Antimicrobial Coating of Medical Implants

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Orthopaedic implants are used routinely worldwide for surgical treatment of the musculoskeletal conditions. The primary aim of these devices is to provide mechanical stabilization so that alignment and function of bone can be maintained during physiological loading. By providing stability to the injured limb or body part, foster earlier return to function.

Although bulk properties of an implant can initially determine the material suitability, the physical properties and chemistry of the material surface are crucial to the function of many biomedical devices. While physical modification results in a change in the topography or morphology of the surface, chemical treatment can result in surface functionalization. Modifying the surfaces of the implants can prevent corrosion, enhance biocompatibility, and improve osseointegration without compromising the bulk properties.

Implant-related infection is one of the leading reasons for failure in orthopaedics and trauma, and results in high social and economic costs. Surgical site infection (SSI) after implant use for closed fracture has a reported incidence ranging from 0.5% to 10%, and up to 50% after open fractures. Various antibacterial coating technologies have proven to be safe and effective both in preclinical and clinical studies, with post-surgical implant-related infections reduced by 90% in some cases, depending on the type of coating and experimental setup used.

The most preferred method to increase the compatibility of metallic implants with bone tissue is to coat their surfaces with calcium phosphate based ceramics. The next logical step is to prevent implant-related infections by adding antimicrobials to it. Given the high risk of antibiotic resistance associated with antibiotic-loaded coatings and other problems, non-antibiotic substances are a much more attractive alternative. Among the various substances, silver stands out with its inhibition of bacterial attachment, its broad antibacterial spectrum, its long-term antibacterial effect and its less prone to resistance development. By using silver in combination with ceramic bioactive surface material such as hydroxyapatite, we obtain a product with both high bone integration and antimicrobial activity.