The purpose of the project is to use ion exchange materials as carriers for drugs against osteoporosis and as fillers with remineralization potential in dental composites. The concept of the project is presented in Figure 1.

The first part of the project is related to drugs for osteoporosis. Osteoporosis is a disease that reduces bone mineral density. This disease is the world's most common skeletal system disease; affecting over 200 million people globally. As a result of this disease, the bones are more fragile, and the risk of bone fracture is up to 40%. Popular drugs for osteoporosis are bisphosphonates. Unfortunately, each of the methods of their delivery used so far has low effectiveness and many side effects. Therefore, a new way of delivering these drugs is sought to improve the living conditions of people who have osteoporosis. In this project, it was decided to propose a new way of drug delivery of bisphosphonates. The drug will be delivered from a polymer implant filled with a carrier or from the surface of titanium implants coated with the carrier. The advantage of the planned materials over those that have been used so far will be that they will release the drug under the influence of human body fluids. Controlled drug release will result from the use of ion exchange materials with divalent ions. There are interactions between these materials and the drug that disappear under the influence of components in human body fluids. Local slow drug delivery will increase the bioavailability of the drug. Research will allow the preparation of new generation of drug-releasing materials for osteoporosis, which will improve the quality of life for many people.

The second part of the project concerns dental fillers with remineralization potential. Calcium, phosphate, and fluoride ions play an important role in the battle between demineralization and remineralization processes of teeth. Their content in the oral cavity affects the tooth's susceptibility to the progression of caries. During demineralization of teeth, calcium release precedes phosphate release from enamel and dentin. Therefore, calcium should be used to suppress the demineralization process, not phosphates. Calcium ions delivered from the external sources to the human mouth environment can rebuild the hydroxyapatite structure of dentin and enamel. So far, the most popular experimental materials used for this purpose are calcium phosphates. Unfortunately, the release of calcium ions from their structure results from their partial dissolution. Partial dissolution deteriorates the mechanical properties of the composite. Due to this, in this project, we have planned to prepare new calcium releasing fillers. The release of ions from these materials will not be due to dissolution. Therefore, their structure will not be damaged. Due to the lack of changes in the structure of the filler, the ion release will not adversely affect the mechanical properties of the composite. The research may allow the production of dental composites with better properties than those used so far, which will improve the quality of humans' life.

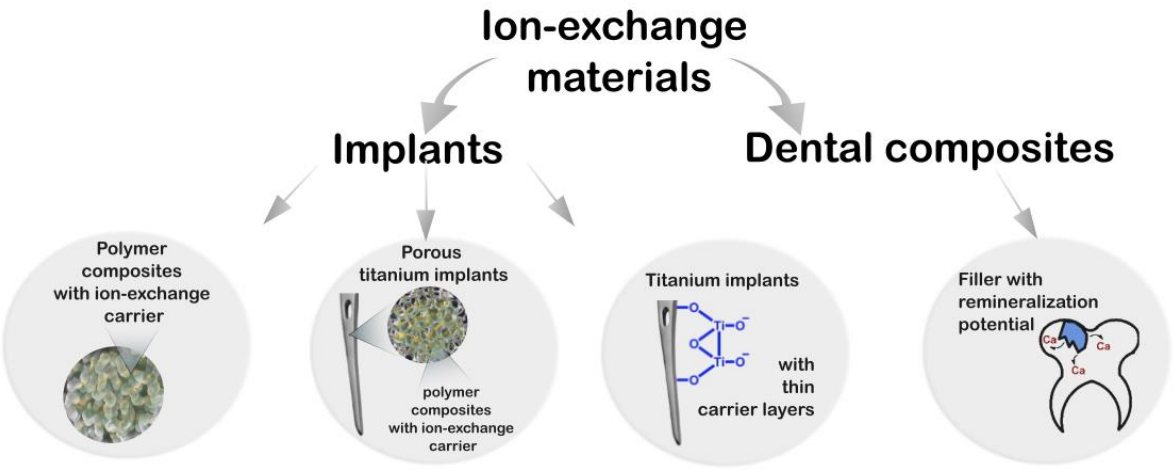

Fig. 1 The aim of the project.