Association Between ABO Blood Groups and Severity of Chronic Periodontitis

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Abstract. The aim of this study was to investigate if there is an association between ABO blood group and severity of chronic periodontitis. Data were collected from 161 chronic periodontitis patients. Medical history, dental history, and periodontal parameters (such as probing depth, clinical attachment loss, and distance from cemento-enamel junction to gingival margin, furcations, and mobility and missing teeth) were recorded. Blood samples were analyzed to determine blood group and Rhesus factor. The mean age of the study sample was 34.5 years ($\pm$ 13); there was no significant difference among ABO blood groups ($p = 0.3$). Gender distribution was also similar among groups. Periodontal parameters were compared among all ABO groups except for the AB group owing to its small sample size. Mean clinical attachment loss (CAL) and mean proportion of sites with CAL $\geq$ 3 mm were the greatest among group B, and the differences among groups were significant ($p < 0.05$). Other clinical parameters were not significantly different among groups. Significant relationships were determined between ABO blood type and the severity of chronic periodontitis. Patients with group B were found to be at greater risk of developing more severe form of periodontitis. Further, long-term studies with larger sample sizes are needed to confirm this conclusion.

Keywords: ABO blood group, Rhesus factor, Chronic periodontitis, Clinical attachment loss.

Introduction

Human periodontal disease comprises a heterogeneous group of infectious diseases that lead to pathologic destruction of the

periodontium. It is well known that periodontal disease can vary with respect to bacterial etiology, host response, and clinical disease progression. Although differences exist among the various types of periodontal disease, all share the common characteristic of complex host–bacterial interactions. Disease onset and progression reflect the balance between homeostasis and destruction of the periodontal tissues[1].

Although bacteria are the main cause of inflammatory periodontal disease, there is increasing evidence that host factors, such as diabetes, smoking and genetic predisposition, contribute to the clinical appearance, distribution of lesions and severity of destruction in each individual. It has been estimated that less than 20% of the variability in periodontal disease severity can be explained by the quantity of specific bacteria found in disease-associated plaques. Instead, a key role for genetic effects have been suggested[2].

The most important blood-typing system, the ABO blood group, is the determinant for transfusion reactions and organ transplantation. Unlike the other blood-typing systems, the ABO blood type system has significance beyond transfusion and transplantation, as, for example, it determines many of the digestive and immunological characteristics of the body[3]. The ABO blood type system comprises of four blood types: O, A, B and AB. Blood group O erythrocytes have no true antigen, but blood serum of O-type individuals carries antibodies to both A and B antigens. Type A and B erythrocytes carry the A and B antigens, respectively, and make antibodies to the others. Type AB erythrocytes do not manufacture antibodies to other blood types because they have both A and B antigens[3,4]. Anthropologists have used the ABO blood types as a guide to the development of modern humans. Many diseases, particularly digestive disorders, cancer, and infection, show preferences among the ABO blood types[3-7]. These preferences are not generally understood or appreciated by physicians or the general population.

The other important blood system is the Rhesus (Rh) system. This system is determined by the nature of different proteins present on the surface of erythrocytes.

Few studies have investigated the relationship between blood type and dental caries. Individuals of blood group A appear to have a lower incidence of caries and cavities compared with those with other blood groups; this difference is particularly marked if the Group A individuals are secretors. The secretion of ABO antigens into saliva probably

inhibits the ability of bacteria to attach to the tooth surface; this is because many of these bacteria have surface lectins, which they use to attach to body surfaces and are often ABO specific. Also, non-secretors tend to have lower levels of the immunoglobulin A (IgA) antibodies in their saliva, which may compromise their ability to keep bacterial counts low[8-11]. It has been noted that many individuals with high rates of caries have low rates of periodontal disease, and vice versa. One possible mechanism by which individuals of a specific blood group have a lower frequency of periodontal disease could be due to increased levels of antibodies against more strains of periodontitis-causing bacteria[8-11].

Limited efforts have been made to investigate the relationship between ABO blood group and periodontal disease. The majority of the researchers[12-16] have claimed that different ABO blood groups constitute an increased risk for the development of periodontal and oral diseases; whereas one study[17] failed to find such an association.

