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Evaluation of the Effects of AB0 Blood Types on the Severity of Peri-implant Diseases

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ABSTRACT

Peri-implant diseases are inflammatory conditions with a complex etiology including host-related risk factors and genetic traits which may affect the soft and hard gum tissues around dental implants. The aim of this study was to evaluate the effects of blood types on the severity of peri-implant diseases. A total of 77 dental implants of 39 patients with peri-implant diseases were included. Demographic data of the patients such as age, sex, frequency of tooth brushing and interdental cleaning and blood types were recorded. Clinical variables such as probing depth (PD), gingival index (GI), and plaque index (PI) and radiographic bone loss level were also noted. Dental implants were divided into two groups as Group 1 (n=19) including those diagnosed with peri-implant mucositis and Group 2 (n=20) including those diagnosed with peri-implantitis. The PD and GI scores and radiographic bone loss level were significantly higher in Group 2 than Group 1 ($p<0.005$). The frequency of tooth brushing was significantly higher in Group 1 than Group 2 ($p=0.002$). There was no significant difference in the distribution AB0 blood types between the groups ($p>0.05$). However, the majority of the patients had A Rh (Rhesus factor) (+) blood type in Group 1 and 0 Rh (+) blood type in Group 2. In conclusion, the blood types have no significant effect on the severity of peri-implant diseases.

Keywords: Blood type, Dental implant, Peri-implant diseases, peri-implantitis

Introduction

Modern dental implants, which date back to 1960s, are artificial structures that are designed to offer functional and aesthetic replacement of missing teeth (1). With the widespread use of implants in recent years, the prevalence of peri-implant diseases has increased dramatically (2). In 2017, implant-related conditions and diseases were discussed in the World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions and the characteristics of peri-implant health, peri-implant mucositis, peri-implantitis, and soft- and hard-tissue deficiencies were focused (3). In the consensus report of the working group, peri-implant mucositis was defined as the presence of bleeding on gentle probing, erythema, swelling and/or suppuration and even pain (4). Peri-implantitis was defined as the presence of clinical signs of inflammation and crestal and marginal bone loss (5).

Although microbial dental plaques play a central role in the etiology of peri-implant diseases (6), several factors including prosthetic design of the implant, iatrogenic factors, incorrect cementation, functional duration of prosthesis, systemic diseases, smoking, implant design, surface characteristics of the implant, age and sex of the patient, the use of radiotherapy, chemotherapy, and local and systemic factors (*e.g.*, peri-implant soft tissue phenotype) are also implicated (7-9). In recent years, many studies have examined the effect of AB0 blood types and genetic factors on periodontal and peri-implant health (10, 11). The AB0 blood types have been shown to be associated with the increased susceptibility to infections (12) and systemic diseases (13-15). Bacterial colonization, the primary reason for periodontal diseases, has been also thought to be linked to blood types (11).

Although periodontal and peri-implant diseases have a different histopathogenesis, they share some culprit pathogens (16). To the best of our knowledge, there is no study to investigate the effect of blood types on peri-implant mucositis and peri-implantitis in the literature. In this study, we aimed to evaluate the effects of blood types on the severity of peri-implant diseases.

Materials and Methods

This single-center, cross-sectional study was conducted at Van Yuzuncu Yil University, Faculty

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of Dentistry, Department of Periodontology between August 2020 and March 2022. A total of 77 dental implants of 39 patients aged between 18 and 65 years (22) who were admitted with pain, swelling, edema, suppuration, and bleeding in the peri-implant site and diagnosed with peri-implant diseases were included. A written informed consent was obtained from each patient. The study was approved by the Van Yuzuncu Yil University Interventional Clinical Research Ethics Committee with the Approval No: 13 and Date: 17/06/2020 and conducted in accordance with the principles of the Declaration of Helsinki.

