

This research examines the impact of basic calcium phosphate particulates (BCPs) on the frictional properties of the intact rat knee joint. The formation of mineralized cysts within the matrix of articular cartilage is a form of cartilage degradation associated with aging, decreased joint function, and severity of OA in humans. As these cysts increase in size or cartilage is worn away at the articulating surface of the joint, they become exposed and ultimately rupture, releasing their contents into the synovial fluid.

The introduction of hard particulate matter into the lubricating fluid of any joint or bearing necessarily alters the interaction between contact surfaces, typically resulting in abrasive wear. However, the specific relationship between synovial BCPs and joint friction is currently unknown. Improved understanding of the frictional effects of cystic rupture and BCP release in the rat model could lead to improved understanding of frictional wear and degradation of articular cartilage due to similar mechanisms in humans.

A pendulum apparatus for evaluating the whole-joint coefficient of friction (COF) of whole small animal joints was designed and constructed. The femur is mounted to the apparatus at a fixed angle, and a weighted pendulum is affixed to the tibia such that its weight places the joint in compression. The pendulum is displaced, then allowed to oscillate freely until it returns to rest. The oscillation of the pendulum is recorded using an optical tracking system. A decay function is fitted to the oscillation in MATLAB, and the COF is derived from this function. A sample population of naïve specimens was prepared, and the COF of each specimen was determined. Specimens then received an injection of an organically-derived calcium phosphate particulate suspension or a sham solution, and the COF of each specimen was reevaluated. Analysis of variance was used to determine significant differences between groups.