Streszczenie w języku angielskim

The oral microbiome is the most complex ecosystem in the human body. In most cases, microorganisms of the microbiome growing in the form of biofilm do not cause clinical problems and can be considered commensal, but some changes in the species composition and quantity of oral microorganisms may result in the development of biofilm-dependent diseases (pulp, periapical tissues, periodontium, tissues around implants, oral mucosa, and caries). Advanced infections are difficult to treat completely, especially when opportunistic microorganisms such as *Enterococcus faecalis* and *Candida albicans* are responsible for their development. Oral candidiasis poses particular therapeutic problems, and therefore effective antifungal agents are being sought. AMP – endogenous antimicrobial peptides characterized by a broad spectrum of activity, limited microbial resistance and rapid action have become a model for the development of cheaper and more effective therapeutic agents. These include ceragenins – cationic steroidal antibiotics. They show selective toxicity towards microorganisms and are cheaper in large scale preparation than AMPs. They are also resistant to degradation by proteases and characterized by high biocompatibility.

The primary objective of the dissertation was to evaluate the ability of *C. albicans* to penetrate dental tissues and materials and the resulting degradation phenomenon. Experiments were planned to determine the effect of CSA-44 on biofilm adhesion of *C. albicans*, *E. faecalis*, and *C. albicans* and *E. faecalis* to the surfaces of human teeth and discs made of composite material and to evaluate the effectiveness of CSA-44 in eliminating biofilm already existing on these surfaces. The experiments were carried out under conditions as similar as possible to those prevailing in the oral cavity – the composite was subjected to wear processes: stresses imitating the forces of chewing, aging, destruction associated with wear over time and the tested material samples and teeth were incubated in the presence of human saliva. The effect of CSA-44 on the morphology of biofilm-forming cells and the surface of the composite material was also evaluated. Biofilm mass analysis was performed using crystal violet (CV) staining. The morphology, viscoelastic properties of the biofilm in the presence of CSA-44 and changes in the composite surface in response to biofilm growth were determined by AFM microscopy.

In this study, CSA-44 was shown to be effective in preventing the formation and reducing the mass of biofilm on the surface of teeth and composite restorations (composite discs). Weight reduction occurred due to the ability of CSA-44 to destroy and reduce the stiffness of stationary biofilm as well as individual cells. Due to the ease of removal of biofilm

treated with CSA-44 from the composite and human tooth surfaces, *C. albicans* and *E. faecalis* were found not to penetrate the composite and tooth tissue structures. Based on AFM studies, it was proven that the biofilm of *C. albicans* and *E. faecalis* changes the local mechanical properties of the composite. The structure of the polymer becomes inhomogeneous, which can cause microcracks when used as a restorative material.

Biofilms of *C. albicans* and *E. faecalis* are difficult or even impossible to eliminate with traditional therapeutic preparations, care products or simple hygiene and prophylactic procedures. Ceragenin may serve as an effective substance for the elimination of opportunistic pathogens causing difficult-to-treat biofilm-dependent oral diseases and as a new component of polymers and oral hygiene products. Future use of ceragenin in clinical practice may provide an alternative to replacing infected fillings and restorations. This requires further research.