

Corrosion and Surface Roughness in Retrieved Modular THR: Has Anything Changed in 20 Years?

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INTRODUCTION: Total Hip Replacement (THR) may improve patient functionality by removing the damaged hip and replacing it with an artificial joint. Modular devices with tapered connections are widely used; however, the addition of modular junctions increases the risk of implant failure due to corrosion and fretting at the taper junction (Papalia et al., 2019). The purpose of the present study was to investigate how corrosion and surface roughness at taper connections correlated with implant service, comparing recent retrievals with devices from the early 2000's. We hypothesized that corrosion and roughness would correlate positively with service time and that retrieved implants that presented corrosion would be associated with implant loosening.

METHODS: A total of 24 implants were selected for this study (20 from the early 2000's, four from 2022). Medical records were assessed for cause of removal, and corrosion was evaluated at the taper connections using the Goldberg Corrosion Score (Goldberg et al., 2002). This score reflects the percent surface area containing corrosion damage, with severity ranging from 1 through 4. A surface profilometer was used to evaluate the surface roughness of the taper region. Results were then analyzed using a non-parametric Two Sample Independent t-test, while regression analysis described the relationship between corrosion and roughness against time of service.

RESULTS: Early 2000's implants presented an average Goldberg score of 1.85, with an average service time of 72.8 months, while 2022 devices averaged 1.5 (Goldberg) with a service time of 129 months. The differences were not significant (Corrosion score $p = 0.698$; time to revision $p = 0.314$). Roughness averages (Ra) averaged 37.98 ± 12.2 (early 2000's), and 28.9 ± 4.48 (2022) - the difference was not significant ($p = 0.816$). Ten implants from the early 2000's presented Goldberg score > 2 ; eight of which were removed for aseptic loosening, while the other two were septic loosening.

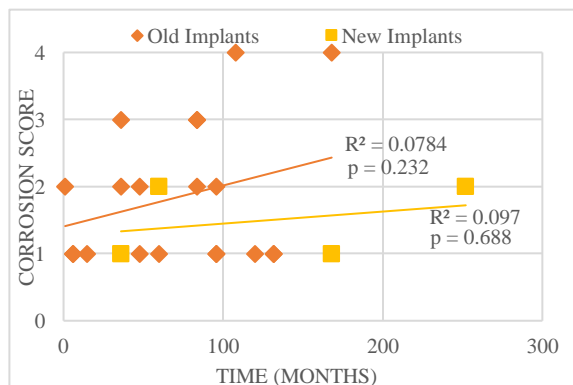
DISCUSSION: The results showed that roughness and corrosion were not positively correlated with time of service. 80% of implants with Goldberg scores greater than 2 were associated with aseptic loosening. This study was limited by the small number of recent retrievals.

SIGNIFICANCE/CLINICAL RELEVANCE: THR failure is multi-factorial. Modular devices provide surgeons with increased flexibility during surgery; therefore, better understanding of corrosion at modular connections may lead to increased device longevity, since aseptic loosening is the leading cause for revision procedures (Sadoghi et al., 2013).

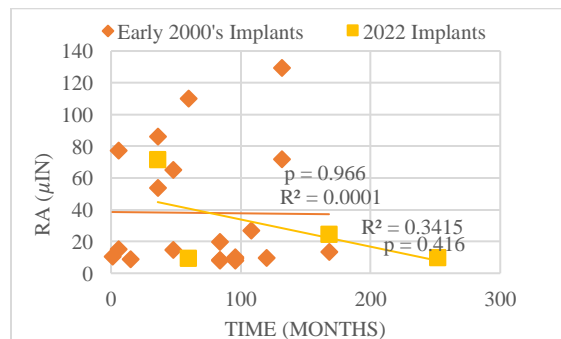
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IMAGES AND TABLES:

Graph 1: Corrosion Score vs. Time of Service



Graph 2: Surface Roughness vs. Time of Service



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