Smith+Nephew

REDAPT◊

Revision Acetabular System

Design Rationale

Design surgeon list

Smith+Nephew thanks the following surgeons for their participation as part of the REDAPT◊ Revision Acetabular System design team:

Dr. Robert Bourne

London, Ontario
London Health Sciences,
University of Western Ontario

Dr. Richard McCalden

London, Ontario
London Health Sciences,
University of Western Ontario

Dr. Andrew Shinar

Nashville, TN
Vanderbilt Orthopaedics

Dr. Scott Marwin

New York, NY
NYU-Hospital Joint Diseases

Dr. Steven Weeden

Fort Worth, TX
The Texas Hip and Knee Center

Dr. Mathias Bostrom

New York, NY
Hospital for Special Surgery

Dr. John Masonis

Charlotte, NC
OrthoCarolina

Dr. James Waddell

Toronto, Ontario
University of Toronto, St.
Michael's Hospital

Dr. Craig Della Valle

Chicago, IL
Midwest Orthopaedics at RUSH

Mr. Stephen Jones

Cardiff, UK
University Hospital of Wales and
University Hospital Llandough

Dr. David Campbell

Adelaide, South Australia
Wakefield Orthopaedics Clinic

Prof. Christian Götze

Bad Oeynhausen, Germany
Auguste-Viktoria-Klinik

REDAPT◊ Acetabular Revision Shells

The revision shells are developed for use in revision cases where compromised bone makes implant fixation and stability more difficult. The REDAPT Fully Porous Shell (Figure 1) accommodates cemented liners whereas the REDAPT Modular Shell (Figure 2) is manufactured to accommodate snap in liners. To allow ingrowth, an additive manufacturing process is used to produce an implant with porous structure that is intended to mimic the structure of cancellous bone.[1] Additionally, variable-angle locking screws can be used. Compared to conventional screws, REDAPT Variable Angle Locking Screws have demonstrated enhanced rigidity*, which can increase the initial stability of the construct.[2-5]

*As demonstrated in benchtop testing

Please utilize the QR Code here to view the Additive Manufacturing Video.

Figure 1: Fully Porous Shell with variable angle locking screws

Figure 2: REDAPT Modular Shell with variable angle locking screws

Material

CONCELOC◊ is made from Ti-6Al-4V and meets the ASTM and ISO standards for that alloy, with a good clinical history and over 40 years of use in medical devices.[1, 6-8] (Figures 3-5)

Figure 3: CONCELOC

Porosity

CONCELOC Advanced Porous Titanium has an interconnected network of pores with an average porosity of 80% in the near-surface regions where the initial fixation will occur, and an average overall porosity of 63%.[9] These porosities are within the range of 60-80% porosity reported for other advanced porous structures.[10-13]

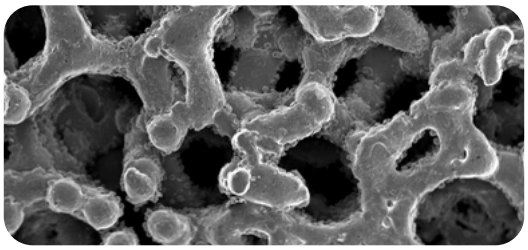


Figure 4: CONCELOC at 25x magnification

Pore size

CONCELOC has pore sizes greater than 100 µm, which literature suggests is beneficial to biological fixation.[14-16] CONCELOC Advanced Porous Titanium has an average pore size that ranges from 202 to 342µm overall and from 484 to 934µm at the surfaces of the porous structure.[9,17]

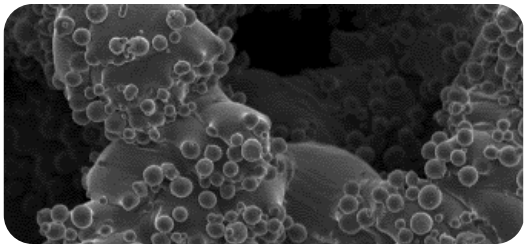


Figure 5: CONCELOC at 80x magnification

Stability

Variable angle locking screws

For bone ingrowth to occur, it is critical that implants remain stable. It has been reported that as little as 150 microns of motion can interrupt the process of bone ingrowth.[18]

