# Function of Silver Nanoparticles (AgNPs) in Dental Biomaterials

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## Description

Due to the antibacterial properties of Silver (Ag), it has been used in the field of medicine for ages. Silver nanoparticles have recently been created and added to a number of biomaterials because of their remarkable antibacterial impact and small size at low filler levels. Therefore, these nanoparticles have been used in dentistry to stop or slow down the growth of biofilm on the surfaces of dental materials. Special features of silver nanoparticle include antibacterial potential, mechanical properties, cytotoxicity, and long-term effectiveness. Ag is an effective antibiotic along with the number of benefits, including minimal toxicity, strong biocompatibility with human cells, long-lasting antibacterial activity due to continuous ion release, and little bacterial resistance. Silver Nanoparticles (AgNPs) have been synthesised and have effective antibacterial capabilities with the development of nanotechnology. AgNPs have shown distinctive interactions with different bacterial and fungal species as a result, they are frequently used in the medical industry in equipment like bone prostheses, endotracheal tubes, surgical instruments, and wound sutures.

Additionally, AgNPs have been used in various fields of dentistry like endodontics, dental prosthetics, implantology, and restorative dentistry. The combination of AgNPs seeks to prevent, or at least reduce microbial colonisation over dental materials, enhancing oral health and life quality. The larger surface area and smaller particles of AgNPs offer effective antibacterial effects at low filler levels, reducing the concentration of Ag particles required for its efficacy and preventing adverse effects on mechanical properties. AgNPs ability to pass through cell membranes more easily because of their small size is another advantage. This is a key factor since microorganisms in biofilms are more resistant to antimicrobial agents than planktonic pathogens. Through Transmission Electron Microscopy (TEM), the Ag dispersion has been examined in numerous research projects. Using this method, the diffusion of AgNPs throughout the tested substance may be seen, and the particle size can be determined. The 3 nm Silver Nanoparticles (AgNPs) were well distributed throughout the polymer matrix and were easy to see. Due to extremely small size of AgNPs, it is possible to penetrate into dentinal tubules and potentially inactivate any remaining bacteria. The Minimum Inhibitory Concentration (MIC) of AgNPs is defined as the lowest antimicrobial agent concentration at which 90% of the expected growth is detected in the medium, which is a fundamental aspect that needs to be examined.

The form of AgNP obtained also causes different variations. In some cases, the AgN particles are acquired directly from the manufacturers as they are commercially available. In other cases, $AgNO_3$ is reduced with $NaBO_4$, polyvinylpyrrolidone, sodium citrate, and gallic acid, among others, to prepare AgNPs. Some other applications of AgNPs in the field of denstistry include endodontic materials, titanium implants, acrylic resin, composite resin, adhesive systems, and forms of incorporation. Depending on the type of material, different methods are employed to introduce AgNPs into dental materials. The addition of a monomer, generally 2-(tert-butylamino) ethyl methacrylate, to increase Ag salt solubility in the resin solution is the most common method for composite resin and adhesive systems. Whereas, the procedure is entirely different for dental implants, titanium samples are immersed in $AgNO_3$ solutions, washed with deionized water, dried, and exposed to UV light from a high-pressure Hg lamp. Depend-ing on the concentration of the $AgNO_3$ solution, this method enables the production of samples with various Ag concen-trations.

## Conclusion

Moreover, AgNPs have been verified to be biocompatible with mammalian cells, indicating that using it in dental materials poses no risk to human health. More research is required to find the ideal concentration of this silver complex in order to ensure the antibacterial activity without increasing its cytotoxicity. Also, additional research is required to examine the Ag ion release and long-term characteristics of the new dental materials containing AgNPs. Researchers have to investigate and interpret the optimum methods of silver inclusion along with the potential drawbacks of adding AgNPs in dental materials, particularly about colour changes and mechanical characteristics.

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