

The Effect of Titanium (Ti) and Titanium 500 (Ti 500) Implantation on the Activation of Rat Macrophage Subgroups

^{1,2}Sibel AKYOL, ¹Yagmur ORUC, ²Besim BEN NISSAN

¹University of Istanbul, Cerrahpasa Medical Faculty, Department of Physiology, Istanbul, Turkey. ²University of Technology Sydney, Faculty of Science, School of Life Sciences, Sydney, Australia

Introduction: Nowadays it is necessary to make new researches in order to solve the problems related to the prolongation of life and related health problems, especially fractures and spinal degeneration. The biocompatibility, mechanical compatibility, morphological compatibility and osseointegration properties of the implant material are very important. In order to prevent unwanted side effects in the use of biomaterials, new strategies need to be developed. Implants, where they will be implanted and their functions will vary according to the characteristics of the material used. The most commonly used metallic materials are 316L stainless steel, Co-Cr alloys and Ti alloys.

Objective: To demonstrate the effect of Titanium and Titanium 500 on activation of macrophages

Material and Methods: Our research was performed in the Laboratory of Cytokines and Receptors in the Department of Physiology of Cerrahpasa Medical Faculty, Istanbul University-Cerrahpasa. Our research has been approved by the Animal Experiments Local Ethics Committee of Bezmialem Vakıf University (Approval Number:2017/218).

In order to control the rejection of the patient with specific inflammation caused by titanium implantation, we analyzed the first triggered cells of the innate immun system, especially macrophages and sub-groups (M1, M2a, M2b, M2c), by implanting Titanium and Titanium 500 into the spinal region in *Wistar albino* male rats. According to the Power Analysis statistic program, 3 different groups of *Wistar albino* species male rats with a weight of 250 - 300 grams and 10-12 weeks of age were formed. Group I (n: 8, Sham group (Control)), Group II (n: 8, Titanium alloy), Group III (n: 8, Titanium 500). No implant was used in Group I (sham group). Only surgical stress was applied to the rats and they were closed again. In Group II and Group III, the rods were placed on the lamina. Peripheral blood samples were collected on the 1st, 3rd, 5th and 7th days following the implantation phase. M1 macrophages (CCL3, CCL4, CXCL9, IL-23), M2a

macrophages (CD163, CD206), M2b macrophages (CCL1), M2c macrophage (SLAM) markers were examined by ELISA (Enzyme-Linked ImmunoSorbent Assay) method. Groups were compared with one-way analysis of variance (ANOVA). For the paired comparison of significant variables, a statistically significant difference (HSD) test was used for Tukey's homogeneous variance variables. Statistical significance was set at $p < 0.05$.

Results and Conclusions: We believe that our analysis results will be helpful in the control, prevention, immunological and therapeutic methods of the reactions (inflammation, rejection, etc.) that may occur in patients who are implanted with Titanium (Ti) and Titanium 500 (Ti 500) implants (spinal, orthopedic, dental etc.).

Keywords: Titanium, Titanium 500, Implantation, rat, macrophage