The Southwest Mechanics Lecture Series

at

Texas A&M University

THE EVALUATION OF WEAR IN TOTAL KNEE REPLACEMENTS – AN INTEGRATED APPROACH

TIMOTHY WRIGHT, PHD

Hospital for Special Surgery

New York, New York

Date: **Wednesday 15 October 2003**
Time: **4:15 PM**
Location: **Room 118 Civil Engineering Building**

Abstract

Implant wear is the major problem limiting the longevity of modern total joint replacements. Efforts to combat implant wear have included design improvements and the introduction of new bearing materials. These efforts are hampered, however, by lack of understanding of wear mechanisms and of how material and implant design variables influence wear. Three related but heretofore primarily separate approaches have been employed in studying wear: retrieval analysis, wear simulators, and computational simulations. All three have provided valuable information, but all suffer from limitations. Observations made from retrieved components limited in that the loads and kinematics responsible for the damage are largely unknown. Wear simulators connect capture the complex in vivo environment that leads to wear and do not measure the stress and strain state in the polyethylene. Computational simulations using finite element analysis (FEA) have limitations as well - wear performance has been assessed only from singular stress or strain measures and the necessary analytical complexity has reduced studies to only a few loading conditions or relative positions of the implant components. To overcome limitations in these individual methods, we have embarked on a project to merge all three approaches. We have combined a computational model of a knee simulator with FEA of the tibial component, wear measurements performed on the knee simulator, and observations made on retrieved components to determine the stress and strain histories in tibial components tested in the simulator. Our long term goal is to develop an integrated approach that combines the strengths of each methodology to provide insight into wear mechanisms and a tool for assessing the preclinical performance of total knee replacements.

SOUTHWEST
MECHANICS LECTURE SERIES