Zimmer® Continuum™ Acetabular System

Bringing together proven technologies.

zimmer

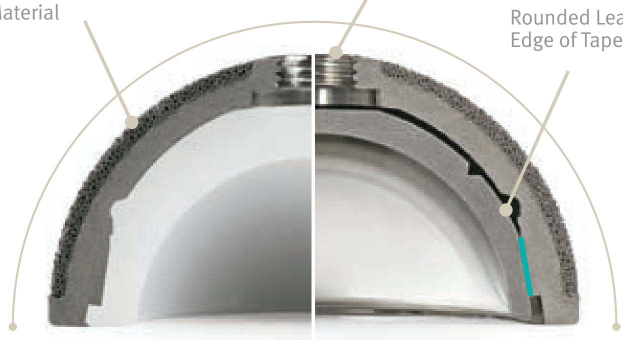
The power to meet individual patient needs.

Zimmer® *Continuum*™ Acetabular System provides highly flexible solutions for orthopaedic surgeons who treat a wide range of patients. The system combines the proven biologic fixation[1,2] of *Trabecular Metal*™ technology with Zimmer advanced bearing options. With one comprehensive system, surgeons have the ability to address variations of anatomy and bone quality and choose the bearing technology that best meets the needs of each patient.

† *BIOLOX* is a registered trademark of CeramTec AG Corporation

Highly porous *Trabecular Metal* Material with over 10+ years of clinical history

- Initial stability[3]
- Long-term biologic fixation[4,5]
- Proven history[1,2,6-11]



Power to choose advanced bearing technologies to match patient demands

Longevity® Highly Crosslinked Polyethylene is highly resistant to wear[12] and aging[13-21] with over ten years of clinical history.[22]

Metasul® Metal-on-Metal Material has a very low wear rate[23] with over twenty years of clinical history.[24-31]

BIOLOX® delta Ceramic† affords a very low wear rate in a material with improved mechanical properties compared to traditional ceramics.[32]

Trabecular Metal Technology

For the orthopaedic surgeon who desires a proven[1,2, 6-11] advanced fixation material, *Trabecular Metal* Technology provides optimized mechanical and physical properties to address the need for initial stability and long term biologic fixation.

Initial Stability

.98 Coefficient of friction*[3]

Trabecular Metal Technology offers a high coefficient of friction and scratch fit.

- Helps reduce or eliminate the need for supplemental screws or grafts
- Reduces micromotion, enabling tissue ingrowth

* For non-machined surfaces such as the *Trabecular Metal* Modular Shell and *Continuum* Shell

