An Excerpt From:

8th ANNUAL INTERNATIONAL SYMPOSIUM ON TECHNOLOGY IN ARTHROPLASTY (ISTA) (FORMERLY ISSCP) FINAL PROGRAM

SAN JUAN - PUERTO RICO
CERROMAR BEACH RESORT

WED. SEPTEMBER 27th - SUN. OCTOBER 1st 1995

SPONSORED BY THE DIVISION OF ORTHOPAEDIC SURGERY
UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE

HARD ON HARD BEARING SURFACES FOR THA

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Background:

There is renewed interest in hard on hard bearing surfaces in THA, due largely to increased incidence of debris related osteolysis. Metal on Metal and Ceramic on Ceramic have been used in the past with varied clinical results. Low fracture toughness poses unique challenges in structural designs using ceramics, and high friction and point loading of Metal on Metal designs raises concerns. This paper will review design and material concepts and concerns.

Method:

The area of contact between bearing surfaces affects contact stress and thus wear rate. Two methods were used for evaluating contact area. F.E.M. Analysis and a new method by spraying a light coat of rubber cement onto a hemispherical surface of the cup and applying a coat of black permanent marker to the surface of the head. Where the surfaces made contact the rubber cement lifted marker ink from the head, rendering the contact region visible.

Two basic designs were tested - a solid and segmented ceramic cup with a ceramic head.

Results and Discussion:

The total contact surface was reduced by 49.3% with the segmented cup with 22.4% of its surface in contact. (Figure 1) This increases the contact surface by 46.5% and reduces the average contact pressure by 42.4% with respect to the solid cup's surface area.

The segmented cup reduces the socket stiffness in comparison to a solid ceramic cup by 69.3%.

Conclusion:

Increased conformity between bearing surfaces should reduce the risk of fracture, reduce peak stresses, reduce friction and reduce the question of particulate debris.

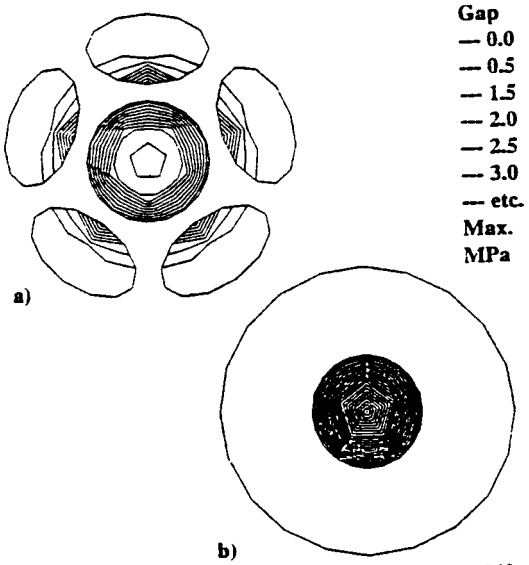

Fig. 1 a) Contact Pressure 2.0 mm UHMWPE at 90°. b) Contact Pressure Solid Ceramic at 90°.