



Innovative Nanoporous Titania Surface with Stabilized Antimicrobial Ag-Nanoparticles Via *Salvadora Persica* L. Roots (Miswak) Extract for Dental Applications

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Abstract

Oral infections are still one of the major problems facing dental implants and cause delay in the healing process which leads eventually to the failure of the implant surgery and bone loss. In this study, *Salvadora persica* L. root (miswak), SPE, extract acts as a bio-reductant solution to produce a tiny size (< 20 nm) AgNPs with spherical shape spread easily on nanoporous anodized titanium implant (NPAT) surface to increase its corrosion resistance and antibacterial properties for good bone integration after dental surgeries. AgNPs were stabilized as nano-granules like pearls on NPAT surface formed our novel modified titanium surface named AgNPs(SPE)/NPAT where its morphology and structure were confirmed by transmission electron microscope (TEM), scanning electron microscope (SEM), and energy-dispersive X-ray analysis (EDX). Electrochemical impedance spectroscopy (EIS) with its fitting data based on $R_s[R_pQ_p][R_bQ_b]$ was used to predict the duplex structure of titania film and to confirm its stability in a simulated physiological solution where the corrosion resistance increase from 10 to 72.9 k ohm/cm² and from 4 to 5.53 k ohm/cm² for the outer and the inner layer respectively, after 1 month of immersion in Hank's solution at 37 °C. The pour plate method was used to achieve the antibacterial efficiency of the AgNPs(SPE)/NPAT against *Staphylococcus aureus* (ATCC6538) and established its significant inhibition better than NPAT surface that explains the vital role of SPE to keep the oral cavity with implant surfaces wellness. The study shows the effectiveness of metal nanoparticles prepared from the aqueous miswak roots treated with modern techniques and new metal surfaces to become resistant to microbial infections in dental applications. According to the hadith of Prophet Muhammad, may God bless him and grant him peace, "Swak are pleasing to Allah and cleanse the mouth."