

O 672 THE NEXT GENERATION BEARING: ZIRCONIA TOUGHENED ALUMINA

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Purpose of the Study: The objective of this study is to investigate the feasibility of a new Alumina based ceramic material with improved toughness for hip joint applications. This objective can be met through the addition of 25% Zirconia. All other properties of the Alumina will be maintained.

Materials and Methods: Two candidate Zirconia Toughened Alumina (ZTA) ceramics were analysed. The following test methods were used: Mechanical testing, hardness (HV), flexural strength (ASTM C1161), indentation fracture toughness, X-ray diffraction (XRD), aging (accelerated and real time) and wear simulator testing. All test data was analysed by descriptive statistics where applicable.

Results: Flexural strength results show an increase of between 50% and 75% for the ZTA over Alumina, statistically significant at $p < 0.05$. The indentation fracture toughness was also increased by up to 50%. The ZTA ceramics maintain almost the same hardness value as the base Alumina. X-ray diffracton analysis showed no transformation in the Zirconia phase after ageing. The wear testing showed that both ZTA-ZTA couples articulating against themselves have even lower wear than Alumina-Alumina couples, statistically not significant at $p < 0.05$.

Conclusions: The toughness and bending strength of the Alumina was successfully increased. All other properties of the Alumina were maintained. The wear properties of the ZTA demonstrate even lower wear than Alumina, though statistically not significant. Zirconia Toughened Alumina looks promising for the next generation of fracture and wear resistant ceramic bearings for hip joint prosthesis.