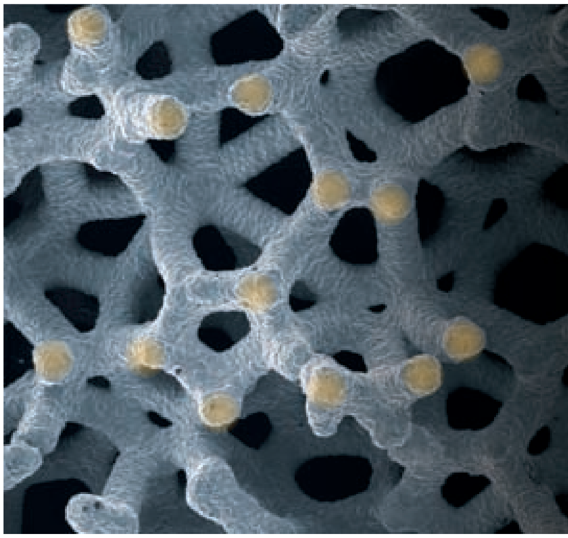
Long Term Fixation

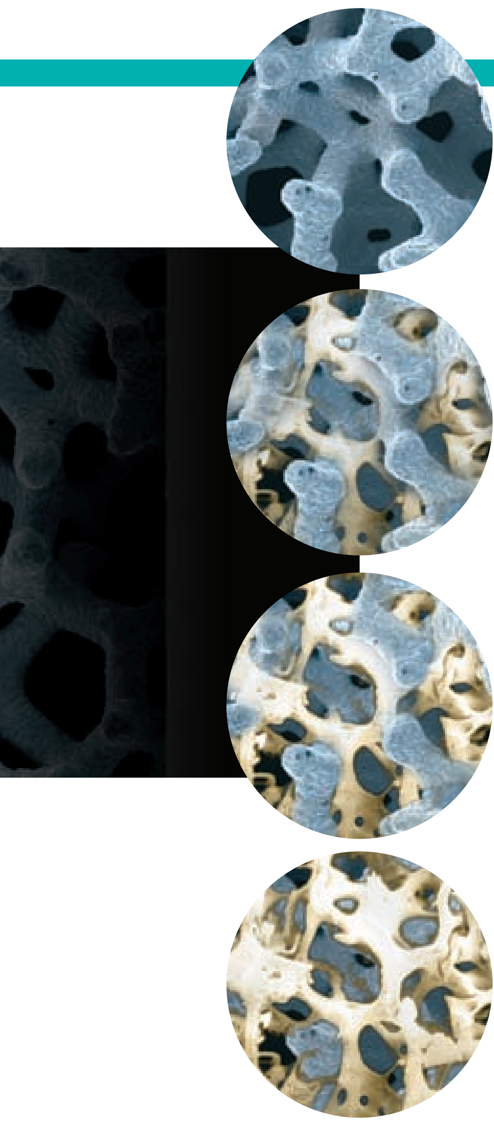
80% Porosity[4,5]

Trabecular Metal Technology 3D construct provides a high level of porosity and potential for osteoconductivity.

- Allows for more rapid bone and soft tissue ingrowth
- Supports a vascularized structure to maintain healthy bone

Trabecular Metal Cancellous-like Structure with Struts





Extensive Clinical History

10+ years[1,2,6-11]

- More than 10+ years of clinical history, with over 75 peer-reviewed journal publications.
- More than 750,000 *Trabecular Metal* Components have been implanted worldwide since 1997[12]

Longevity Highly Crosslinked Polyethylene

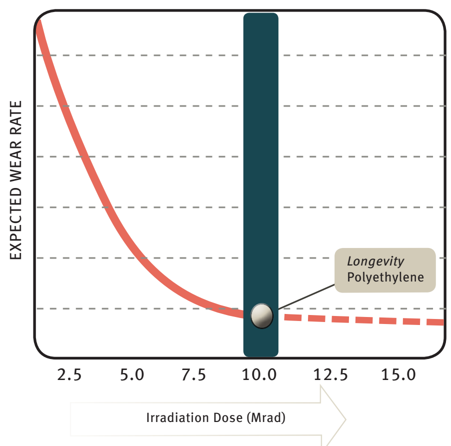
Longevity Highly Crosslinked Polyethylene offers the orthopaedic surgeon a highly advanced polyethylene choice in bearing surfaces. *Longevity* Polyethylene provides a proven[22] low wear bearing surface which is resistant to aging.[13-21]

Highly reduced wear

89% over standard Polyethylene[10]

Proprietary electron beam process delivers 10Mrad dosage for greater crosslinking, resulting in superior long-term polyethylene wear performance.

Relationship Between Wear Resistance and Level of Crosslinking[23,24]



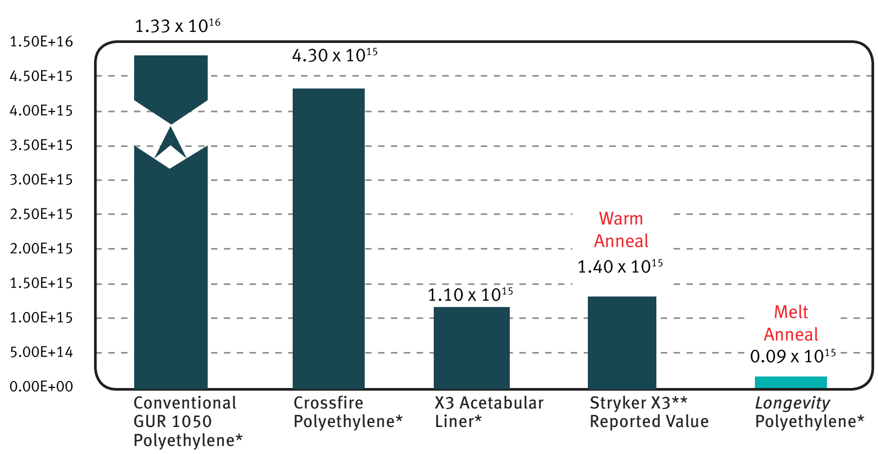
Zimmer scientists have determined that for crosslinked polyethylene in the hip, the optimal irradiation dose without compromising mechanical strength is in the range of 9.5 to 10.0Mrad.[24,25]

