Adhesion of Plasma Spray Coated Hydroxyapatite Film on the Two-Step Anodized Dental Implant

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Abstract: In this study, adhesion of plasma spray coated hydroxyapatite film on the two-step anodized dental implant was investigated. The plasma spray was carried out on the dental implant after two step anodization. The adhesion of coated HA film was investigated by FE-SEM after fatigue test. In the case of two-step anodized implant showed a good adhesion between implant and coated film.

1. Introduction

The electrochemical formation of ordered micropores and nanotubes has been reported for Ti anodization in fluoride-containing acid electrolytes at moderate voltage. Micropore and nanotube formation on the Ti oxide is expected to be important for improvement of cell adhesion and proliferation under clinical conditions and expected that formation of micropores and nanotubes on the implant surface would improve cell adhesion and proliferation.

Pulsed laser plating is used to coat the hydroxyapatite(HA) for dental implant. HA coating is reported to be superior in corrosion resistance]. However, the surface properties of HA film coated by plasma spray on Ti alloy that is used as medical materials has problem of spalling between dental implant and HA film after clinical use.

In this research, adhesion of plasma spray coated hydroxyapatite film on the two-step anodized dental tmplant were studied using experimental instruments.

2. Experimental

Dental implants were prepared from Kj company, Korea. Electrochemical surface treatment was carried out for surface modification of the titanium implant for two-step anodization. Micropore formation was first performed using a potentiostat with a conventional two-electrode configuration at 180 V and 30 mA in 1 M H_3PO_4 electrolyte at room temperature for 20 min. Nanotube formation was performed in 1M H_3PO_4 containing small additions of 0.8wt% NaF at room temperature by using a potentiostat (EG&G, Model 362, USA). The foregoing electrochemical treatment consisted of a potential ramp from the open-circuit potential to an ending potential of 10V, using a scan rate of 500mV/s, followed by holding the sample at 10V for 2hr. The dental implants were coated using plasm spray HA coater. For adhesion of HA film, mechanical test was carried out in accordance with ISO14801:2003(E), the maximum fracture load was studied by giving the pressure load of 5 mm/min using tensile and compression tester (AG - 10kNX, Shimadzu, Japan). To put the cyclic loading to the prepared specimen, using air-cooled dynamic materials testing machine, it was fixed in accordance with ISO/FPIS14801:2003(E) for fatigue test of implants. After fixing, the loading condition of sine type of cyclic loading from the minimum loadings and the maximum were applied at 30° of angle, and the load cycle was set as 15 Hz maintaining constant temperature and humanity (temperature 25 ℃, humidity 40 %). And by setting the maximum number of repetition as 10^6 times which is corresponding to the average number of mastication for about 1year, the number of repetition was calculated until implant was fractured by adding the load. FE-SEM, XRD, and STEM were used to observe the electrochemical treated surface and interface between implant and HA film.

3. Conclusion

In the case of two-step anodization surface, adhesion interface of HA showed a good fixation without spalling.

References

1. Y. H. Jeong, C. H. Lee, C .H. Chung, M. K. Son, H. C. Choe, Sur. & Coat. Tech, (2012) http://dx.doi.org/10.1016/j.surfcoat.2012.02.046.