Inclusion criteria were as follows: having no systemic diseases, being a non-smoker, having no pregnancy or breastfeeding, receiving no medical treatment within the past six months, giving consent for the participation in the study. Same-brand dental implants with a single tooth prosthetic restoration without using advanced surgical interventions were selected (NucleOSS® T6 Torq Gr4 surface, Izmir, TURKEY). Inclusion criteria for peri-implant mucositis are; the patient presents with peri-implant mucosal swelling, edema, suppuration, bleeding on probing, and edema without radiographic bone loss. In addition to all these clinical conditions, patients diagnosed with peri-implantitis also have radiographic bone loss (3). Patients with healthy peri-implant tissues, patients with peri-implantitis in whom surgical treatment was required, and those who did not give consent for the participation in the study were excluded. The study started with 44 patients with 83 implants, but 3 patients were excluded because they didn't meet the inclusion criteria, 1 patient couldn't maintain oral hygiene, and 1 patient didn't come to the controls. Detailed anamnesis and consent forms were obtained from the patients who met the selection criteria. Participants were informed about peri-implant diseases, treatment methods and the content of the study. Oral hygiene education was explained in detail to all patients.

Demographic characteristics of the patients including age, sex, frequency of tooth brushing and interdental cleaning and blood types were recorded. Medical history and clinical measurements of each patient were evaluated and peri-implant status was assessed. Oral examination was performed from four locations of each implant (*i.e.*, mesial, distal, lingual and palatal-buccal) using a plastic explorer.

Clinical variables such as probing depth (PD), gingival index (GI) (17), and plaque index (PI) (17) and radiographic bone loss level were also noted by a single clinician. While making the radiographic evaluation, panoramic radiographs were used and Image J software (ImageJ, National Institutes of Health, Bethesda, MD, ABD) (8). GI and PI were taken from 4 regions (buccal, palatal/lingual, mesial and distal) with a plastic probe, as suggested in the literature (17). Dental implants were divided into two groups as Group 1 (n=19) including those diagnosed with peri-implant mucositis and Group 2 (n=20) including those diagnosed with peri-implantitis.

Statistical Analysis: Statistical analysis was performed using the SPSS version 21.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean ± standard deviation (SD) or number and frequency, where applicable. Normality of distribution was checked using the Shapiro-Wilk test or Kolmogorov-Smirnov test. The Mann-Whitney U test was used to compare differences between two independent groups. The chi-square test was used to analyze categorical data. A p value of <0.05 was considered statistically significant.

Results

Sample number of the study PASS (Power Analysis and Sample Size Software (2017) NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/pass) calculated. Two-way alternative hypothesis, with 80% power and 5% Type I error margin, with a sample size of at least n:77. A total of 77 implants were calculated in the group.

Of a total of 39 patients, 19 were males and 20 were females with a mean age of 47.79±12.13 (range, 23 to 65) years. There was no significant difference in the age and sex between the groups ($p>0.05$). A total of 57.8% of the patients in Group 1 and 30% of the patients in Group 2 brushed their tooth twice daily, indicating a statistically significant difference ($p=0.002$). A total of 5.2% of the patients in Group 1 had no tooth brushing at all. There was no significant difference in the frequency of interdental cleaning between the groups ($p>0.05$). Descriptive data of the patients are summarized in Table 1.

In addition, no statistically significant difference in the distribution of AB0 blood types between the groups ($p>0.05$). However, the majority of the patients had A Rh (Rhesus factor) (+) blood type in Group 1 and 0 Rh (+) blood type in Group 2. While there were no patients with 0 Rh(-) blood group in Group 1, it was observed that 2 patients (10%) in Group-2 had this blood group.