Knowledge of the ABO blood groups of patients and their association, if any, with the severity of periodontal disease may be important in the development of early treatment strategies, and it would help to target non-responding areas to periodontal therapy of highly susceptible individuals.

The aim of this pilot study was to investigate the association, if any, between ABO blood group and the severity of chronic periodontitis.

Design and Methodology

Study Design

This was a cross-sectional double-blind study. The examiners were not aware of the blood group of the patients and the laboratory technicians were not aware of the periodontal status of the patients. The study design was reviewed and approved by the Ethical Committee of the Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia.

Study Population

Data were collected from 161 systemically healthy patients with chronic periodontitis referred to the Division of Periodontology, Faculty of Dentistry, King Abdulaziz University. Patients were advised of their role in this study and asked to provide informed consent. Age and gender were recorded for all participants. Extensive medical and dental

histories were recorded for each patient. Patients with aggressive periodontitis or any systemic disorder that may affect the periodontal tissue (such as diabetes, pregnancy and immunological disorders) and smokers were excluded from the study.

Periodontal Examination

Full mouth examinations (excluding third molars) were conducted for all patients. Six sites were examined for each tooth (mesiobuccal, mid-buccal, distobuccal, mesiolingual, mid-lingual, and distolingual). Plaque index (PI), bleeding on probing (BOP), and positive or negative suppuration were recorded for each site. Probing depths (PD), distance from the cemento-enamel junction to gingival margin (CEJ-G), and clinical attachment loss (CAL) were recorded using a marked periodontal probe (UNC-15 Hu-Friedy®, Chicago, IL, USA). Increased tooth mobility was assessed using an ordinal score: 1, horizontal displacement of 1 mm; 2, horizontal displacement > 1 mm; and 3, horizontal and vertical displacement > 1 mm. Furcation involvement and the number of missing (NM) teeth were also recorded.

Blood Analysis

Non-fasting venous blood was collected from each subject, and analyzed for determination of ABO blood group and Rh factor.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS, Version 16). The means of continuous variables and frequency distributions of categorical variables were calculated. Mean age, CAL, PD, BOP, PI, and NM were compared across ABO blood groups using the ANOVA statistical test. Gender distribution and prevalence of furcation involvement were compared among groups using Pearson Chi^2 test. Age and periodontal parameters were compared between Rh-positive and Rh-negative individuals using the Student's *t*-test.

Results

Characteristics of the study population are shown in Table 1. The mean age of the study sample was 34.5 years (± 13). Females constituted about 55% of the study sample. About 39% of the study samples were group O, whereas only 2.5% were group AB. More than 96% of the population was Rh-positive, whereas only about 4% were Rh-negative. More than 59% of the patients had generalized moderate/severe chronic

periodontitis, as defined according to the presence of CAL $\geq$ 3 mm at $\geq$ 30% of sites. The mean proportions of sites with bleeding on probing and with plaque were 55.6 and 70.9%, respectively. CAL averaged 2.3 mm and mean PD was 2.6 mm. More than 81% of patients had no teeth with furcation involvement, about 9% of the patients had furcation grade I only, and grade II or greater was detected in 10% of the patients. On average each patient had about five missing teeth.

The correlations between age and periodontal parameters are shown in Table 2. The mean of CAL, proportion of sites with CAL $\geq$ 3 mm, and number of missing teeth had strong positive associations with age, whereas bleeding on probing had a negative but weak and non-significant association with age. Means of periodontal parameters by gender status are shown in Table 3. The mean CAL was significantly higher for males than females, whereas the mean number of missing teeth was significantly greater among females.

Table 1. Characteristics of the study sample.

