The Effect of Aging on Fretting Corrosion of ZrO_2 Ceramic Artificial Hip Joints

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Abstract Zirconia-based materials have been widely employed in artificial hip replacements, primarily owing to their superior phase transition toughening characteristics.Nevertheless, the correlation between in vivo measurements and in vitro predictions is often weak, particularly when zirconia components are involved.This weak correlation can be largely attributed to the insufficient representation of current in vitro experimental models.The surface roughness of the zirconia ceramic ball tips, measured prior to testing, increased with aging time, aligning with the phenomenon reported in the literature whereby hydrothermal aging induces a phase transformation in zirconia ceramics from the tetragonal to the monoclinic phase, leading to greater surface roughness.Additionally, to validate the fretting corrosion results, this study conducted static tensile testing on zirconia ceramic ball heads in accordance with ISO 7206-10:2018, revealing that tensile load increased with extended hydrothermal aging.These findings further suggest that prolonged aging time enhances the tightening force between the zirconia ball tip and the taper shank, consequently reducing the fretting corrosion process.This study underscores the importance of considering hydrothermal aging in understanding the long-term performance of zirconia-based components in hip implants.

Keywords Zirconia-based materials；hydrothermal ageing；fretting corrosion；roughness；tightening force

Reference

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