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The Effect Of Titanium Dioxide Nanoparticles on the Activity of Salivary Alkaline Phosphatase and Peroxidase in Chronic Periodontitis Patients

A thesis Submitted to the Council of the College of Dentistry/University of Baghdad in Partial fulfillment of the Requirements for the Degree of Master of Science in Periodontics

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Abstract

Background: Nanotechnology application has rapidly extended into all areas of life. It provides new methods to solve scientific and medical problems. Nanomaterials such as titanium dioxide nanoparticles has been used in biomedical applications. Biological influence of the nanoparticles appears to be as a result of the interactions between the nanoparticles and proteins. Salivary alkaline phosphatase is an enzyme that is linked to the outer membrane of some cells and formed by many other. Peroxidases are oxidizing enzymes that catalyze the oxidation reactions for a number of substances. The oxidation reaction continues with the help of hydrogen peroxidase that is reduced to water. Salivary alkaline phosphatase and peroxidase activity increase in periodontal diseases especially in the active phase of the disease.

Aims of the study: was to evaluate the effect of titanium dioxide nanoparticles on the activity of salivary alkaline phosphatase and peroxidase in chronic periodontitis and non-periodontitis patients.

Materials and methods: The effect of titanium dioxide nanoparticles was studied on the activity of salivary alkaline phosphatase and peroxidase in 75 participants (44 with chronic periodontitis and 31 non periodontitis). Age range of the participants was 35_50 years for both groups. The periodontal disease was determined based on clinical periodontal parameters including gingival index, plaque index, bleeding on probing, probing pocket depth and clinical attachment level. Unstimulated saliva was collected from all participants and analyzed (colorimetric method) using spectrophotometer for the activity of both enzymes with and without the effect of titanium dioxide nanoparticles.

Results: Salivary alkaline phosphatase activity increased in the presence of titanium dioxide nanoparticles with maximum activation at 1.45 μ g/mL. Salivary peroxidase activity was also increased by the presence of titanium dioxide nanoparticles with maximum activation at 0.79 μ g/mL. The results showed that the activity of both Salivary alkaline phosphatase and peroxidase was significantly higher in chronic periodontitis patients compared to the non-periodontitis group (p-value \leq 0.05) and there was a positive non-significant correlation between these enzymes activity and periodontal parameters (p-value $>$ 0.05).

Conclusion: The nanoparticle surface can induce conformational changes in adsorbed protein molecules which may affect the total bio-reactivity of the nanoparticle. Titanium dioxide nanoparticles play a role in increase the activity of salivary alkaline phosphatase and peroxidase in chronic periodontitis patients.