MECHANICAL & INDUSTRIAL ENGINEERING COLLOQUIUM: ME 794 001

Evolution of the Electronic Knee Prosthesis

Dr. Mark Kester, Professor

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Wednesday, November 28, 2012
221 MEC
1:30 to 2:30 pm

Abstract:

Tibiofemoral forces are imperative to the design and analysis of knee implants. Investigators relied on theoretic data from mathematical models to predict mechanical forces in the knee. Theoretical models predicting forces are highly variable because of the complex interplay of the muscles involved in activities. Ideally, knee forces should be directly measured. Scripps Clinic therefore had a goal to develop a fully instrumented tibial component or an electronic total knee prosthesis (e-Knee) of a total knee prosthesis containing multichannel transducers (load cells), a microtransmitter, and an antenna to directly measure tibiofemoral compressive and tensile forces in vivo. After 13 years of research and development, the e-Knee was implanted into a patient in 2004. Tibiofemoral force data were collected intraoperatively and throughout the postoperative period during activities of daily living and during exercise. Direct measurement of knee forces can lead to a better understanding of the stresses seen following total knee arthroplasty. Long-term collection of in vivo measurements of loads on a total knee prosthesis will allow future improvements in knee replacement design, rehabilitation, and assistive devices such as lower-extremity braces, orthotics, and shoes. This presentation describes the history and results of the use of a total knee prosthesis with a telemetric implant, the e-Knee under various loading conditions.

Biographical:

Dr. Kester attended Wake Forest University in North Carolina. He enrolled in a program operated conjointly between Wake Forest and North Carolina State University that fused both liberal arts and technical curriculums. He graduated in 1979 with Bachelor of Science degrees in both Chemical Engineering and Physics. Following this, Dr. Kester was admitted to the Biomedical Engineering program at Tulane University where he obtained his Master of Science degree under the guidance of Steven C. Cowin, Ph.D. The research focused on bone remodeling under a superimposed stress state in canine femora. After graduating from his master's degree, Dr. Kester worked with Drs. Stephen D. Cook and Michael Brunet on a project that involved determining the mechanical effect of transferring tendons about the knee joint to address instability induced by Anterior Cruciate Ligament insufficiency. This introduced Mark to knee biomechanics which has continued to be a primary focus ever since. After receiving his Ph.D. in 1985, Dr. Kester stayed for a two-year post doctorate in the Biomaterials Lab where his focus was on implant retrieval and design under Drs. Stephen Cook and Ray J. Haddad.

In 1987, Mark left the Biomaterials Lab and went to work for Osteonics- a division of Stryker Corporation. He has held a variety of positions with the company. Dr. Kester was granted a patent in 1998 involving a knee design with a single sagittal radius throughout the functional flexion arc- a concept which formed the basis for the Scorpio knee system. He also has a patent on the Triathlon knee, which is the single largest brand at Stryker Corporation. Dr. Kester is currently the Senior Director of Research for Stryker Orthopedics. He has numerous publications, presentations and remains active in several professional societies.

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