Design Rationale

Smith & Nephew
REDAPT®
Revision Femoral System
Introduction

Revisions today are anything but routine. As more patients have their first total hip at a younger age, it’s becoming common for many to have multiple revision surgeries in their lifetime for infections, fractures, implant subsidence and wear. Each patient deserves the best possible fit and function from their implant and the surgeon expects a revision hip system that helps them achieve personalized patient treatment as quickly and effectively as possible. REDAPT™ Revision Femoral is uniquely designed to address the needs of today’s revision hip patient.

One system for all revision types

REDAPT was developed to specifically provide one system that allows the surgeon to treat mild to severe femoral revisions and has been used in all Paprosky types. The Proximally Fluted stem was designed for cases where proximal defects are limited and the Modular Sleeved stem was designed for cases where metaphyseal and cortical defects are prevalent.
The key goals of any revision hip are fixation, stem fit and joint stability. REDAPT™ combines unique implant and instrument designs to confidently address your patient’s individual needs.

**ROCKTITE® Fixation**
Initial and long term fixation is critical in femoral revision surgery. The REDAPT Revision Femoral System addresses this issue by providing ROCKTITE flutes for rock-solid fixation, three degree stem taper for subsidence resistance, a monoblock stem for improved strength and adjustable proximal fit and fill options for improved metaphyseal support. The ROCKTITE flutes are a patented, multilevel spline pattern designed for rock-solid subsidence control and rotational stability.

**Adaptability**
REDAPT implants are designed to provide distal fixation and secondary proximal support allowing the surgeon intra-operative flexibility to achieve the best patient fit without compromising strength. The REDAPT System provides a variety of options to achieve joint stability and return center of rotation through two stem types, modular proximal sleeves, and the use of modular necks.

**Reproducibility**
The REDAPT system offers an efficient and precise surgical technique that allows the implant to be consistently placed at the level the surgeon desires. The combination of ROCKTITE flutes and the ability to trial off the reamers ensure a reproducible and consistent surgical experience.
**REDAPT™ Proximally Fluted (PF) Stem**

**Modular neck**
- Forged cobalt chrome alloy
- 12/14 Head taper
- Circulotrapezoidal neck
- 5 Neck options
  - Offset: Standard and high
  - Height: high offset +10
  - Version: antevered left and right
- Provides 54 head center options
- Compatible with Smith & Nephew heads

**Stem**
- Forged Titanium alloy (Ti-6Al-4V) tapered, fluted cylinder with proprietary ROCKTITE™ flutes
- Diameters: 12-27mm (1mm increments)
- Lengths: 240mm and 300mm
  - Stem length is measured from +0 head center at the greater trochanter to distal tip of the stem
REDAPT® Modular Sleeved (MS) Stem

**Modular neck**
- Forged cobalt chrome alloy
- 12/14 Head taper
- Circulotrapezoidal neck
- 5 Neck options
  - Offset: Standard and high
  - Height: high offset +10
  - Version: anteverted left and right
- Provides 54 head center options
- Compatible with Smith & Nephew heads

**Modular sleeve**
- Titanium (Ti-6Al-4V)
- HA on grit blast
  - Extra small
- HA on STIKTITE™ coating
  - Small, medium, large
- 50mm length

**Stem**
- Forged Titanium alloy (Ti-6Al-4V) tapered stem with proprietary ROCKTITE™ flutes
- Diameter: 12mm–27mm (1mm increments)
- Lengths: 240mm and 300mm
  - Stem length is measured from +0 head center at the greater trochanter to distal tip of the stem
ROCKTITE® Fixation

ROCKTITE™ is a monoblock, 3° tapered titanium stem with ROCKTITE distal flutes for improved diaphyseal fixation.

ROCKTITE Flutes are a patented multi-level spline pattern which has been shown to provide rock-solid fixation in a wide variety of revision types. Combined with a three degree taper on the distal stem section, ROCKTITE flutes reduce the potential for stem rotation and subsidence, a key complication of many conical and tapered stems.

The REDAPT Stem features a 3° taper angle, providing a proven wedge fit. This taper angle is naturally more resistant to subsidence than competitive stems with smaller stem taper angles.

