“Overcoming the problems that inhibit the long term success of hip revision surgery is now considered to be one of the most pressing problems facing orthopaedic surgeons today.”

Dr. Wayne Paprosky, 1998
For every problem there is a solution

The unparalleled success of total hip arthroplasty (THA) over the past 30 years has improved the quality of life for millions of people. However, as more patients are treated each year, including a greater number of high demand young patients, there has been a substantial increase in the number of procedures to revise failed implants.

Revision surgery is rarely straight-forward. Extensive metaphyseal bone loss, well fixed implants and cement lodged in the distal femur can all present difficulties in revision surgery.

In general, the results of cemented and cementless revision procedures fall short of those achieved for primary arthroplasty.

The Solution System® was developed to address problems encountered during revision surgery, from mild to severe bone loss.

A simple defect classification system, a comprehensive range of femoral and acetabular components, together with dedicated instrumentation, provide the surgeon with a complete range of answers.

Femoral stem design is based upon 20 years of clinical experience using extensively coated cementless implants. Results achieved using the Solution System® are comparable with those reported for primary surgery.

Five to 14 year follow-up studies of Solution System® components report survivorship as high as 97.6%.

Typical results reported for revision surgery using conventional implants

Uncemented results:
- 17% re-revision at 8.1 years
- 10% revision and 24% mechanical failure rate at 4.6 years
- 17% revision and 55% femoral loosening at 4.7 years
- 3.4% femoral failure at an average of 3 years

Cemented results:
- 29% mechanical failure and 17% re-revision at 8.1 years
- 9.5% re-revision and a further 16% loose; 26% mechanical failure at 10 years
- 26% mechanical failure rate / re-revision at 15.1 years
- 3% revision, 44% probability of femoral loosening at 4.5 years

Results using the Solution System®
- 82% bone ingrowth and 69% pain free at 5 years
- 97.6% survivorship at 8.2 years
- 97.7% survivorship at 5 years
- 99% stability at 4.4 years
**Solution System® Femoral Defect Classification**

by Dr Wayne G Paprosky, MD

The Solution System® provides a simple defect classification, allowing the surgeon to identify femoral deficiencies, the appropriate procedure and the type of implant to be used.

**Type 1**
- The calcar region is supportive.
- Minor cancellous bone loss exists anterior/posterior - the metaphysis is intact.
- The diaphysis is intact.

**Type 2**
- The calcar is non-supportive.
- Cancellous/cortical structural bone is absent - the metaphysis is not intact.
- The diaphysis has minimal damage.

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

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

**Type 4**
- Extensive meta-diaphyseal damage exists.
- The cortices in the isthmus have been eroded - reliable distal fixation is not indicated.
- Alternative femoral fixation methods must be considered.
Femoral Reconstruction

The extensive range of cobalt chrome Solution System® stems ensures that the anatomic requirements of each patient are met. The range includes:

6 inch and 8 inch straight Solution System® stems.
- 10.5 mm - 22.5 mm diameters.
- A choice of two proximal triangles: standard; or MMA (Modified Medial Aspect) which is smaller in the medial/lateral dimension and is intended for patients with narrow proximal femora.
- Straight stems are used in cases with metaphyseal bone loss, and minimal or no diaphyseal damage.

8 inch and 10 inch bowed Solution System® stems.
- 13.5 mm - 22.5 mm diameters.
- Accommodates the needs of patients with greater meta-diaphyseal bone loss and obvious femoral curvature.
- The 10 inch stem is used to obtain more distal anchorage.

7 inch straight and 9 inch bowed calcar replacement stems.
- 7": 12 mm - 19.5mm diameter
- 9": 13.5 mm - 19.5mm diameter
- Supplements the calcar region when there is severe metaphyseal bone loss, or loss of abductor tension.

Femoral Head Options

The Solution System® now features:
- 12/14 self-locking taper
- 22.225 mm, 26 mm, 28 mm and 32 mm Articul/eze® cobalt chrome femoral heads
- 26 mm, 28 mm and 32 mm zirconia ceramic femoral heads.
- A range of neck lengths in each head size to facilitate the restoration of normal biomechanics.

- Zirconia offers twice the fracture toughness of alumina. It has a very fine particulate structure and a smooth surface finish, shown in laboratory testing, to generate up to 42% less polyethylene wear debris than alumina and 68% less wear debris than metal.11
Bone deficiencies in the proximal third of the femur may significantly limit the chances of initial stability for proximally fixed implants.

