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Evaluation of mechanical and histological significance of nano hydroxyapatite and nano zirconium oxide coating on the commercial pure titanium implants

A Thesis

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Abstract

Background: Dental implant considered a treatment option for the replacement of missing dentition. The new trend of implants is looking for materials which accelerate bone formation in bone implant interface and enhance osseointegration to provide immediate loading directly after placement and decrease the time period which is disturbs patients and uncomfortable.

Aim of the study: To determine the effect of nano hydroxyapatite (HA) and nano zirconium oxide (ZrO_2) mixture, coated on the screw shape commercially pure titanium (cpTi) implant on the strength of bone-implant interface compared to non coated implants by using torque removal test and histological examination.

Materials and methods: The electrophoretic deposition process (EPD) was applied to form a homogenous layer of coating on cpTi implants. For evaluating the surface coating layer; microscopical examination, X-ray diffraction analysis (XRD), atomic force microscope (AFM) and coating thickness measurement were applied to the titanium specimen coating layer.

Rabbits Tibia of 10 New Zealand white animals were selected for titanium implant insertion. Two implants placed in each animal tibia, one with coating and one without coating and the total 40 implants were inserted, then application of removal torque test for measurement the strength of bone implant contact after two healing periods (2 and 4 weeks). From each healing interval 16 implants examined by removal torque needed and the remaining 4 screws observed histologically.

Results: The mean of torque removal for implants with coating was more than implants without coating after both healing intervals and it increased with time for both coated and non coated implants.

The histological examination illustrate formation of new bone in response to coated implants more than non-coated implants.

Conclusion: The biomechanical and biological properties of the bone-implant interface associated with the nano hydroxyl apatite and nano zirconium oxide coated implants were improved comparing to the non coated implants.