# Antibacterial Bioactive Glasses in Orthopedic Surgery and Traumatology

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**Abstract :** Large bone defects are not able to heal spontaneously. Bioactive glasses seem to be appropriate (bio)materials for bone reconstruction. Bioactive glasses are osteoconductive and osteoinductive, therefore, play a useful role in bony regeneration and repair. Because of their not optimal mechanical properties (e.g., brittleness, low bending strength, and fracture toughness), their applications are limited. Bioactive glass can be used as a coating material applied on metal surfaces. In this way -when using them as implants- the excellent mechanical properties of metals and the biocompatibility and bioactivity of glasses will be utilized. Furthermore, ion release effects of bioactive glasses regarding osteogenic and angiogenic responses have been shown. Silicate bioactive glasses (45S5 Bioglass) induce the release and exchange of soluble Si, Ca, P, and Na ions on the material surface. This will lead to special cellular responses inducing bone formation, which is favorable in the biointegration of the orthopedic prosthesis. The incorporation of other additional elements in the silicate network such as fluorine, magnesium, iron, silver, potassium, or zinc has been shown, as the local delivery of these ions is able to enhance specific cell functions. Although hip and knee prostheses present a high success rate, bacterial infections -mainly implant associated- are serious and frequent complications. Infection can also develop after implantation of hip prostheses, the elimination of which means more surgeries for the patient and additional costs for the clinic. Prosthesis-related infection is a severe complication of orthopedic surgery, which often causes prolonged illness, pain, and functional loss. While international efforts are made to reduce the risk of these infections, orthopedic surgical infections (SSIs) continue to occur in high numbers. It is currently estimated that up to 2.5% of primary hip and knee surgeries and up to 20% of revision arthroplasties are complicated by periprosthetic joint infection (PJIs). According to some authors, these numbers are underestimated, and they are also increasing. Staphylococcus aureus is the leading cause of both SSIs and PJIs, and the prevalence of methicillin-resistant S. aureus (MRSA) is on the rise, particularly in the United States. These deep infections lead to implant removal and consequently increase morbidity and mortality. The study targets this clinical problem using our experience so far with the Ag-doped polymer coatings on Titanium implants. Non-modified or modified (e.g., doped with antibacterial agents, like Ag) bioactive glasses could play a role in the prevention of infections or the therapy of infected tissues. Bioactive glasses have excellent biocompatibility, proved by in vitro cell culture studies of human osteoblast-like MG-63 cells. Ag-doped bioactive glass-scaffold has a good antibacterial ability against Escherichia coli and other bacteria. It may be concluded that these scaffolds have great potential in the prevention and therapy of implant-associated bone infection.

**Keywords :** antibacterial agents, bioactive glass, hip and knee prosthesis, medical implants
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