The Solution System® stem becomes mechanically stable when just 4-6 cm of cortical contact is achieved in the diaphysis, where cortical bone is most reliable.15

**AML® Heritage of Proven Clinical Success**

The Solution System® shares its design rationale with the extensively Porocoat® porous-coated AML®, an implant that has been in clinical use for more than twenty years and that has consistently produced results that have yet to be matched by any other cementless hip implant.12,13,14

The Solution System® is a dedicated revision system, comprising implants and instruments, providing comprehensive and specific answers to a range of revision problems.

When a primary implant has failed, retrieval may reveal substantial deficiencies in the proximal third of the femur, the region which many cementless implants rely upon for fixation. Consequently, it can be difficult to gain initial fixation with a proximally fixed cementless stem, making long-term ingrowth and stability unlikely.

Deficiencies in the proximal femur may also preclude cemented implantation without substantial reinforcement to the proximal femur.

The Solution System® femoral stems are

---

A reliable platform for long-term success

The Solution System® stem becomes mechanically stable when just 4-6 cm of cortical contact is achieved in the diaphysis, where cortical bone is most reliable.15
designed to achieve strong cortical interlock in the mid-diaphysis of the femur, where undamaged cortical bone is most likely to be found.

The stem is symmetrical (parallel sided) making femoral preparation and implantation a straightforward and simple procedure.

When implanting a straight stem, the femur is typically under-reamed by 0.5 mm, but is reamed line-to-line to accommodate a curved stem.

The implant is driven into the diaphysis obtaining a “scratch fit” over 4-6 cm providing mechanical stability - an essential factor for biological fixation to occur.
Porocoat® - a unique fixation interface

The Solution System® stems are extensively coated with Porocoat® porous coating. This unique and proprietary porous surface is composed of sintered metal beads that create a three-dimensional structure. As the stem is impacted, autogenous bone is “grafted” into the pores of the coating.

The clinical performance of Porocoat® has been demonstrated over twenty years, and retrieval studies continue to provide definitive evidence of extensive ingrowth.15,18

Porocoat® Features:

- a pore size of 250 microns, documented in laboratory studies to be the optimum size for penetration of bone tissue;16
- a porosity gradient that enhances the potential for ingrowth;
- superior bond strength at the substrate/implant interface;16
- a coefficient of friction 33% higher than any other porous coating, significantly increasing Porocoat’s resistance to shear and tensile stresses.17

Long-term clinical results demonstrate...
that the extensive coating of the Solution System® stem increases the likelihood of long-term implant stability.15

This unique combination of mechanical implant stability and extensive biological ingrowth consistently produces successful, long-term clinical results in even the most demanding and complex revision cases.

![A pore size comparison of alternative coatings. 15
Optimum average pore size is 250 microns. Smaller pores restrict bone development; larger pores produce slower, inconsistent ingrowth.15](image)

Superior bond strength allows the Porocoat® porous coated stem to be safely driven into the femur to create a strong implant to bone interlock.

Published shear strength values of alternative coatings15

![Published shear strength values of alternative coatings](image)
The Solution System® for revision hip arthroplasty. Mid to long term results.

97.6% stem survivorship with 297 patients and 5-13 year follow up.

Krishnamurthy AB, MacDonald SJ, Paprosky WG.

No fixation failures, 90.6% of stems bone ingrown and 92.6% patient satisfaction, with 86 femoral revision arthroplasties and a mean follow up of 3 years.

Paprosky WG, Jablonsky WS, Bradford MS.

99% stability, in a series of 166 cementless revision arthroplasties with a mean follow up of 4.4 years.

Engh CA.

97.7% stem survivorship, with 175 cases and an average follow up of 5 years.

Moreland J.

82% of stems bone ingrown, with 297 patients and 5-15 year follow up.

Paprosky WG, Krishnamurthy A.
Revision Total Hip Arthroplasty: Five to 15 Year Follow-up on Cementless Femoral Revisions. Orthopedics, Vol 19, No 9, September 1996.

Case study 1 - Defect type 2

Pre-operative
This patient presented with a failed Müller type stem and apparent fracture at the femoral neck junction. The calcar is non-supportive, with erosion of the proximal femur extending down to the lesser trochanter. There is minimal damage in the diaphysis.