Highly resistant to aging

Over 10X fewer free radicals[13,16,33]

In contrast to warm-annealing, which leaves residual free radicals, melt-annealing virtually eliminates free radicals and results in long-term mechanical strength.

Free Radical Concentration (spins/gram)[34]



* MGH Data
**X3 Brochure, The Power of Technology, Stryker, 2006
Note: Competitor trademarks are trademarks of their respective owners.

Works as Predicted

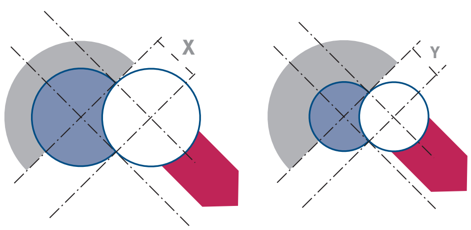
10+ years of clinical experience.[22] More than 1 million Zimmer Highly Crosslinked Polyethylene Liners have been implanted worldwide.[12]

Metasul Metal-on-Metal Technology

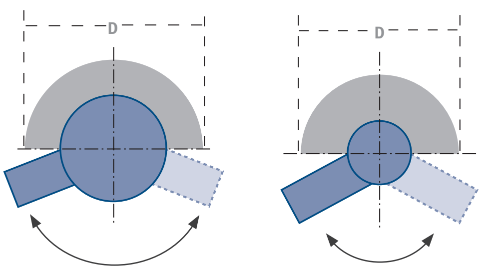
With successful clinical history dating back to 1988, *Metasul* Metal-on-Metal Technology offers a bearing surface with very low wear[35,36] for multiple femoral head diameters. It offers the potential to improve stability and function of total hip arthroplasty.

Stability and Function

- Metal-on-metal liners allow for a larger head size versus a polyethylene liner
- A larger head increases jump height and reduces the risk for dislocation
- A larger head size allows for greater range of motion before impingment and its associated risks for dislocation[44,45]



Large diameter heads increase the distance the head must displace before dislocation (X > Y).



Larger diameter femoral heads are the most direct way to improve range of motion.

Extensive Clinical History

- 20+ years of published clinical history[24-31]
- Launched in 1988, with over 460,000 implantations worldwide[12]
- More than 50 independent publications have discussed the performance of *Metasul* Technology bearings

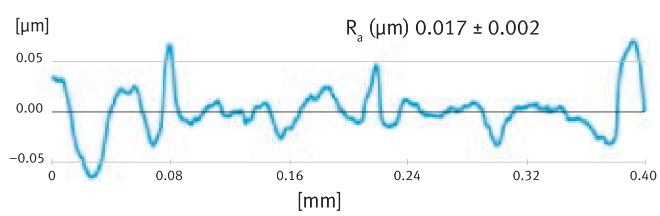
Lower wear characteristics

- *Metasul* wrought forged surface roughness is greatly reduced, which leads to a lower rate of wear in comparison to cast chromium-cobalt alloys[37-43]
- Optimized clearance provides enhanced lubrication and minimized wear[35,36]

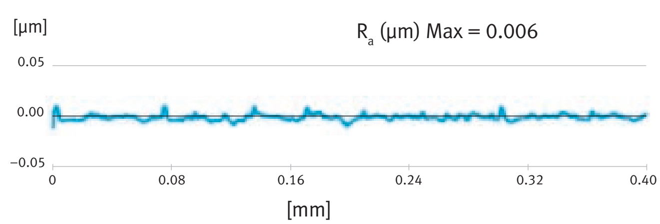
Internal Zimmer Analysis[2]

This information demonstrates the differences between cast and wrought alloys.

