Corrosion Behavior of Ti-6Al-4V Alloy after Plasma Electrolytic Oxidation in Solutions Containing Ca, P and Zn

In-Jo Hwang* and Han-CheolChoe
Department of Dental Materials, School of Dentistry, Chosun University, Korea (E-mail: hcchoe@chosun.ac.kr)

초 록 : Ti-6Al-4V alloy have been used for dental implant because of its excellent biocompatibility, corrosion resistance, and mechanical properties. However, the integration of such implant in bone was not in good condition to achieve improved osseointergraiton. For solving this problem, calcium phosphate (CaP) has been applied as coating materials on Ti alloy implants for hard tissue applications because its chemical similarity to the inorganic component of human bone, capability of conducting bone formation and strong affinity to the surrounding bone tissue. Various metallic elements, such as strontium (Sr), magnesium (Mg), zinc (Zn), sodium (Na), silicon (Si), silver (Ag), and yttrium (Y) are known to play an important role in the bone formation and also affect bone mineral characteristics, such as crystallinity, degradation behavior, and mechanical properties. Especially, Zn is essential for the growth of the human and Zn coating has a major impact on the improvement of corrosion resistance. Plasma electrolytic oxidation (PEO) is a promising technology to produce porous and firmly adherent inorganic Zn containing TiO_2(Zn-TiO_2)coatings on Ti surface, and the a mount of Zn introduced in to the coatings can be optimized by altering the electrolyte composition. In this study, corrosion behavior of Ti-6Al-4V alloy after plasma electrolytic oxidation in solutions containing Ca, P and Zn were studied by scanning electron microscopy (SEM), AC impedance, and potentiodynamic polarization test. A series of Zn-TiO_2 coatings are produced on Ti dental implant using PEO, with the substitution degree, respectively, at 0, 5, 10 and 20%. The potentiodynamic polarization and AC impedance tests for corrosion behaviors were carried out in 0.9% NaCl solution at similar body temperature using a potentiostat with a scan rate of 1.67mV/s and potential range from -1500mV to +2000mV. Also, AC impedance was performed at frequencies ranging from 10MHz to 100kHz for corrosion resistance (This work was supported by NRF: 2015H1C1A1035241;hcchoe@chosun.ac.kr).