

Wear of Articulating Surfaces: Understanding Joint Simulation

STP 1472

**Stanley Brown
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Editors**



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and Victoria D. Good, editors

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Foreword

This publication *Wear of Articulating Surfaces: Understanding Joint Simulation*, contains papers presented at the symposium of the same name, held in Dallas Texas, on November 8, 2005. The symposium was sponsored by ASTM Committee F04 on Medical and Surgical Materials and Devices. Stanley A. Brown of the FDA Center for Devices and Radiological Health in Rockville Maryland, Leslie N. Gilbertson of Zimmer, Inc. in Warsaw, Indiana , and Victoria D. Good of Smith and Nephew in Memphis, Tennessee, presided as symposium chairmen and are the editors of the resulting publication. The editors would like to thank Joanne Tipper from the University of Leeds, UK for presenting an invited paper. We would also would like to congratulate Dong Zhao a graduate student from the University of Florida, in Gainesville, Florida, who was the winner of the student paper contest. We would also thank the other authors who contributed to the symposium, some of whom traveled from the United States, Switzerland, Australia, Austria, and the United Kingdom, We would also like to express our thanks to the ASTM staff that helped make the symposium and publication possible: most notably Dorothy Fitzpatrick for her help with the symposium planning and Maria Langiewicz for handling the manuscript submissions and Teri Vail, Vera Langstone, and Kristen Girardi from the Journal of ASTM International at the American Institute of Physics who handled the electronic submissions and the publication preparation. We are indebted to all the reviewers who volunteered their time and expertise for their careful consideration and critique of the manuscripts. Stanley A. Brown FDA / CDRH, Rockville, Maryland, USA Leslie N. Gilbertson Zimmer Inc. Warsaw, Indiana, USA Victoria D. Good Smith and Nephew Memphis, Tennessee, USA

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Overview

Papers were invited for the Symposium on Wear of Articulating Surfaces: Understanding Joint Simulation, sponsored by ASTM Committee F04 on Medical and Surgical Materials and Devices. The symposium was held November 8, 2005 in Dallas, Texas, in conjunction with the November 8-11, 2005 standards development meetings of Committee F04.

Simulator wear testing of orthopedic joint systems is a work-in-progress. The current hip simulator wear testing methodology has come the closest to simulating clinical results in terms of ranking of articulating systems. However, there continue to be opportunities for improvement since simulator results tend to be significantly lower than clinical wear. Knee wear simulation is not as well understood as the hip and is much more complicated to simulate than hips. Kinematics and loads can vary with implant design and produce significantly different results. Additionally, due to the complex shape of the implant, it is difficult to quantify and compare retrievals to simulator worn implants. Simulator wear of the spinal joint implant is in its infancy. There is even less knowledge about the requirements for wear simulation than either of the other two joint systems. Clearly there is a need for understanding in all these articulating joint simulations. The goals of the symposium were to increase our knowledge of wear simulation, gain knowledge about the relationship of simulated wear to clinical wear, and to ultimately create standards that are useful in evaluating the systems of the future.

The papers in this proceedings are in the same order in which they were presented at the symposium. Therefore the sequencing is based in part on the timing of a daily schedule. The first session addressed issues of modeling and motion constraints of total knee simulation. These included force control, soft tissue constraints, and slip velocity. Two papers presented new concepts of modeling with neural networks or computational prediction of wear. The second session addressed simulation of total disc prostheses. These papers represent the early stages of establishing a correlation between wear patterns seen in simulators with those seen in the limited number of retrievals. The third session contained a variety of papers on lubricants and examination of wear debris and their biological effects. Emphasis was made on the importance, yet complexity of effectively separating lubricant absorption from effects of wear and the problem of measuring low wear rates associated with radiation modified polyethylene. The final paper examined different setups for total hip simulators.

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