

4.2 Analysis of Alumina-Alumina Hip Prostheses Wear Behavior after 10 Years of Implantation *

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Abstract

The aim of this study was to investigate the surface topography of 11 Al_2O_3 - Al_2O_3 hip prostheses retrieved for aseptic loosening, after a mean implantation time of 11 years. Macroscopic wear features were assessed by measuring dimensions' changes, using a coordinate measuring machine (CMM) and microscopic wear features were evaluated by Talysurf analysis. Scanning electron microscopy (SEM) was used to look at the alumina microstructure after thermal etching. Clinical as well as roentgenographic data were reviewed by an independent party.

Components were classified into 3 groups according to their visual wear patterns and characterized as a function of wear magnitude.

„Low wear“ ($n = 4$) with no sign of wear as confirmed by R_a values below $0.05\ \mu\text{m}$; „Stripe wear“ ($n = 5$) with a visible oblong worn area on heads and characterized by penetration rates below $10\ \mu\text{m}/\text{yr}$; and „Severe wear“ ($n = 2$) with a visible loss of material on both components, showing R_t

values up to $4\ \mu\text{m}$ and maximum penetrations higher than $150\ \mu\text{m}$. Alumina quality assessed by grain size measurements and porosity percentages appeared to improve progressively during the 1977–1988 period of interest. This resulted in a correlated decrease of the microscopic wear magnitude. However, on a macroscopic scale, penetration rates were emphasized by a combination of unfavorable factors responsible for increasing the load (patients weight, young age, and male gender) the joint was submitted or impairing the load's distribution over the component surfaces (large grain size, non optimal initial cup inclination, and occurrence of cup migration and/or tilting).

As a conclusion, the use of alumina-alumina bearing surfaces is safe, but its use should not be advocated to patients without a risk evaluation inquiry.

KEY WORDS: Total Joint Arthroplasty; Alumina; Retrieved implants; Wear.

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