Roughness of Cast Alloy

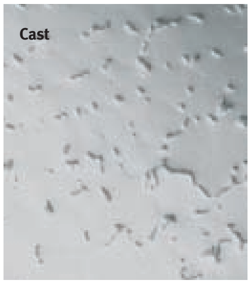


Roughness of Wrought Alloy (*Metasul* material)



Profilometry charts demonstrate lower surface roughness of *Metasul* Wrought Alloys.

A wrought high-carbon alloy with a carbide size up to forty times smaller than cast CoCr alloys leads to a lower surface roughness.



BIOLOX delta Ceramic Technology

BIOLOX delta Ceramic offers very low wear, high fracture resistance, and excellent biocompatibility.[8-28] It is a high-performance material that meets the increased patient demands and outperforms earlier versions of ceramic materials.[46]

Very Low wear

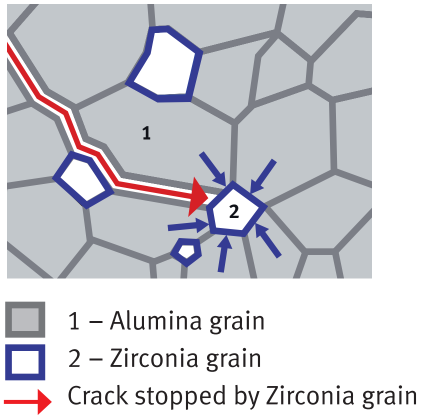
- Increased hardness offers resistance to scratching and subsequent wear
- Better wetting characteristics offer enhanced lubrication and lower wear[47]

Wetability contributes to lower wear.

High fracture resistance

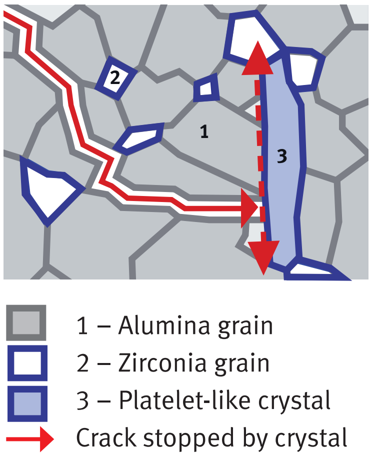
- Optimum composite balance combines hardness with increased bending strength[13,40]

Zirconia Particles in Alumina Matrix



Small Zirconia particles distributed throughout Alumina particles help toughen the material.

Platelet-like Crystals in Alumina Matrix



Platelet-like crystals reinforce the Alumina matrix.

References:

1. Unger AS, et al., Evaluation of a porous tantalum uncemented acetabular cup in revision total hip arthroplasty: clinical and radiological results of 60 hips. *J Arthroplasty.* 20(8); 2005: 1002-1009
2. Macheras GA et al., Eight to Ten-Year Clinical and Radiographic Outcome of a Porous Tantalum Monoblock Acetabular Component, *JOA* Vol. 00 No. 02008, In Press
3. Zhang Y, et al., Interfacial frictional behavior: cancellous bone, cortical bone, and a novel porous tantalum biomaterial. *J Musculoskeletal Res*. 1999; 3(4): 245-251
4. Levine B. A new era in porous metals: applications in orthopaedics. *Advanced Engineering Materials*. August 2008; 10(9): 788-792
5. Barbella M. Materials marvels: titanium is a top choice for implants, but other materials are gaining popularity. *Orthopaedic Design & Technology*. September 1, 2008
6. Lewallen DG, et al., Revision hip arthroplasty with porous tantalum augments and acetabular shells. Scientific Exhibition: 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons; Chicago, IL, 2006
7. Macheras GA, et al., Eight to Ten-Year Clinical and Radiographic Outcome of a Porous Tantalum Monoblock Acetabular Component, *J Arthroplasty.* 2008; Vol. 00 No. 0: In Press
8. Lewis, R, et al., Monoblock *Trabecular Metal* Acetabulum – Two to Five Year Results, 70th Annual Meeting of the American Academy of Orthopaedic Surgeons, New Orleans, LA, February 5-9, 2003
9. Gruen T, et al., Radiographic evaluation of a non-modular acetabular cup: a 2- to 5-year multi-center study. Scientific Exhibit: 71st Annual Meeting of the American Academy of Orthopaedic Surgeons; San Francisco, CA, 2004
10. Gruen TA, et al., Radiographic evaluation of a monoblock acetabular component: a multicenter study with 2- to 5-year results. *Journal of Arthroplasty*. April 2005; 20(3)
11. Weeden, SH, et al., The Use of Tantalum Porous Metal Implants for Paprosky Type 3A and 3B Implants, *J Arthroplasty*. 2007; 22(6) (suppl 2): 151-155
12. Data on file at Zimmer
13. Wannomae KK, et al. In vivo oxidation of retrieved crosslinked ultra-high molecular-weight polyethylene acetabular components with residual free radicals. *J Arthroplasty.* 2006; 21(7): 1005-1011
14. Medel FJ, Kurtz SM, MacDonald DW, et al. First-generation highly crosslinked polyethylene in THA: clinical and material performance. Las Vegas, 55th Meeting of the Orthopaedic Research Society, 2009
15. Collier JP, et al. Comparison of crosslinked polyethylene materials for orthopaedic applications. *Clin Orthop*. 2003; 414: 289-304
16. Bhattacharyya S et al. Severe In Vivo Oxidation in a Limited Series of Retrieved Highly-Crosslinked UHMWPE Acetabluar Components with Residual Free Radicals, 50th Annual Meeting of the Orthopaedic Research Soceity, Paper 0276, Las Vegas, 2004
17. Jibodh, SR, et al., Minimum Five Year Outcome and Wear Analysis of Large Diameter Femoral Heads on Highly-Cross-linked Polyethylene Liners, Poster No. 2445, 55th Annual Meeting of the Orthopaedic Research Society, Las Vegas, 2009
18. Kärrholm, Digas G, J, Thanner J, Herberts P. Five to seven years experiences of highly crosslinked PE. SICOT Hong Kong, August 2008
19. McCalden RW, MacDonald SJ, Rorabeck CH, Bourne RB, Chess DG, Charron KD, Wear Rate of Highly Crosslinked Polyethylene in Total Hip Arthroplasty. A Randomized Controlled Study. *J Bone Joint Surg Am.* 2009; 91: 773-782
20. Bragdon CR, et al., Minimum 6-year Follow up of Highly Crosslinked Polyethylene in THA, Clinical Orthopaedics and Related Research, 2007; Number 465: 122–127
21. Digas et al., Crosslinked vs. Conventional Polyethylene in Bilateral Hybrid THR Randomised Radiostereometric Study, 50th Annual Meeting of the Orthopaedic Research Society, Poster No. 0319, Las Vegas, 2004
22. Bragdon, CR, et al., Seven to Ten Year Follow-Up of Highly Crosslinked Polyethylene Liners in Total Hip Arthroplasty, Poster No. 2444, 55th Annual Meeting of the Orthopaedic Research Society, Las Vegas, 2009