Screws have historically been used as a means to provide adjunctive fixation. Spherical head screws or REDAPT◊ Variable Angle Locking Screws can be used in any of the available screw holes on the REDAPT Acetabular Shells. Compared to conventional screws, the use of REDAPT Variable Angle Locking Screws has demonstrated increased construct rigidity*, which may reduce micromotion and in turn promote bone ingrowth.[2-5]

- Variable angle lock up to 12˚ (included angle) (Figure 6)
- Testing has shown increased stiffness in static bending compared to non-locking screws[3]
- Variable Angle Locking Screws create a construct with greater than 7x the rigidity of a construct using non-locking screws[3] (Figure 7)
- 6.5mm cancellous thread
- Lengths 15mm – 50mm

Figure 6: Variable angle locking screw

High friction surface

The high friction surface of the CONCELOC◊ Advanced Porous Titanium is designed to aid in achieving the initial stability needed to hold the implant in place upon insertion.[19,20]

- Topographically mapped “bumps” on all bone-interfacing surfaces (Figure 8)
- Patented design feature
- Benefit of additive manufacturing

Figure 7: REDAPT Fully Porous Shell with variable angle locking screw

Figure 8: Three dimensional model before and after application of friction bumps

*As demonstrated in benchtop testing

Liner stability

- Same locking taper as with the R3◊ shell
- Double-channel lock design to provide axial stability for XLPE liners
- 12 large anti-rotational tabs on the XLPE liner that provide rotational stability

Joint stability

- 36mm head from shell size 50mm (anteverted liners only), from shell size 52mm for all other XLPE liners
- 40mm and 44mm* head options available
- OR3O◊ Dual Mobility option (Figure 9)

* Excluding anteverted liners

Figure 9: REDAPT Modular Shell with OR3O Dual Mobility

Liner removal tool

Intraoperative adjustment of the liner position can be performed by using the liner removal tool. Laboratory tests of the R3 locking mechanism have shown it withstands consecutive insertions of the same liner without damaging its locking integrity. Additionally, the REDAPT◊ Modular Shell is designed with a liner removal slot, which allows for efficient and simplified intraoperative adjustments using the liner removal tool (Figure 10).

Figure 10: Liner removal tool

Adaptability

Optimized screw hole pattern for all REDAPT◊ Shells (Figure 11)

- 9-Hole (48mm-58mm)
- 12-Hole (60mm-80mm)
- Designed to reduce the risk of “drill through”
- Provides peripheral locking options in ischium+pubis

Cemented liners (Figure 12)

- Compatible with REDAPT Fully Porous Shell
- Neutral and anteverted liner options
- Self-aligning flange built into rim
- Uniform 1.5mm cement mantle
- Dual mobility option for complex primary and revision THA cases

Snap in liners

- Compatible with the REDAPT Modular Shell
- Accepts R3◊ liners
- Locking mechanism featuring 12 anti-rotational tabs
- Snap in 20 degree anteverted liner for revision cases
- Dual mobility option for complex primary and revision THA cases

REDAPT Acetabular Augments (Figure 13)

- Both shell types can be used with REDAPT Acetabular Augments
- 3 styles available to address varying acetabular defects

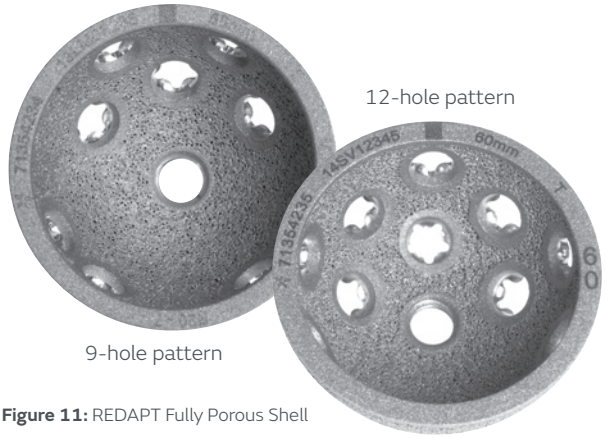


Figure 11: REDAPT Fully Porous Shell

Figure 12: REDAPT cemented liners

Figure 13: REDAPT Acetabular Augments

Reproducibility

Solid reinforcement features internalized (Figure 14)

- Designed for balance between solid support features and porous ingrowth surface
- High-demand areas bolstered for added strength

Threaded apex hole

- Designed to simplify technique through compatibility with standard shell impactor instrumentation
- Designed to provide consistent joint stability assessment using a range of screw-in trial liners*