Post-operative
Immediately post-operatively the implant is stable, with good cortical contact distally. An 8” straight Solution System® stem was used, with strut grafting to provide additional support to the proximal femur.

7 years post-operative
The Solution System® implant is well fixed with good cortical contact and a well incorporated strut graft.

The patient was reported to be doing well at seven years and, now nine years post-operatively, the patient remains satisfied with the outcome.

Case study 2 - Defect type 2

Pre-operative
This patient presented pre-operatively with evidence of loosening, cement mantle failure and lytic lesions.

The metaphysis is non-supportive, but the diaphysis shows minimal damage.

Post-operative
An 8” straight Solution System® stem has been used to achieve distal fixation and implant stability.

4.5 years post-operative
Laterally the stem appears to be marginally undersized, but in the A/P view, the stem is well centralised and distal spot welds confirm implant stability.

Case study 3 - Defect type 3B

Pre-operative
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-operative
An 8” Solution System® stem was used to obtain distal fixation below the level of the defect. Strut grafts were used to provide metadiaphyseal support.

8 years post-operative
Good implant-to-bone contact is apparent distally over at least 4-6 cm. At 8 years the implant is stable and the strut grafts show signs of incorporation. At 10 years the patient remains satisfied with the revision arthroplasty.
Solution System® Accessory Products

Solution System® and Duraloc® Acetabular Cup
- Porocoat® porous coating provides optimum pore size to encourage ingrowth
- The Duraloc® 1200 Series cup provides multiple dome screw holes for fixation
- The +4 Deep Profile Solution System® shell, available in sizes 56 mm - 80 mm, moves the centre of rotation of the femoral head 4 mm more laterally to address protusio indications
- Six peripheral screw holes (5 mm screw holes) provide additional fixation where inadequate host bone provides support for the metal shell
- +4 Enduron™ polyethylene liners can be used with the Duraloc® or Solution System® shell to move the centre of rotation of the femoral head 4 mm more laterally.

Control™ Cable Cerclage System
- 1.8 mm cobalt chrome cable (18 inches in length) and sleeve are offered, packaged together
- Cable passer handle incorporates small or large inserts, depending on anatomical requirements
- Cable tensioner offers improved tactile feel combined with gauging to provide predictable tensioning
- Crimper offers a “stop” mechanism to verify consistent crimping

Protrusio Cage
- Available in commercially pure titanium alloy, allowing the implant to be custom shaped
- Available in sizes 52, 56, 60, 64, 68 & 72 mm, left and right
- Multiple 6.5 mm screw holes are offered to allow fixation in the acetabulum, the ilium and the ischium
- Implanted using the Duraloc® cup impactor
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

Solution System® Instrumentation

• Femoral instruments include cement plug drills, bone tamps and thin shaft reamers to facilitate reaming beyond the anterior bow of the femur
• Acetabular instruments include straight and angled bone tamps to fill acetabular voids, retractors and hand finishing reamers

Please contact your local DePuy representative for additional information on these accessory products.

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 Vise System

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

Lere Bone Mill™

• Processes cortico-cancellous bone stock to a consistent particulate size
• Prepares bone slurry or paste for use in total joint arthroplasty
• Powered by compressed air or nitrogen
### Ordering Information

#### 6" Straight Stems
- 1571-02-000 10.5 mm, Standard, 12/14 Taper
- 1571-03-000 12.0 mm, Standard, 12/14 Taper
- 1571-04-000 13.5 mm, Standard, 12/14 Taper
- 1571-05-000 15.0 mm, Standard, 12/14 Taper
- 1571-06-000 16.5 mm, Standard, 12/14 Taper
- 1571-07-000 18.0 mm, Standard, 12/14 Taper
- 1571-08-000 19.5 mm, Standard, 12/14 Taper
- 1571-09-000 21.0 mm, Standard, 12/14 Taper
- 1571-10-000 22.5 mm, Standard, 12/14 Taper

#### 7" Straight Calcar Stems
- 1571-61-000 12.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-63-000 13.5 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-65-000 15.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-67-000 16.5 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-69-000 18.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-71-000 19.5 mm, Standard, 1.5 cm Platform, 12/14 Taper

