above the superior obturator transverse line.
- Further loss and distortion of the superior hemisphere.
- Medial, posterior and anterior bone is intact.

The following options are recommended:
Duraloc® 1200, Ultima® ring or Protusio cage.

Type 2C
- Significant medial migration.
- Teardrop destruction is moderate to severe.
- Minimal ischial lysis.
- Posterior column supportive.

The following options are recommended:
Duraloc® 1200, Ultima® ring or Protusio cage.

Type 3A
- Severe superior bone loss with no supportive superior dome.
- Anterior and posterior columns may still be supportive.
- Teardrop and ischial lysis remain mild to moderate.

The following options are recommended:
S-ROM® Oblong Cup, Octopus™, Ultima® ring or Protusio cage.

Type 3B
- The entire acetabulum is non-supportive.
- The teardrop is obliterated and ischial lysis is severe.

The following options are recommended:
S-ROM® Oblong Cup, Octopus™, Ultima® ring or Protusio cage.
Acetabular Revision

DURALOC®
UNCEMENTED ACETABULAR COMPONENTS
**Indications**

- Paprosky defect type 2A
- Paprosky defect type 2B
- Paprosky defect type 2C

**Key Features**

**Duraloc 1200 Acetabular Shell**

- Duraloc® 1200 has fixation holes in all quadrants to allow freedom for the selection of fixation points.
- Ideal for use in revision situations which require additional fixation.
- Extensive Porocoat® covering to the outer shell.

**Duraloc Constrained Liner**

- The Duraloc® Constrained Liner is indicated for use in total hip cases where dislocation represents a significant post-operative concern.
- The liner is used where more conservative soft tissue tensioning alternatives, such as femoral neck lengthening, component positioning and lateralised acetabular components, may not be effective.
- The minimum thickness of the Enduron™ polyethylene is uncompromised by the constrained liners and is 6 mm or greater in all sizes.
- A titanium alloy reinforcing ring strengthens the construct.

**Implant Range**

Duraloc® 1200 is available in 48 mm to 74 mm diameter sizes.

Duraloc® Constrained Liner is available in 28 mm head configurations from 48 mm to 74 mm and in 32 mm head configurations from 52 mm to 74 mm.

**Surgical Summary**

- After reaming, place the appropriate trial cup in the acetabulum at the desired anteversion and inclination. Implant the appropriate acetabular cup in a position that accurately reproduces the trial cup position.
- If desired, secure the implanted cup with screw fixation.
- Select the appropriate Duraloc® Constrained Liner and place it into the acetabular cup component.
- Place the constrained liner reinforcement ring over the head and neck of the femoral prosthesis. When the fixed head components are in position, the liner reinforcement ring will fit over the fixed head.

Reference:

**Key Features**

- Designed as a simple, effective option to address revision hip arthroplasty
- Options of cobalt chrome or stainless steel cable, or stainless steel wire
- User-friendly instrumentation for maximum flexibility and intra-operative functionality

**Indications**

- Re-attachment of extended proximal femoral osteotomy fragment.
- Revision hip and knee arthroplasty: fixation of strut grafts and iatrogenic fractures.
- Prophylactic cabling or wiring of proximal femur.
- Trauma fracture fixation.
- Re-attachment of trochanter after trochanteric osteotomy.

**Implant Range**

- Cobalt chrome cable and sleeve.
- Stainless steel cable and sleeve.
- Stainless steel wire.

**Instrumentation**

- Streamlined cable tensioner has a quick trigger cam locking action and precise tension gauge.
- Wire tensioner enables instant loading and release.
- Passer handle has optional settings of 0°, 30°, 60° and 90° that allows for optimal intra-operative ergonomics.
- Crimper offers a crimp stop mechanism to allow for consistent crimping.
- The cable cutters improved design moves the cutter blades in closer contact with cable and wire.
- Lightweight, durable delivery system of instruments, case and trays.

**Control™ Cable and Wire System**

**Cobalt chrome cable and sleeve**
- 1.8 mm diameter
- 24 in. length
- 7x7 strand configuration
- Stress relieved through the annealing process
- Low profile sleeve design with chamfered entrance holes

**Stainless steel cable and sleeve**
- 1.8 mm diameter
- 25 in. length
- 7x7 strand configuration
- Stress relieved through the annealing process
- Low profile sleeve design with chamfered entrance holes

**Stainless steel wire**
- 18 gauge steel
- 25 in. length
- Two and four strand increments

**Control™ Cable and Wire System**

- Cable tensioner
- Wire tensioner
- Passer handle
- Crimper
- Instrument case and trays
- Cable cutter
- Post-op x-ray