* Applicable to the REDAPT Fully Porous Shell only

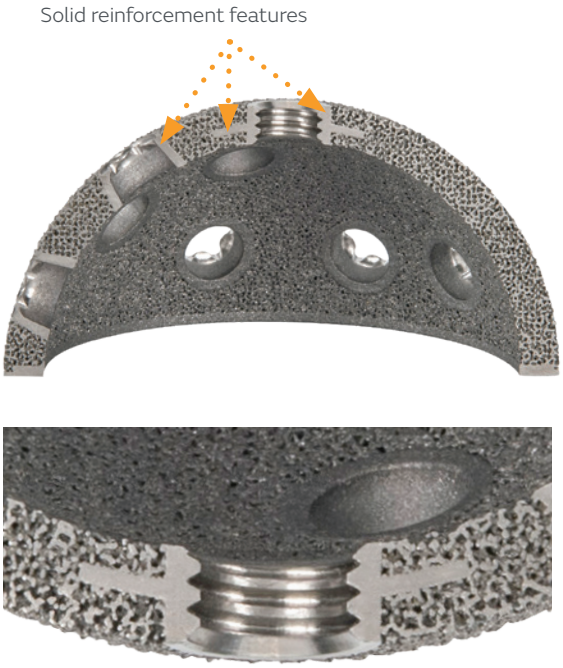


Figure 14: REDAPT◊ Fully Porous Shell

Implant overview

Cemented XLPE liners

Shells	28	32	36	40
48mm	●			
50mm	●	●		
52mm		●		
54mm		●	●	
56mm			●	
58mm			●	●
60mm			●	●
62mm			●	●
64mm			●	●
66-68mm			●	●
70-74mm			●	●
76-80mm			●	●

Size compatibility

REDAPT Fully Porous Shell	POLARCUP Cemented
Size	**Size**
48mm	NA
50mm	NA
52mm	NA
54mm	NA
56mm	43mm
58mm	45mm
60mm	47mm
62mm	49mm
64mm	51mm
66mm	53mm
68mm	53mm
70mm	57mm
72mm	57mm
74mm	57mm
76mm	63mm
78mm	63mm
80mm	63mm

REDAPT◊ Fully Porous Shell

48mm

80mm

0° cemented XLPE liner

20° anteverted cemented XLPE liner

Porous Shell Hole Cover with Kit

REDAPT Hole Cover

REDAPT Hole Cover Kit

POLARCUP◊

POLARCUP Cemented with liner

Snap in XLPE liners

	XLPE				
Shells	**28**	**32**	**36**	**40**	**44****
48	●	●			
50	●	●	● *		
52	●	●	●		
54	●	●	●	● *	
56	● **	● **	●	●	
58	● **	● **	●	●	
60	● **	● **	●	●	●
62		● **	●	●	●
64			●	●	●
66			●	●	●
68			●	●	●
70			●	●	●
72			●	●	●
74			●	●	●
76			●	●	●
78			●	●	●
80			●	●	●

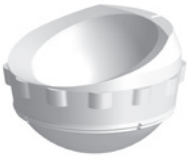
**Excluding anteverted liners
*Anteverted liners only

REDAPT◊ Modular Shell

48mm

80mm

0° XLPE liner
0° +4 lateralized XLPE liner
20° XLPE liner
20° +4 lateralised XLPE liner
Constrained



20° anteverted XLPE liner

Spherical Head Screws

15mm – 70mm

REDAPT Locking Screws

15mm – 50mm

Cat. Item	Description
OR3O◊ Liners	
7135-8201	OR3O Dual Mobility Liner 36/48
7135-8202	OR3O Dual Mobility Liner 38/50
7135-8203	OR3O Dual Mobility Liner 40/52
7135-8204	OR3O Dual Mobility Liner 42/54
7135-8205	OR3O Dual Mobility Liner 44/56
7135-8206	OR3O Dual Mobility Liner 44/58
7135-8207	OR3O Dual Mobility Liner 46/60
7135-8208	OR3O Dual Mobility Liner 48/62
7135-8209	OR3O Dual Mobility Liner 50/64
7135-8211	OR3O Dual Mobility Liner 52/66-70