Table 1. Descriptive Data of The Patients

Group	Age, year Mean+SD	Sex Number (%)		Frequency of tooth brushing n (%)				Interdental care n (%)	
		Female	Male	Once Daily	Twice Daily	Thrice daily	Not at all	Yes	No
Group 1 (n=19)	50.58±12.12	10 (52.6)	9 (47.4)	3 (16)	11 (57.8)	4 (21)	1 (5.2)	4 (21)	15 (79)
Group 2 (n=20)	45.15±11.83	10 (50)	10 (50)	14 (70)	6 (30)	0 (0)	0 (0)	11 (55)	9 (45)
p value	0.147	0.999		0.002*				0.064	
Total	47.79±12.13	39 (100)		39 (100)				39 (100)	

*p<0.05 Indicate Statistical Significance. Chi-square test, Group 1: Peri-Implant Mucositis, Group 2: Peri-Implantitis, SD: Standard Deviation, n: Number, %: Per Cent

Table 2. Distribution of Blood Types of the Patients

Group	Blood type n (%)					
	0 Rh (+)	A Rh (+)	B Rh (+)	AB Rh (+)	B Rh (–)	0 Rh (–)
Group 1 (n=19)	5 (26.32)	11 (57.89)	2 (10.53)	1 (5.26)	0 (0)	0 (0)
Group 2 (n=20)	7 (35)	5 (25)	2 (10)	3 (15)	1 (5)	2 (10)
p value	0.254					
Total	39 (100)					

*p<0.05 Indicate Statistical Significance. Chi-square Test, Group 1: Peri-Implant Mucositis, Group 2: Peri-Implantitis, n: Number, %: Per Cent

Distribution of blood types of the patients is shown in Table 2.

The mean PD and GI scores and radiographic bone loss were significantly higher in Group 2 than Group 1 (p<0.05). However, there was no significant difference in the PI scores between the groups (p>0.05). Clinical variables of the dental implants are presented in Table 3.

Discussion

There are several factors implicated in the etiology of peri-implant diseases (18). Advanced disease may be associated with host-related risk factors (19). Although microbial dental plaques are mostly blamed for peri-implant diseases (6), many factors affect the qualitative and quantitative progression of the diseases. Previous studies have shown that AB0 blood types may play a role in bacterial colonization (20). In the light of these data, we evaluated the effects of blood types on the severity of peri-implant diseases. Our study results showed that blood types did not significantly affect the severity of peri-implant diseases.

In the present study, there was no significant difference in the sex between the patient groups. Although sex has been thought to be a risk factor for peri-implant diseases (21), we found no significant difference. In addition, there was no significant difference in age between the patient groups. In this study, it is thought that possible age-related risks (21) are eliminated since the age range is similar in both groups.

In the current study, the number of patients who brushed their teeth twice daily was significantly higher in Group 1 than Group 2. Interdental cleaning following implantation is of utmost importance for implant care and maintenance and,

Table 3. Clinical Variables of The Dental Implants

	Mann-Whitney U test		
	Group 1 (n=32)	Group 2 (n=45)	
	Mean±SD	Mean±SD	p value
PD (score)	2.47±0.93	4.63±0.96	0.001*
GI (score)	1.53±0.55	1.9±0.48	0.001*
PI (score)	1.25±0.88	1.27±0.77	0.933
Radiographic bone loss (mm)	0.28±0.89	3.29±2.59	0.001*

*p<0.05 indicate statistical significance. Mann-Whitney U test, Group 1: peri-implant mucositis, Group 2: peri-implantitis, SD: standard deviation, n: number

therefore, tooth brushing is recommended for minimum 2 min twice daily (23). Peri-implant mucositis is mainly associated with poor oral hygiene (24). Both professional dental care and routine patient care are essential to maintain peri-implant health, since the severity of peri-implant diseases increases as the frequency of tooth brushing decreases. In a recent study, Zhao et al. (25) reported that the risk of peri-implant diseases increased in patients who brushed their teeth once daily than those who brushed their teeth thrice daily. These findings are consistent with our study results.

In the present study, we found no significant difference in the interdental cleaning between the patient groups. Interdental cleaning is critical to achieve and maintain oral hygiene. In a study investigating healthy dental implants and with peri-implant diseases, inappropriate interdental cleaning was associated with low PI and GI scores. In our study, we only evaluated peri-implant diseases. Therefore, further large-scale studies examining peri-implant mucosa are required to provide a contribution to the evidence-based literature.

