Abstract

Regenerative medicine is one of the most intensively developing scientific fields, and the technologies implemented make modern therapeutic solutions available to patients. Biologically active substances are being sought to enrich new composites with them and thus modulate damaged bone and endothelial tissue regeneration.

The research presented in this thesis focused on determining the role of cholesterol in the regeneration of damaged endothelial and bone tissue. Cholesterol has multifunctional biological properties and is vital in key physiological processes. Its role in endothelial regeneration and angiogenesis has recently attracted researchers' interest.

In this study, cholesterol was selected from among the sterols tested in *in vitro* experiments (cholesterol, 7-ketocholesterol, and calcitriol) as the biologically active substance with the most significant potential to promote vascular endothelial regeneration, i.e., VEGFR2 receptor-dependent migration, proliferation, and angiogenesis.

Based on the results, cholesterol was used as a biologically active substance to modify apatite fibers in a polylactide composite (5PLA10WMCH(H2O)0.15%) to increase its efficiency in regenerative processes. In experiments performed with *in vitro* and *in vivo* models, the cytocompatibility of tested composite and its potential to promote colonization by bone cells and the formation of richly vascularized connective tissue was confirmed. The effectiveness of the 5PLA10WMCH(H2O)0,15% biocomposite was confirmed in a rat cranial bone defect overgrowth study, which showed enhanced regeneration of damaged bone tissue in the composite implantation environment, as well as a strong initiating effect on mineralization processes and the formation of new bone compared to the reference composite (5PLA10W).

In conclusion, this dissertation's *in vitro* and *in vivo* studies indicate that cholesterol can be a potential biocompatible stimulator of angiogenesis and bone formation, making it a promising ingredient for modifying composites in bone tissue regeneration.

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