	N	(%)
Blood Group		
A	55	34.2
B	40	24.8
AB	4	2.5
O	62	38.5
Rh Group		
Negative	6	(3.7)
Positive	155	(96.3)
Gender		
Females	88	(54.7)
Males	73	(45.3)
Severity of Periodontitis		
Slight	65	(40.9)
Moderate/severe	94	(59.1)
Prevalence of Furcation		
No	129	81.1
Grade I	14	8.8
Grade II ,III or IV	16	10.1
	Mean	(SD)
Age (years)	34.5	(13.1)
BOP (%)	55.6	(24.5)
PI (%)	70.9	(24.5)
CAL (mm)	2.3	(01.4)
PD (mm)	2.6	(00.6)
Missing teeth (n)	5.4	(03.7)

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Table 2. Bivariate correlation of age and periodontal parameters.

	Correlation Coefficient	p - value
BOP	-0.02	0.85
PI	0.08	0.35
CAL	0.54	< 0.01
PD	0.15	0.06
CAL >3	0.55	< 0.01
Missing teeth	0.23	< 0.01

Table 3. Mean and standard deviation of periodontal parameters by gender.

	Males		Females		p - Value
	Mean	SD	Mean	SD	
BOP	55.9	26.3	55.3	23.1	0.87
PI	73.8	24.8	68.4	24.2	0.17
CAL	2.8	1.5	2.0	1.2	< 0.01
PD	2.7	0.6	2.5	0.5	0.11
CAL >3	52.4	31.9	33.2	27.8	< 0.01
Missing teeth	4.6	3.3	6.2	3.9	< 0.01

Periodontal parameters were compared among ABO blood groups, excluding the AB group due to its small sample size (Table 4). There were no differences in percentages of sites with bleeding on probing or with plaque deposits among groups. Mean CAL was significantly greatest in group B compared with other groups ($p < 0.05$). Furthermore, mean proportion of sites with CAL $\geq$ 3 mm was also significantly greatest in group B ($p < 0.05$). Mean PD and NM teeth were not significantly different among groups. Also, prevalence of furcation involvement was not significantly different among groups ($p = 0.3$).

Periodontal parameters for Rh-positive and Rh-negative patients are shown in Table 5. Periodontal parameters were not significantly different between Rh-negative and Rh-positive patients, but there was a general trend to better periodontal health in the Rh-negative group.

Table 4. Mean and standard deviation of periodontal parameters by blood group.

	Mean and Standard Deviation (SD) by Blood Group								p - Value
	A		B		AB		O		
BOP (%)	54.1	(25.6)	57.1	(25.3)	48.6	(34.9)	56.3	(22.9)	0.825
PI (%)	71.5	(23.4)	72.6	(26.9)	80	(28.4)	68.6	(24.0)	0.685
CAL (mm)	2.2	(01.3)	2.8	(01.2)	3.1	(01.3)	2.1	(01.4)	0.029
PD (mm)	2.5	(00.6)	2.7	(00.5)	2.7	(00.2)	2.6	(00.6)	0.442
CAL > 3 mm (%)	35.9	(31.1)	52.4	(28.5)	59.3	(27.1)	39.2	(31.6)	0.030
Missing teeth (n)	5.1	(3.0)	5.0	(3.2)	8.3	(3.3)	5.9	(4.5)	0.359

p - value for the differences among groups excluding the AB blood group due to its small sample size

Table 5. Mean and standard deviation of periodontal parameters by Rh factor.

	Rh-positive		Rh-negative		
	Mean	SD	Mean	SD	p - Value
BOP (%)	55.4	24.7	60.7	19.3	0.60
PI (%)	71.1	24.7	65.2	21.1	0.56
CAL (mm)	2.4	1.4	1.7	1.2	0.24
PD (mm)	2.6	.57	2.5	0.7	0.82
CAL > 3 mm (%)	42.6	31.3	25.1	20.7	0.12
Missing teeth (n)	5.5	3.7	3.5	2.7	0.19

Discussion

The ABO blood group and Rh system distributions show marked variation around the world. Some variation may even occur in different areas within the same country[18]. It has been reported that the O blood type is most common in American and Canadian individuals, the B type in Chinese and Indian individuals, and the A type in Eskimos[19]. In Saudi population, it has been reported that the most common blood group was O (about 51% of the total sample) and the lowest was AB (about 4%)[20,21]. In this study, 38.5% (62 patients) of patients were of group O; 34.2% (55 patients) were of group A; 24.8% (40 patients) were of group B, and only 2.5% (4 patients) were of group AB.