#### 8" Straight Stems
- 1571-12-000 10.5 mm, Standard, 12/14 Taper
- 1571-13-000 12.0 mm, Standard, 12/14 Taper
- 1571-14-000 13.5 mm, Standard, 12/14 Taper
- 1571-15-000 15.0 mm, Standard, 12/14 Taper
- 1571-16-000 16.5 mm, Standard, 12/14 Taper
- 1571-17-000 18.0 mm, Standard, 12/14 Taper
- 1571-18-000 19.5 mm, Standard, 12/14 Taper
- 1571-19-000 21.0 mm, Standard, 12/14 Taper
- 1571-20-000 22.5 mm, Standard, 12/14 Taper

#### 8" Bowed Stems
- 1571-74-000 13.5 mm, Standard, Left, 12/14 Taper
- 1571-75-000 15.0 mm, Standard, Left, 12/14 Taper
- 1571-76-000 16.5 mm, Standard, Left, 12/14 Taper
- 1571-77-000 18.0 mm, Standard, Left, 12/14 Taper
- 1571-78-000 19.5 mm, Standard, Left, 12/14 Taper
- 1571-79-000 21.0 mm, Standard, Left, 12/14 Taper
- 1571-80-000 22.5 mm, Standard, Left, 12/14 Taper

#### 10" Straight Calcar Stems
- 1571-04-000 10.5 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-05-000 12.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-06-000 13.5 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-07-000 15.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-08-000 16.5 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-09-000 18.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
- 1571-10-000 19.5 mm, Standard, 1.5 cm Platform, 12/14 Taper

#### 9" Bowed Stems
- 1573-07-000 13.5 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
- 1573-08-000 15.0 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
- 1573-09-000 16.5 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
- 1573-10-000 18.0 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper

#### 10" Bowed Stems
- 1571-03-000 13.5 mm, Standard, Left, 12/14 Taper
- 1571-04-000 15.0 mm, Standard, Left, 12/14 Taper
- 1571-05-000 16.5 mm, Standard, Left, 12/14 Taper
- 1571-06-000 18.0 mm, Standard, Left, 12/14 Taper
- 1571-07-000 19.5 mm, Standard, Left, 12/14 Taper

#### Articul/eze® Femoral Heads

##### Cobalt Chrome
- 1365-29-000 Cobalt Chrome 22.225 mm +4
- 1365-30-000 Cobalt Chrome 22.225 mm +7
- 1365-01-000 Cobalt Chrome 26 mm +4
- 1365-02-000 Cobalt Chrome 26 mm +7
- 1365-03-000 Cobalt Chrome 26 mm +10
- 1365-11-000 Cobalt Chrome 28 mm +1.5
- 1365-12-000 Cobalt Chrome 28 mm +5
- 1365-13-000 Cobalt Chrome 28 mm +8.5
- 1365-14-000 Cobalt Chrome 28 mm +12
- 1365-15-000 Cobalt Chrome 28 mm +15.5
- 1365-21-000 Cobalt Chrome 32 mm +1
- 1365-22-000 Cobalt Chrome 32 mm +5
- 1365-23-000 Cobalt Chrome 32 mm +9
- 1365-24-000 Cobalt Chrome 32 mm +13
- 1365-25-000 Cobalt Chrome 32 mm +17
Articul/eze® Femoral Heads - Zirconia
1365-41-000  Zirconia 26 mm +4
1365-42-000  Zirconia 26 mm +7
1365-43-000  Zirconia 28 mm +1.5
1365-44-000  Zirconia 28 mm +5
1365-45-000  Zirconia 28 mm +8.5
1365-46-000  Zirconia 32 mm +1
1365-47-000  Zirconia 32 mm +5
1365-48-000  Zirconia 32 mm +9

Articul/eze® Instrumentation
2554-30-000  Trial Neck Segment (12/14 Taper)
2573-60-000  Calcar Cutting Guide (7" and 9" Stems)

Solution System® Overlays
2994-03-015  Overlays - 6" and 8"
2994-03-020  Overlays - 7" Calcar
2994-03-025  Overlays - 9" Calcar
2994-03-030  Overlays - 8" and 10" Bowed

6" Straight Trial Stems
Use Excel™ broach and neck segment for trial reduction

7" Straight Calcar Trial Stems
2571-61-000  12.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
2571-63-000  13.5 mm, Standard, 1.5 cm Platform, 12/14 Taper
2571-65-000  15.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
2571-67-000  16.5 mm, Standard, 1.5 cm Platform, 12/14 Taper
2571-69-000  18.0 mm, Standard, 1.5 cm Platform, 12/14 Taper
2571-71-000  19.5 mm, Standard, 1.5 cm Platform, 12/14 Taper

