Surface modification and coating of dental implants with titania nanotubes and the study of the effect of electrochemical anodizing time on the surface properties of dental implants

PURPOSE. Due to their superior mechanical and chemical properties, titanium (Ti) and its alloys have been widely used as dental implantable devices. However, their bioinertness represents a limitation, which can be overcome by employing various surface modifications, such as TiO_2 nanotube (TNT) fabrication via electrochemical anodization. Anodic TNTs present tunable dimensions and unique structures.

MATERIALS AND METHODS. TiO2 nanotube arrays were fabricated on the surface of titanium disk by two-step anodic oxidation. TiO2 nanotube arrays were successfully synthesized by the anodization method of Ti disc in electrolyte containing the mixtures of ethylene glycol (EG), ammonium fluoride (0.3 wt % NH_4F) and deionized water (2 Vol % H_2O). A constant dc power supply at 80 V was used anodization process with different anodizing times. The resultant samples were annealed at 550 °C for 3 h. TiO_2 nanotube arrays were studied by field emission scanning electron Microscope (FESEM), Atomic Force Microscopy (AFM), (XRD) and contact Angle (CA). The prepared TiO_2 NTs has diameter in 30-130 nm. The minimum of diameter TiO_2 nanotube arrays was approximately 30 nm for 10 h of anodization process.

RESULTS. FE-SEM images of TiO_2 NTs exhibited the presence of elongated tubular structures. The XRD pattern of synthesized TiO_2 NTs represented the anatase crystal phase of TiO_2. Our results showed that the average tube diameter ranged from 30 to 130 nm, and tube length increased from 2 to 10 μm and wall thickness from 10 to 21 nm. Additionally, atomic force microscopy analysis were carried out for investigating the effect of anodization on electrochemical and surface properties of amorphous titanium thin films

Keywords: dental implant, nanotitania, surface properties, electrochemical anodizing