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Accelerated fretting and corrosion testing of diffusion hardened OXINIUM Oxidized Zirconium (DH-OXINIUM◊) and cobalt chromium molybdenum modular acetabular liners

Woodard E, Rister D. Poster presented at: ORS 2021 Annual Meeting; February 12–16, 2021; virtual event.

Available at: Orthopaedic Research Society

Key points

In an in vitro study, compared with cobalt chromium molybdenum (CoCrMo) acetabular liners, DH-OXINIUM liners demonstrated:

Significantly less material loss (p=0.001)

Fewer signs of corrosion

Overview

- Comparison of the corrosion and fretting performance of CoCrMo and DH-OXINIUM (97.5% zirconium [Zr], 2.5% niobium [Nb]) modular acetabular liners (n=3 each), interfaced with a Ti-6Al-4V acetabular shell, using a newly developed in vitro test method
- Damage was replicated using a large acetabular defect, high load levels (equivalent to the maximum resultant hip force during stair descent, normalised to 100kg body weight) and a lowered pH (3.5)
- The weight in solution of metal ions released from each construct was measured, and taper surfaces characterised for damage, following testing

Results

- Constructs with DH-OXINIUM liners demonstrated lower material loss than those with CoCrMo liners
  - Average weight in solution values for Ti, Al and V were higher for constructs with CoCrMo liners, compared with DH-OXINIUM liners (p=n.s.)
  - Average weight in solution values for elements from liner alloys (ie, Co, Cr, Mo; Zr, Nb) were significantly greater for CoCrMo liners compared with DH-OXINIUM liners (23.71±3.79 vs 2.21±2.68mg, respectively; p=0.001; Figure)
- Discoloration indicating evidence of fretting and corrosion was observed on both the liner and shell tapers of CoCrMo constructs, in contrast to DH-OXINIUM constructs which exhibited minimal discoloration

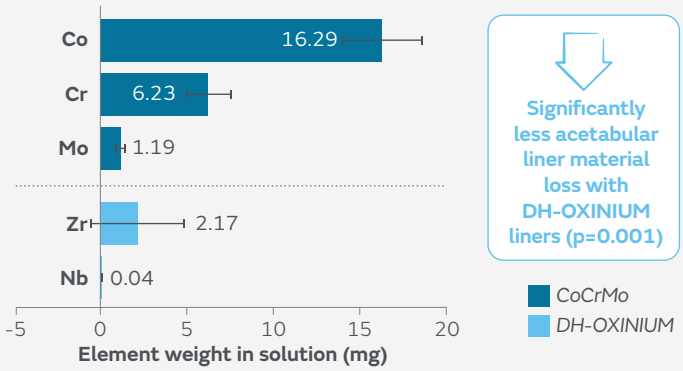

Figure. Average material loss for constructs with CoCrMo and DH-OXINIUM acetabular liners

Conclusions

Constructs with DH-OXINIUM liners demonstrate lower corrosion and material loss, compared with CoCrMo liners, following in vitro testing designed to replicate corrosion damage observed in vivo.

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34724 V1 0422. Published April 2022.

Developed by Evidence Communications, Global Clinical & Medical Affairs
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