

## Abstract

**Introduction and theoretical part:** The thesis focuses on the influence of polymeric materials on the development of septic and aseptic complications in orthopaedics. The properties of polymers, particularly high molecular weight polyethylene (UHMWPE), and their wear and degradation that can lead to aseptic loosening of joint replacements are detailed. Infections in orthopaedic patients, which include osteomyelitis, septic arthritis and prosthetic joint infections, are also discussed. In addition to standard therapeutic procedures, the possibility of using local antibiotic carriers in the prevention and treatment of these infections is discussed and tested in an experimental part of the thesis.

**Material and methods:** Commercial samples of polymethyl methacrylate (Palacos®, Palacos R+G® and Vancogenx®) and calcium sulfate (Stimulan®) were tested and compared with the experimental TPS/PCL system. The glycopeptide antibiotic vancomycin was mixed into the carriers. The effect of the carrier with the antibiotic was tested against the reference strain CCM 4223 *Staphylococcus aureus*. Statistical evaluation of the results was also performed.

**Results:** The results showed that all the local antibiotic carriers tested showed reliable bacteriostatic properties. The bactericidal effects were of limited significance, probably due to multiple factors. A statistically significant difference was observed for some of the results, especially at lower antibiotic concentrations. This suggests that the carriers become similarly effective with increasing antibiotic concentration. The best bactericidal effect was observed with the Vancogenx® system.

**Discussion:** Important trends related to the properties of antibiotic carriers that may affect their efficacy have been identified. The diversity of results was probably due to the homogeneity of antibiotic dispersion in the systems and the poorer reproducibility of the agar method.

**Conclusions:** This study confirms the efficacy of commercial local antibiotic carriers and the experimental TPS/PCL in inhibiting bacterial growth, highlighting the need for further research to optimize materials and treatment methods.

**Keywords:** polymers, UHMWPE, wear, oxidative degradation, tribology, complications of joint replacements, aseptic loosening, infections in orthopedics, prosthetic joint infections, local antibiotic delivery, local release of antibiotic, antibiotic carriers, bone cement, calcium sulfate, antimicrobial susceptibility, *Staphylococcus aureus*, bacteriostatic effect, bactericidal effect, dilution method, agar method, vancomycin, MIC, minimum inhibitory concentration, MBC, minimum bactericidal concentration.