About 85% of general population was Rh-positive. However, the prevalence varies in different countries (for example, 99% in India, 96% in Kenya, 93% in Saudi Arabia, and 90% in Iran)[19-21]. In the present study, it was found that 96.3% (155 patients) of the study population were Rh-positive and only 3.7% (6 patients) were Rh-negative.

Periodontal diseases are serious infections that, if left untreated, can lead to tooth loss[13,22-31]. Dental plaque is the main cause of these diseases. However, other factors such as sex, age, education, oral habits, smoking, and socio-economic status have been identified as risk factors for periodontal diseases[13,22-35].

Only a few studies have investigated the relationship between ABO blood group and periodontal disease. Gawrzewska[14] found that individuals with blood group O have greater severity of periodontal disease, whereas individuals with blood group A have greater resistance to periodontal disease. Kaslick *et al.*[15] found that periodontitis patients were more likely to have A or B blood groups. Frias and Lopez[17] concluded that there is no association between secretor status of ABO

blood group and juvenile periodontitis. However, Arowojolu *et al.*[12] found that all juvenile periodontitis patients had either blood group B or AB and all were Rh-positive, whereas non-juvenile periodontitis patients included those with blood groups B or O who were Rh-positive or Rh-negative and those with blood group AB who were Rh-positive. The sample sizes in the latter studies were small and the results cannot be generalized.

In a recent study, Demir *et al.*[13] investigated the relationship between periodontal disease and ABO blood group. He found a higher percentage of blood type A in patients with gingivitis and a higher percentage of blood type O in patients with periodontitis.

In the present study, the mean CAL and the mean proportion of sites with CAL $\geq$ 3 mm were greatest among patients of blood group B. Periodontal parameters were not significantly different between Rh-factor negative and Rh-positive patients, but there was a general trend to better periodontal health among the Rh-negative group. The lack of statistical significance may be due to the low number of Rh-negative patients in the present sample.

Conclusion

Significant relationships between ABO blood type and severity of periodontitis were determined. Patients with blood group B appear to be at greater risk of developing more severe forms of periodontitis. ABO blood group may constitute a risk factor in the development of periodontal diseases. Further, long-term studies with larger sample size are needed to confirm this conclusion and investigate the biological plausibility to explain this association.

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العلاقة بين فصائل الدم و وحدة أمراض اللثة المزمنة

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المستخلص. الغرض من البحث هو دراسة العلاقة بين فصيلة دم المرضى ووحدة أمراض اللثة عند المرضى الذين يعانون من التهاب مزمن في اللثة. لقد تم جمع معلومات البحث من ١٦١ مريض تم تحويلهم إلى عيادات علاج وجراحة اللثة بكلية طب الأسنان بجامعة الملك عبدالعزيز. تم تعبئة التاريخ الصحي للمرضى وتاريخ علاج الأسنان واللثة، ثم قام مساعدو الباحث بعد التدريب الدقيق بالكشف على اللثة والأسنان لتشخيص أمراض اللثة، بعد ذلك قام فني المعمل بجمع عينات دم من المرضى لمعرفة فصيلة الدم ، معدل عمر المرضى كان ٣٤٫٥ سنة، لم يكن هناك فرق هام في العمر أو الجنس بين فصائل الدم المختلفة. المرضى الذين يحملون فصيلة الدم ب لديهم التهابات أشد في اللثة وفقدان أكثر في الأنسجة المحيطة بالأسنان مقارنة بالذين يحملون فصيلة الدم أ، أما فصيلة الدم أ ب فقد استبعدت من النتائج لقلة عدد المرضى الحاملين لهذه الفصيلة. علاقة هامه تم اكتشافها بين فصائل الدم ووحدة التهاب اللثة، المرضى الذين يحملون فصيلة الدم ب وجد أنهم معرضون لالتهابات أكثر حدة في اللثة مقارنة بالفصائل الأخرى. يجب القيام بأبحاث طويلة المدى على أعداد مرضى أكثر حتى نتمكن من تأكيد هذه النتائج.