



*RingLoc® Acetabular
Series*

A TECHNICAL
REPORT

BIOMET[®]
INC

RingLoc® Acetabular Series

Overview

Implant integrity and polyethylene wear—no other issues are as critical to implant longevity and clinical performance in total hip arthroplasty today. And no competitive line of acetabular components uses technological innovation to address these concerns more effectively than the RingLoc® Acetabular Series from Biomet.

The name “RingLoc” refers to Biomet’s exclusive locking mechanism—a metal ring within the shell periphery that seats securely into a precision machined groove on the outer periphery of the liner.

Polyethylene wear and the consequent production of debris have been linked with osteolysis, bone stock resorption, implant loosening, and, ultimately, reduced longevity.^{1,2} With the RingLoc Acetabular Series, Biomet tackles the problem of premature polyethylene wear in several innovative ways.

Push-out/Lever-out

Push-out and lever-out strength is defined as the force required to disassociate a polyethylene liner from the shell. The unique RingLoc design results in remarkable push-out and lever-out strength, values which are indicative of in vivo dislocation resistance.

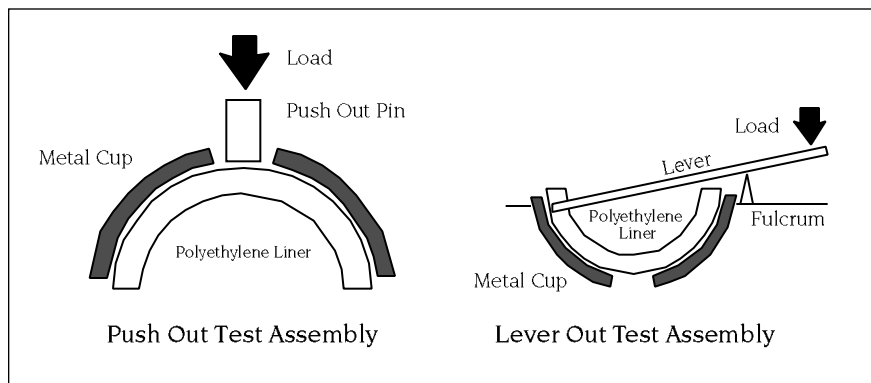


Figure 1. Diagram of Push-out and Lever-out Testing.

Product Name	Pushout Test Results 1993 (N=3)		Lever Out Test Results 1993 (N=3)	
	Initial Push Out Force (lbf)	Repeat Push Out Force (lbf)	Initial Lever Out Force (lbf)	Repeat Lever Out Force (lbf)
Duraloc	663	463	647	*
S-Rom	482	*	556	*
APR	325	219	449	225
HGP II	122	89	21	68
Omnifit	103	70	346	*
PCA	70	61	221	143
Optifix	51	44	69	44
Triloc	29	26	41	34
RingLoc	660†	*	650†	*

* Significant damage

† No retention mechanism failure

RingLoc was tested at the same laboratory in a separate test.

Figure 2. Comparative push-out and lever-out strengths of various liners.

Independent laboratory research demonstrates the RingLoc difference. Tradonsky, et al.³ and Postak,⁴ for example, have tested push-out and lever-out strength for nine leading two-piece acetabular components by measuring the forces required to push out and lever out a fully seated 32mm liner (See Figure 1).

Their findings, summarized in Figure 2, are clear: In push-out and lever-out performance, the RingLoc unit “demonstrated one of the highest strengths of all contemporary components evaluated.”⁴

Micromotion/ Polyethylene Wear

Recent studies indicate that micromotion between modular polyethylene components and their mating metal housings can result in the generation of wear debris.⁵ Unlike many manufacturers, who simply polish their component interiors hoping to reduce wear when micromotion occurs, Biomet prefers to attack the cause, not mask the symptom.

The RingLoc design features tabs on the rim of the shell that create an interference fit with semicircular notches on the liner. As a result, the RingLoc system provides excellent rotational stability. That means minimal, if any, micromotion and, consequently, significantly less polyethylene wear and wear debris.

Shell/Liner Congruity

In modular acetabular systems, shell-liner incongruity reduces the surface area available for load transfer. Surface and subsurface stresses are therefore concentrated on contact regions, which can exacerbate polyethylene liner wear and shorten implant life.⁶

RingLoc components are designed for maximum shell-liner congruity, which reduces not only liner wear but also “gap-closure” deformation under load.

Rosner, et al. have evaluated ten leading acetabular cup systems for shell/liner congruity by assessing the percentage of unsupported polyethylene found in each unit.⁶ Their findings, summarized in Figure 3, demonstrate that Biomet’s RingLoc Acetabular System provides one of the highest levels of polyethylene support available on the market today.

Maximum Uniform Polyethylene Thickness

The RingLoc Acetabular Series features a relatively thin, high-strength titanium shell and maximum uniform thickness in the polyethylene liner (See Figure 4). As a result, stresses are more uniformly dissipated over the entire liner surface and wear is reduced.

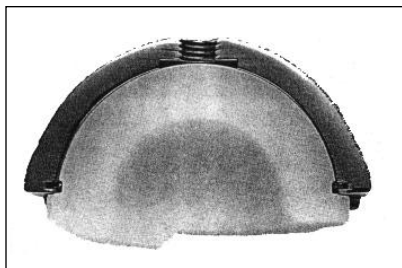


Figure 4. The RingLoc system’s strong, but relatively thin, titanium shell allows maximum uniform polyethylene thickness for enhanced stress dissipation.

