

Comparison of Polyethylene Wear in Machined Versus Molded Polyethylene Liners in RingLoc® Acetabular Cups

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Abstract

Polyethylene wear is a major factor affecting the longevity of total hip prostheses, causing complications such as osteolysis, loosening, and granuloma formation in total hip arthroplasties. One variable that has been identified as a potential factor affecting longevity and survivorship is polyethylene debris generation. Variation in Ultra High Molecular Weight Polyethylene (UHMWPE) quality has been previously noted in the literature as a determinant in the production of such polyethylene debris.^{1,2} The purpose of this retrospective study is to evaluate the differences of volumetric radiographic wear rates between acetabular cup liners machined from GUR resin which have been ram extruded or sheet molded and liners machined from isostatically molded 1900H resin (ArCom®).

The preliminary results of two hundred randomized total hip patients with minimum two-year follow-up evaluations are presented. Radiographic evaluation using the three-dimensional (3-D) technique of Devane et al., was performed using PolyWare™ Pro/3D software produced by Draftware Developers, Inc. One hundred patients were implanted with modular metal-backed polyethylene liners machined from ram extruded or sheet molded bar stock, while one hundred patients were implanted with modular metal-backed polyethylene liners that were isostatically molded (ArCom®). All acetabular components were of the RingLoc® design, all modular heads were of the CoCr design, and all femoral components were of the cemented CoCrMo or press-fit titanium Mallory/Head® design. The RingLoc® and Mallory/Head® designs were developed by Biomet, Inc.

The two groups were equally matched in terms of demographics. The follow-up range for the non-ArCom® patients was 2.36–6.4 years, with an average follow-up of 4.56 years.

The follow-up range for the ArCom® patients was 1.92–4.67 years, with an average follow-up of 2.82 years. The gender breakdown was 56 females and 44 males for the non-ArCom® patients and 55 females and 45 males for the ArCom® patients. Among the non-ArCom® patients, the age range was 20.5–89.3 years, with an average age of 64.148 years. The age range among the ArCom® patients was 17.6–90.6 years, with an average age of 62.487 years. The weight range for the non-ArCom® patients was 103–261 pounds, with an average weight of 172.1 pounds. For the ArCom® patients, the weight range was 107–284 pounds, with an average weight of 179.8 pounds. Among the non-ArCom® patients, the height range was 54–75 inches, with an average height of 65.9 inches. The height range among the ArCom® patients was 53–78 inches, with an average height of 66.7 inches.

The Harris Hip Score was used for clinical assessment. At the most recent follow-up evaluation, 52 of the one hundred non-ArCom® patients and 56 of the one hundred ArCom® patients reported no pain. Normal function was reported in 49 of the one hundred non-ArCom® patients and in 55 of the one hundred ArCom® patients.

Using the Mann-Whitney Rank Sum Test for statistical analysis, results from the three-dimensional polyethylene wear technique indicated a median volumetric wear rate of 80.81 cubic millimeters per year for machined GUR resin polyethylene and 48.71 cubic millimeters per year for isostatically molded 1900H resin polyethylene (ArCom®). These findings were statistically significant, with $P \leq 0.001$. The 40% reduction in clinical volumetric wear observed with the ArCom® liners suggests a potential increase in the longevity and survivorship of total hip prostheses.

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¹ Tanner MG, Hoernschemeyer DG and Whiteside LA: "Polyethylene Quality Variations in Currently Available Bar Stock." Presented at the 64th Annual Meeting of the American Academy of Orthopaedic Surgeons, February 13–17, 1997.

² Blunn GW, et al.: "Wear in Retrieved Condylar Knee Arthroplasties." *The Journal of Arthroplasty*, Vol. 12, No. 3, 1997.

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