In the current study, there was no significant difference in the distribution of blood types between the patient groups. Although it did not reach statistical significance, the majority of the patients had A Rh (+) blood type in Group 1 (57.8%) and 0 Rh (+) blood type in Group 2 (45%). To the best of our knowledge, there is a limited number of studies investigating the relationship between the blood types and periodontal/peri-implant diseases in the field of dentistry. Review of the literature reveals no study examining the link between peri-implant mucositis/peri-implantitis and AB0 blood types. Therefore, we obtained relevant data from the field of medicine. In a study investigating the relationship between COVID-19 infection and blood types in hospitalized patients, the blood type containing no anti-A antibody (A and AB) was a predisposing factor for COVID-19 infection (27). Based on the literature data, genetic traits also play a role in the severity of infection. However, data regarding the relationship between blood types and infection are controversial. In a study, Anup et al. (15) showed that patients with A blood type were more prone to gingivitis, while patients with 0 blood type were more prone to periodontitis. In another study, Masoud et al. (28) reported that patients with 0 and A blood type had more severe periodontitis. Despite differences in histopathogenesis of periodontal and peri-implant diseases, signs of inflammation and culprit pathogens that initiate and maintain disease are similar and have common anatomic tissues such as keratinized gingiva, attached gingiva, and bone tissue (29). Therefore, it has been proposed that conditions that affect the host response may be implicated in the development of peri-implant diseases, such as blood type. In a study investigating the relationship between the survival of implants and blood types, patients aged ≥50 years with 0 blood type had higher mesial and distal bone resorption around the dental implant (10). Similar to this study, the majority of patients with peri-implantitis characterized by bone loss had 0 blood type in our study (Group 2). Unlike the aforementioned study, there was no significant difference in the age between the patient groups. This can be attributed to the fact that blood type phenotype affects the host response which is implicated in the bone resorption (19).

Considering clinical variables, all scores, except for PI, was significantly higher in patients with peri-implantitis, which is an expected finding (30). The increased PD and radiographic bone loss is a relevant factor to differentiate peri-implantitis from peri-implant mucositis. In addition, higher scores in Group 2 indicate more severe hyperemia, bleeding, and ulceration in the peri-implant mucosa (3). Although not statistically significant,

the mean PI was higher in the patients with peri-implantitis, consistent with the literature (24). Although previous studies have shown higher PI scores in peri-implantitis, the fact that patients in our study visited the dentist by brushing their teeth may have yielded similar results.

The main limitation to this study is that patients with severe peri-implantitis in whom surgical treatment was indicated and those with healthy peri-implants were excluded. The inability to standardize brushing habits is also a limitation of our study. In addition, the sample size is relatively small. Also, Rhesus factor (Rh) was unable to be confirmed and the blood types were noted based on patient records. In addition, the intraoral location of the single member implants included in the study was not taken into account.

In conclusion, our study results showed that blood types did not have a significant effect on the severity of peri-implant diseases. However, the rates of patients with A blood type and 0 blood type were significantly higher in the group of peri-implant mucositis and peri-implantitis, respectively. In addition, as the frequency of tooth brushing increased, the severity of peri-implant diseases decreased. In patients with severe peri-implant diseases, clinical variables and the amount of radiographic bone loss, which are signs of inflammation, increased. Based on these findings, host-related risk factors should be considered in the diagnosis and treatment of peri-implant diseases. Additionally, patients should be instructed about good oral hygiene and clinicians should guide patients to maintain oral hygiene appropriately and effectively. Brushable dental prostheses should be also designed for this group of patients. Nevertheless, further large-scale studies investigating the relationship between peri-implant diseases and blood types are warranted to confirm these findings and to draw more reliable conclusions on this subject.

Conflict of interests: The authors declare they have no potential conflict of interest regarding the investigation, authorship, and/or publication of this article.

Ethical Approval: This study was approved by the Van Yuzuncu Yil University, Interventional Clinical Research Ethics Committee with the Approval No: 13 and Date: 17/06/2020.

Consent to participate: Prior to study, all participants were informed about the nature of the study and a written informed consent was obtained on the voluntary basis.

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