Cat. Item	Description
OR3O XLPE Inserts	
7135-8213	OR3O Dual Mobility XLPE Insert 22/36
7135-8214	OR3O Dual Mobility XLPE Insert 22/38
7135-8216	OR3O Dual Mobility XLPE Insert 22/40
7135-8218	OR3O Dual Mobility XLPE Insert 28/42
7135-8219	OR3O Dual Mobility XLPE Insert 28/44
7135-8221	OR3O Dual Mobility XLPE Insert 28/46
7135-8222	OR3O Dual Mobility XLPE Insert 28/48
7135-8223	OR3O Dual Mobility XLPE Insert 28/50
7135-8224	OR3O Dual Mobility XLPE Insert 28/52

OR3O Liner SZ 48-70

OR3O Insert

Implant overview (continued)

OR3O◊ - REDAPT◊ liner compatibility

Shell Size	48	50	52	54	56	58	60	62	64	66	68	70
Insert ID	**Insert OD**											
22mm	36mm	●										
	38mm		●									
	40mm			●								
28mm	42mm				●							
	44mm					●	●					
	46mm							●				
	48mm								●			
	50mm									●		
	52mm										●	●

Notes

Smith & Nephew, Inc.
1450 Brooks Road
Memphis, Tennessee 38116
USA

www.smith-nephew.com
Telephone: 1-901-396-2121
Information: 1-800-821-5700
Orders/Inquiries: 1-800-238-7538

06331-us V4 12/20

References

1. Smith+Nephew 2017. Technical Memo TM-17-031. **2.** Milne L, Kop A, Kuster M. Polyaxial locking and compression screws improve construct stiffness of acetabular cup fixation: A biomechanical study. J Arthroplasty. 2014;29(5):1043-1051. **3.** Smith+Nephew 2015. Technical Memo TM-15-043. **4.** Paprosky W, O'Rourke M, Sporer S. The treatment of acetabular bone defects with an associated pelvic discontinuity. Clin Orthop Relat Res. 2005;441:216-220. **5.** Wong M, Leung F, Chow S. Treatment of distal femoral fractures in the elderly using a less-invasive plating technique. Int Orthop. 2005;29(2):117-120. **6.** Sidambe A. Biocompatibility of Advanced Manufactured Titanium Implants-A Review. Materials. 2014;7(12):8168-8188. **7.** Williams D. Titanium and Titanium Alloys. In: Williams D, ed. Biocompatibility of clinical implant materials Boca Raton, Fla: CRC Press; 1981. **8.** Smith+Nephew 2016. Internal Report PCS028-18-02 V3. **9.** Smith+Nephew 2015. Orthopaedic Research Report OR-14-091A. **10.** Minter J, Rivard K, Aboud b. Characterization of a New Rougher Porous Coating for Revision Reconstructive Surgery. Poster presented at: The 54th Annual Meeting of the Orthopaedic Research Society 2016. **11.** Patil N, Lee K, Goodman S. Porous tantalum in hip and knee reconstructive surgery. J Biomed Mater Res B Appl Biomater. 2009;89(1):242-251. **12.** Scholvin D, Linton D, Moseley J. Poster No: 0459 - Bonding of Titanium Foam to Cobalt Chrome Substrates. Poster presented at: Orthopaedic Research Society 2013 Annual Meeting 2013; San Antonio, Texas. **13.** Stryker. Tritanium Advanced Fixation Technology. Available at: https://www.strykermeded.com/medical-devices/hips-knees/hips/tritanium/. Accessed 30th January 2020 **14.** Kienapfel H, Sprey C, Wilke A, Griss P. Implant fixation by bone ingrowth. J Arthroplasty. 1999;14(3):355-368. **15.** Bobyn J, Pilliar R, Cameron H, Weatherly G. The optimum pore size for the fixation of porous-surfaced metal implants by the ingrowth of bone. Clin Orthop Relat Res. 1980(150):263-270. **16.** Smith + Nephew 2019. Technical Memo TM-19-067. **17.** Smith & Nephew Research report. OR-15-119. **18.** R.M. Pilliar, J.M. Lee and C. Maniatopoulos, "Observations on the effect of movement on bone ingrowth into porous-surfaced implants," Clin Orthop Relat Res, 1986;208:108-113. **19.** Smith+Nephew 2016. Orthopaedic Research Report OR-16-008 **20.** Smith+Nephew 2017. Technical Memo TM-17-081.