Development and Characterization of a Novel Orthopaedic Bearing Surface Material

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Project Description

The use of ultra high molecular weight polyethylene (UHMWPE) inserts in total joint replacements (TJR), including total knee replacements (see Fig. 1), results in wear particle-caused osteolysis, the predominant cause for prosthesis failure and revision surgery. UHMWPE particle generation is inevitable despite the numerous efforts in improving this material. This project seeks to further develop and modify an enriched UHMWPE material (patent pending) that will serve as a drug delivery device to mitigate osteolysis. Students performing this research will compression mold, test and characterize modified polymers.

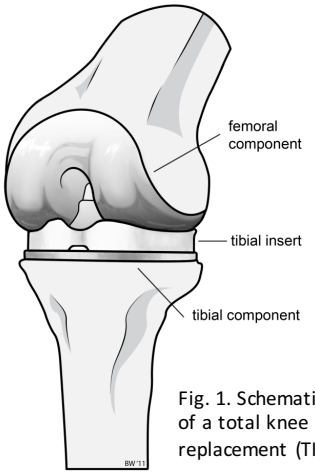

Fig. 1. Schematic of a total knee replacement (TKR)

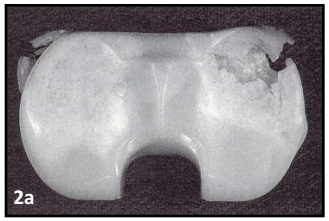

Fig. 2. Examples of failed implants. (a) Photo of a failed tibial knee insert (b) x-ray of a TKR exhibiting osteolysis of the bone surrounding the implant.

Project Timeframe/Plan

Project to begin either Winter or Spring quarter. Students interested in summer research should also apply. Time frame for this project is one year. However, upon successful completion of the proposed project, it will be extended to perform biological testing of the new materials. Performance will be evaluated throughout the project.

Student Duties

1. Conduct relevant literature reviews.
2. Mix and compression mold polymer.
3. Perform & analyze results from tensile testing and pin-on-disk wear experiments.
5. Keep the research lab clean and organized.
6. Actively participate in biweekly group meetings and write summary reports.

Outcomes

Students will be actively involved in cutting edge orthopaedic research (patent pending on the material they will be modifying). Students will learn how to (1) perform polymer characterization, (2) conduct literature reviews and interpret data from other research, (3) become familiar with writing peer-reviewed research article for publication.

Student Qualifications

1. This research is open to 1st year students through senior.
2. Time requirement: minimum of 10 hours/week
3. Minimum two consecutive quarters of work.

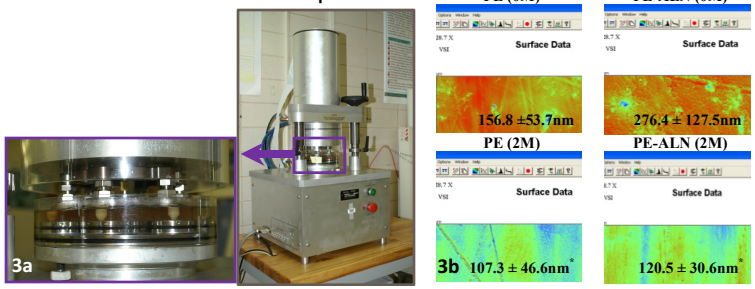

Fig. 3. (a) OrthoPOD pin-on-disk testing apparatus (b) Surface characterization results from 2-million cycle wear test of standard versus enriched UHMWPE (PE & PE-ALN, respectively) using a Stanmore Instron Knee Simulator.