

Abstract

This thesis focuses on the introduction with the problems of high molecular weight polyethylene (UHMWPE) in orthopedics in the first part. It discusses the history, properties and processes that lead to the failure of UHMWPE joint replacement components.

The experimental part validates the hypotheses expressed. It acquaints readers with the experimental verification of the effect of different types of sterilization on the oxidative stability of laboratory prepared samples and explanted UHMWPE joint replacement components using methods of infrared microscopy, electron spin resonance, mechanical tests and tests of microhardness. Other experimental measurements on a large set of explanted components of hip and knee total joint replacements validates the hypothesis that the amount of oxidative damage affects the lifespan of joint replacements. The third part of the experimental study maps the degree of oxidative damage in different places of the hip and knee joint replacements. In the final part we experimentally demonstrate the fact that the rate of oxidative damage has an effect on supramolecular structure of the UHMWPE.

From the above experiments are concluded clearly defined recommendations for clinical practice, which should lead to extend the lifespan of total joints replacements in orthopaedics.

Keywords

UHMWPE; oxidation; lifespan; infrared spectroscopy; joint replacement