Affect of Stem Taper to Axial Displacement

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<th>Competitor A</th>
<th>Competitor B</th>
<th>REDAPT</th>
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<tr>
<td>Stem Taper</td>
<td>2°</td>
<td>2.5°</td>
<td>3°</td>
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<tr>
<td>Axial Displacement with 1mm change in Diameter</td>
<td>29mm</td>
<td>23mm</td>
<td>19mm</td>
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![Bar graph showing axial displacement for different stem tapers.](image)
**Rotational and axial stability**

ROCKTITE™ is a multi-level flute geometry consisting of major and minor splines which provide axial and rotational stability, and reduce potential subsidence. The major splines are the primary factor contributing to the rotational and axial stability of the REDAPT™ stem. The major splines increase in height from distal to proximal along the stem, and make up the 3 degree taper profile. The major splines also increase 50% in width from distal to proximal and provide a 0.25mm press fit to the distal reamer.

The minor splines of the ROCKTITE Flute pattern offer additional axial stability to the REDAPT stem. These minor splines increase in both width and height as you progress from distal to proximal along the stem. These minor splines provide for multiple wedges to be formed into the bone for excellent subsidence control.
Adaptability

Proximal Sleeves
The ability to adapt to proximal bone loss and defects is critical in hip revision surgery. The REDAPT Revision Femoral system offers modular sleeves to provide secondary proximal support when required and various size options for filling metaphyseal defects which may enhance implant stability.

Sleeves are available in extra small, small, medium, and large sizes. The small, medium and large titanium alloy conical sleeves are coated with STIKTITE® and hydroxyapatite (HA). Extra small sleeves are available with grit blast finish and HA coating. For cases when a proximal sleeve is not required, the Proximally Fluted stem may be used. With the Proximally Fluted and Modular Sleeved stems, the surgeon has five different proximal size options for each stem diameter, providing a more adaptable solution than many competitive stems.

STIKTITE Advanced Titanium Coating
With one of the highest coefficients of friction in the industry, STIKTITE coating provides a solid foundation for both initial and long-term fixation.
Proximal Options by Competitor

Proximal Size Options by Distal Size
Adaptability continued

Necks
Regaining joint stability and restoring head center are primary goals of revision surgery. The modular necks used with the REDAPT™ stem allow the surgeon to make adjustments to offset, leg length, neck angle and version to achieve optimal patient fit and function for a stable joint. Modular necks are available in five options: standard offset, high offset, high offset +10mm, anteverted left and anteverted right. Each of the anteverted necks provide 10 degrees of anteversion/retroversion depending on the hip they are used to treat. In combination with all head lengths, bidirectional assembly of these five necks allows the surgeon 54 head center options.

54 distinct head centers
In the following table, each dot represents a head center that is achievable with the REDAPT system and the vast complement of Smith & Nephew femoral heads.

Offset Options by Competitor

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<tr>
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<td>Competitor C</td>
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<tr>
<td>Competitor D</td>
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Offset [mm]
Material and design matter. Each Smith & Nephew neck is made of cobalt chrome for improved fatigue strength. They are designed with a 12/14 head taper for use with Smith & Nephew cobalt chrome, ceramic, and OXINIUM® heads. Smith & Nephew modular necks are designed to maximize surface area of the neck in the pocket. The circulotrapezoidal neck allows for optimal range of motion.

**Taper design**

Smith & Nephew modular necks are designed with a larger taper surface area in order to minimize the risk of fretting and corrosion. The neck taper is designed to have as much as a 50% more contact surface area compared to competitive options.

**Strength**

A CoCr modular neck provides for a strong neck construct. Fatigue testing has shown that the REDAPT™ stem with the cobalt chrome modular neck design exceeds the fatigue strength of the same neck design made out of titanium alloy by as much as 83% and a conventional titanium monolithic hip stem by as much as 18%.

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![Diagram showing relative neck fatigue strength](image)

Ti modular stem  | REDAPT stem  | Ti monolithic stem
---|---|---
83% | 100% Contact Area | 84% Contact Area
18% | 66% Contact Area
Reproducibility

The REDAPT™ system’s highly efficient surgical technique uses over-the-top reaming and over-the-top trialing. In essence, the final distal reamer is used as the distal trial. Using the distal reamer as the trial allows the surgeon to maintain a tight, non-disrupted fit within the femoral canal while proximal stem preparations are made using the proximal reamer. The precision reaming of the proximal reamers over the distal reamer also ensures appropriate orientation of the proximal sleeve to the distal aspect of the stem.

Additionally, color coded instruments and packaging reduce potential for confusion in the operating room. The color indicated on the final distal and proximal reamers corresponds to the sizes of the implanted stem and sleeve.
Anterior-Posterior Chamfer
The REDAPT™ stem features an Anterior-Posterior chamfer that allows a long straight stem to be inserted safely and reliably. The chamfer is designed to skirt the anterior cortex, similar to a bowed stem, while allowing a consistent and reproducible surgical technique for any stem length.
References