9" Bowed Trial Calcar Stems
2573-03-000  13.5 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
2573-04-000  15.0 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
2573-05-000  16.5 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
2573-06-000  18.0 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
2573-07-000  19.5 mm, Standard, 2.25 cm Platform, Left, 12/14 Taper
2573-13-000  13.5 mm, Standard, 2.25 cm Platform, Right, 12/14 Taper
2573-14-000  15.0 mm, Standard, 2.25 cm Platform, Right, 12/14 Taper
2573-15-000  16.5 mm, Standard, 2.25 cm Platform, Right, 12/14 Taper
2573-16-000  18.0 mm, Standard, 2.25 cm Platform, Right, 12/14 Taper
2573-17-000  19.5 mm, Standard, 2.25 cm Platform, Right, 12/14 Taper

8" Straight Trial Stems
2571-12-000  10.5 mm, Standard, 12/14 Taper
2571-13-000  12.0 mm, Standard, 12/14 Taper
2571-14-000  13.5 mm, Standard, 12/14 Taper
2571-15-000  15.0 mm, Standard, 12/14 Taper
2571-16-000  16.5 mm, Standard, 12/14 Taper
2571-17-000  18.0 mm, Standard, 12/14 Taper
2571-18-000  19.5 mm, Standard, 12/14 Taper
2571-19-000  21.0 mm, Standard, 12/14 Taper
2571-20-000  22.5 mm, Standard, 12/14 Taper

10" Bowed Trial Stems
2571-24-000  13.5 mm, Standard, Left, 12/14 Taper
2571-25-000  15.0 mm, Standard, Left, 12/14 Taper
2571-26-000  16.5 mm, Standard, Left, 12/14 Taper
2571-27-000  18.0 mm, Standard, Left, 12/14 Taper
2571-28-000  19.5 mm, Standard, Left, 12/14 Taper
2571-29-000  21.0 mm, Standard, Left, 12/14 Taper
2571-30-000  22.5 mm, Standard, Left, 12/14 Taper

9" Bowed Trial Stems
2571-34-000  13.5 mm, Standard, Right, 12/14 Taper
2571-35-000  15.0 mm, Standard, Right, 12/14 Taper
2571-36-000  16.5 mm, Standard, Right, 12/14 Taper
2571-37-000  18.0 mm, Standard, Right, 12/14 Taper
2571-38-000  19.5 mm, Standard, Right, 12/14 Taper
2571-39-000  21.0 mm, Standard, Right, 12/14 Taper
2571-40-000  22.5 mm, Standard, Right, 12/14 Taper

8" Bowed Trial Stems
2571-74-000  13.5 mm, Standard, Left, 12/14 Taper
2571-75-000  15.0 mm, Standard, Left, 12/14 Taper
2571-76-000  16.5 mm, Standard, Left, 12/14 Taper
2571-77-000  18.0 mm, Standard, Left, 12/14 Taper
2571-78-000  19.5 mm, Standard, Left, 12/14 Taper
2571-79-000  21.0 mm, Standard, Left, 12/14 Taper
2571-80-000  22.5 mm, Standard, Left, 12/14 Taper

Articul/eze® Trial Heads
2530-69-000  22.225 mm +4
2530-70-000  22.225 mm +7
2530-71-000  26 mm +4
2530-72-000  26 mm +7
2530-73-000  26 mm +10
2530-81-000  28 mm +1.5
2530-82-000  28 mm +5
2530-83-000  28 mm +8.5
2530-84-000  28 mm +12
2530-85-000  28 mm +15.5
2530-91-000  32 mm +1
2530-92-000  32 mm +5
2530-93-000  32 mm +9
2530-94-000  32 mm +13
2530-95-000  32 mm +17

Articul/eze® Overlays
2994-03-015  Overlays - 6" and 8"
2994-03-020  Overlays - 7" Calcar
2994-03-025  Overlays - 9" Calcar
2994-03-030  Overlays - 8" and 10" Bowed
References:


Caution: Federal law (USA) restricts these devices to sale by or on the order of a physician

AML®, Articul/eze®, Duraloc®, Porocoat® and Solution System® are registered trademarks and Allogrip™Bone Vise System, Control Cable™, Enduron™, Excel™ and Lere Bone Mill™ are trademarks of DePuy Orthopaedics, Inc.