23. Rieker CB, Schön R, Köttig P, et al. Development and validation of a second-generation Metal-on-Metal bearing: laboratory study and analysis of retrievals. J Arthroplasty. 2004;19 (8, suppl 3): 5-11
24. Sharma S, et al., Metal-on-Metal total hip joint replacement: a minimum follow-up of five years. Hip Int, 2007; 17: 70–77
25. Migaud H, et al., Cementless Metal-on-Metal hip arthroplasty in patients less than 50 years of age. Comparison with a matched control group using ceramic-on-polyethylene after a minimum 5-year follow- up. *J Arthroplasty* 19 (8, suppl 3), 2004, 23–28
26. Long WT, et al., An American experience with Metal-on-Metal total hip arthroplasties. A 7-year follow-up study. *J Arthroplasty* 19 (8, suppl 3), 2004: 29–34
27. Jessen N, et al., Metal/Metal – A new (old) hip bearing system in clinical evaluation. Prospective 7-year follow-up study. *Orthopäde* 2004; 33: 594–602
28. Delaunay CP, Metal-on-metal bearings in cementless primary total hip arthroplasty. *J Arthroplasty* 19(8, suppl 3), 2004: 35–40
29. Grübl A, et al., Long-term follow-up of Metal-on-Metal total hip replacement. *J Orthop Res*, 2007; 25: 841–848
30. Eswaramoorthy V, et al., The Metasul Metal-on-Metal articulation in primary total hip replacement: clinical and radiological results at ten years. *J Bone Joint Surg Br*, 2008; 90B: 1278–1283
31. Delaunay CP, et al., THA using Metal-on-Metal articulation in active patients younger than 50 years. *Clin Orthop Relat Res*., 466, 2008: 340-346
32. Kuntz M, Validation of a New High Performance Alumina Matrix Composite for use in Total Joint Replacement. Seminars in Arthroplasty 17, 2006: 141-145
33. Muratoglu OK, et al. Knee-simulator testing of conventional and Crosslinked polyethylene tibial inserts. *J Arthroplasty*, 2004; 19(7)
34. Muratoglu OK, Bragdon CR, O'Connor DO, Jasty M, Harris WH. A novel method of crosslinking ultra-high-molecular-weight polyethylene to improve wear, reduce oxidation, and retain mechanical properties. *J Arthroplasty*. 2001; 16(2): 149-160
35. Jin ZM. Analysis of mixed lubrication mechanism in metal-on-metal hip joint replacements. *Proc Instn Mech Engrs*. 2002; 216 (part H): 85-89
36. Chan FW, Bobyn JD, Medley JB, et al. Wear and lubrication of metal-on-metal implants. *Clin Orthop*. 1999; 369: 10-24
37. Wang A, Yue S, Bobyn JD, et al: Surface characterization of metal-on-metal implants tested in a hip simulator. *Wear* 225, 1999: 708-715
38. Fisher J, Ingham E, Stone MH, et al: Wear and debris generation in artificial hip joints. In: Reliability and Long-term Results of Ceramics in Orthopaedics. Sedel L, William G (eds), Stuttgart-New York, Thieme. 1999: 78-81
39. Streicher RM, Semlitsch M, Schön R, et al: Metal-on-metal articulation for artificial hip joints: laboratory study and clinical results. Proceedings of the Institution of Mechanical Engineers, Part H 210, 1996: 223-232
40. Tipper JL, et al. Quantitative analysis of the wear and wear debris from low and high carbon content cobalt chrome alloy used in metal-on-metal hip replacements. *J Mat Sci: Mat Med*. 1999; 10(6): 353-362
41. Scholes SC, Unsworth A: Pin-on-plate studies on the effect of rotation on the wear of metal-on-metal samples. *J Mat Sci Mater Med* 12, 2001: 299-303
42. St. John KR, Zardiackas LD, Poggie RA: Wear evaluation of cobalt-chromium alloy for use in a metal-on- metal hip prosthesis. *J. Biomed Mater Res* 68B, 2004: 1-14
43. Firkins PJ, Tipper JL, Saadatzadeh MR, et al: Quantitative analysis of wear and wear debris from metal-on-metal hip prostheses tested in a physiological hip joint simulator. *Biomed Mater Eng* 11, 2001: 143-57
44. Cuckler JM, Moore KD, Lombardi AV Jr., McPherson E, Emerson R; Large versus small femoral heads in metal-on-metal total hip arthroplasty, *J Arthroplasty*. Dec. 2004; 19(8 Suppl 3): 41-44
45. Amstutz HC, Le Duff MJ, Beaule PE.; Prevention and treatment of dislocation after total hip replacement using large diameter balls. *Clin Orthop Relat Res*. Dec. 2004; (429): 108-116
46. CeramTec AG, internal data on file

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