The ArCom® Advantage

RingLoc Acetabular Series liners are available with argon packaged, compression molded (ArCom®) polyethylene — a Biomet innovation that potentially enhances component longevity. Unlike the extruded bar material used in most competitive acetabular liners, ArCom polyethylene is compression molded. This process provides the improved wear resistance properties of molded polyethylene in modular acetabular components.

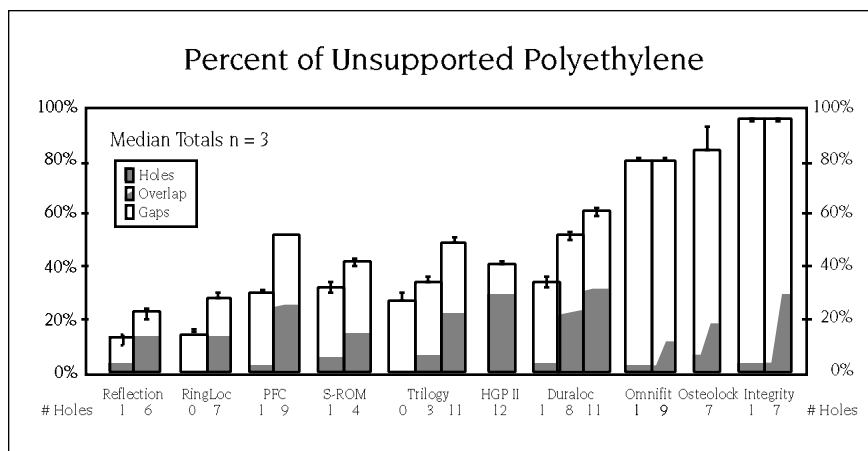


Figure 3. Contact area of unsupported polyethylene over outer surface of liner up to, but not including, the rim.

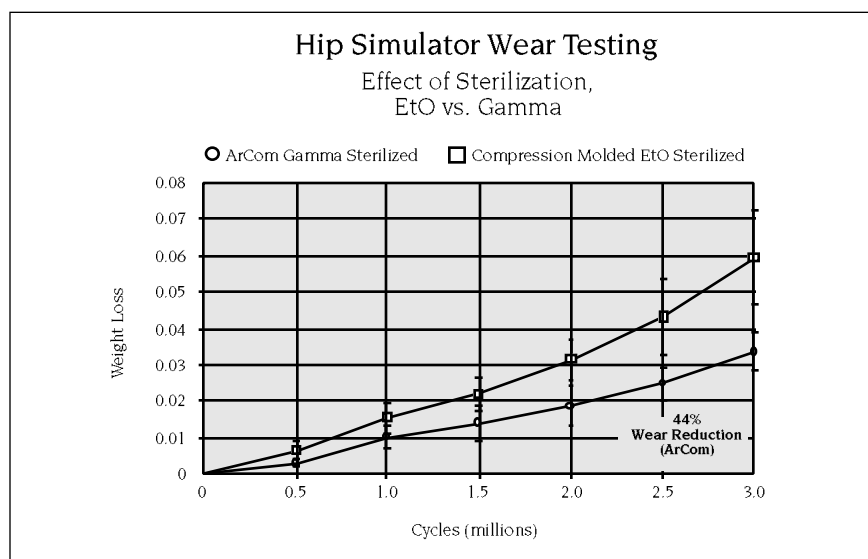


Figure 5. Hip simulator wear testing: effects of sterilization EtO vs gamma radiation in an inert environment.

ArCom polyethylene is gamma sterilized in an inert environment. As a result, ArCom polyethylene consistently outperformed EtO sterilized polyethylene in hip joint simulator testing, and, at 3 million cycles, demonstrated a 44% reduction in wear.⁷ Streicher reports:

“The influence of sterilization irradiation on the tribological properties of UHMWPE has been reported by several authors. Although the results differ, all show the same or better wear resistance if irradiation was performed in inert atmosphere.”⁸

Gamma sterilization in an inert environment enhances the cross-linking of polyethylene which shows benefits in mechanical and wear resistant properties⁸ [See Figure 5].

Its properties, combined with the overall integrity of Biomet’s RingLoc design, make ArCom polyethylene the preferred choice in modular acetabular components.

Proven Performance

Research conducted by leading independent laboratories confirms the fact: No competitive line of acetabular components can match the RingLoc Series in implant integrity and polyethylene wear resistance.

RingLoc/ArCom — Setting the Standard for Modular Acetabular Components.

References

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- ⁶B.I. Rosner, P.D. Postak, A.S. Greenwald, "Cup/Liner Conformity of Modular Acetabular Designs," Orthopaedic Research Laboratory, The Mt. Sinai Medical Research Center, Cleveland, Ohio, 1995.
- ⁷Information on file at Biomet, Inc., Warsaw, Indiana.
- ⁸Streicher, R.M.: "Influence of Ionizing Irradiation in Air and Nitrogen for Sterilization of Surgical Grade Polyethylene for Implants," Sulzer Brothers, Department of Medical Engineering, CH-8401 Winterthur, Switzerland.

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The porous coated implants shown are marketed for non-cemented use in skeletally mature patients undergoing primary hip replacement surgery as a result of noninflammatory degenerative joint disease.



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