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Relationship between ABO Blood Group and Periodontal Disease: A Clinical Study

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Conflicts of Interest: Nil.

Abstract

Objectives: The purpose of the present study was to determine the association between periodontal diseases and ABO blood groups, particularly in relation to a specific geographic location, namely Kamrup District, Assam.

Methods: A total of 310 subjects aged between 16 to 57 years was selected for the study based on the clinical findings. They were divided in to three groups: subjects with healthy gingiva (group I), subjects with chronic gingivitis (group II) and subjects with chronic periodontitis (group III). Blood samples were collected to identify ABO blood groups.

Results: The subjects with blood group B had a greater propensity for both gingivitis and periodontitis, while relatively higher percentage of subjects with healthy gingiva belong to blood group O.

Conclusion: Blood group points toward susceptibility of the subjects to periodontal disease. However, studies with large-sized samples are needed to make a more comprehensive assessment of the association of ABO group on periodontal diseases.

Keywords: *ABO blood group, geographic variation, gingiva, periodontitis.*

Introduction

Periodontal disease, including gingivitis and periodontitis, is most prevalent disease affecting a large population worldwide. It is a chronic immune inflammatory response associated with both the genetic makeup and the environmental influence, if left untreated may lead to tooth loss [1]. Though bacterial plaque is generally accepted as the primary etiologic factor of periodontitis, severity of it depends on the host's immunologic response to bacterial challenges, which in turn depends on the host susceptibility [2]. Several studies have shown that periodontal disease is influenced by genetic factors, such as HLA antigen, salivary secretor status, familial predisposition, ABO blood group (erythrocyte antigen system). These factors may alter the oral ecology and thereby, facilitates the occurrence of periodontitis [3].

The ABO blood group system is used to denote the presence of one, both, or neither of the A and B antigens on erythrocytes. It 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 [4] (Fig. 1). Anthropologists have used the ABO blood types as a guide to the development of modern humans. Even though human population shares the same blood systems, the distribution pattern of ABO is complex with geographical and racial variation. It is reported that group O is found to be more common in India, being the group B and O are more common in Northern and Southern India, respectively [5, 6]. Further than transfusion and transplantation, ABO blood group system is important as it determines many of the immunological characteristics of the body by acting as receptors for infectious agents and also contributes to forensic medicine, genetics, anthropology and legal medicine [4]. Faser Roberts discussed the relationship between ABO blood group and susceptibility to chronic disease as an example of genetic basis for family predisposition [7]. In India and Western countries, many studies have been conducted to find the relationship between ABO blood group and various systemic diseases. Relationship of 'ABO' blood groups with malignancy has been investigated widely; individuals with blood group 'A' are reported to be more prone to oral cancer [8] and salivary gland tumors [9], while blood group 'AB' are relatively less susceptible. Similarly, individuals with blood group A have been reported to be more prone to gall stones, cholitis and tumors of pancreas as well as ovary [10], while blood group O is associated with risk of coronary artery disease [11, 12], A and O blood groups are associated with the risk of diabetes mellitus [13]. Again, Singh et al. (1995) observed individuals with B and O groups are equally susceptible to malaria, while with AB are less susceptible [14].

Though several studies showed the relationship between ABO blood group and incidence of various diseases in general, very limited studies have been carried out to evaluate the relationship between ABO blood groups and oral diseases. Association of ABO blood group with periodontal disease was first described by Weber and Pastern in 1927 [15]. Koregol *et al*. (2010) observed that blood group A and O formed a significantly higher percentage in gingivitis and periodontitis group, respectively, being the least percentage of periodontal disease in AB group [16]. In contrast, Al Ghamdi (2009) showed that blood group B is at greater risk for developing periodontitis [4], while studies conducted by Barros and Witkop (1963) and Frías and López (1994) did not observe any significant association between blood group and periodontal disease [17, 18]. Kaslick *et al.*, (1971) observed more subjects with blood group B suffered from aggressive periodontitis, while less with blood group O [19]. Considering the findings of these studies, we may speculate an association of blood group with the occurrence of periodontal disease. However, inconsistent findings are attributed to the geographical and racial diversity of the population. Since this kind of study to assess the association of periodontal diseases and ABO blood group has not yet been carried out in the north eastern region of the country, the present piece of work was carried out to evaluate the association between periodontal disease and ABO blood groups.

Materials And Methods

A total number of three hundred ten (n=310, 147 male and 163 female) subjects participated in this study. The subjects considered for the study were from similar socio-economic status, non-smokers and with no history of systemic disease such as diabetes, leukemia, metabolic bone disease or epilepsy and had at least 20 teeth and received no periodontal treatment or antibiotic-related therapy for medical or dental reasons 3 month prior to the study

The subjects were divided into three groups:

• group I (n = 68): subjects with clinically healthy periodontium.

• group II (n = 80): may have probing pocket depth with less than 3 mm of attachment loss (chronic gingivitis) but displayed signs of gingivitis (e.g. gingival bleeding, altered color, contour, position and surface texure of gingiva)

• group III (n = 162): subjects with true pocket and clinical attachment loss of ≥ 4 mm

The clinical parameters considered were probing pocket depth (PPD) and clinical attachment level (CAL). All the subjects were informed about purpose and methods of the study in details and written consent was obtained.

A. Probing pocket depth (PPD):

PPD was measured from gingival margin to the base of the pocket.

B. Clinical Attachment level (CAL):

CAL was measured from a fixed point to the base of the pocket.

PPD and CAL were measured using calibrated UNC-15 periodontal probe. It is a 15 mm long probe with millimeter marking at each millimeter and color coding at 5th, 10th and 15th millimeter. The probe is inserted with a firm, gentle pressure (0.75 N) to the bottom of the pocket. The shank should be aligned with the long axis of the tooth surface to be probed. Each tooth was examined at four sites, namely mid-facial, mesio-facial, disto-facial and at centre of lingual surfaces. In the present study, an occlusal stent was used as a fixed reference point [20]. After placing the stent over the teeth, the distance from the border of the stent to the base of the pocket was measured in mm using UNC -15, keeping the probe on vertical grooves prepared on the occlusal stent as a reference point to avoid clinical variations at different time points of measurement. PPD and CAL of each subject was determined by adding all the individual scores and then dividing this by the total number of surfaces recorded, respectively.

To prepare the occlusal stents, upper and lower casts were made in dental stone from the recorded impressions of upper and lower arch. Occlusal stents were fabricated with cold cure acrylic resin for each patient. It is used to cover the occlusal surfaces of the teeth to be recorded and extended buccally and lingually to cover more than occlusal one third of the crown. Four grooves in relation to a tooth were made in the stent to guide the periodontal probe at the time of recording the pocket depths and clinical attachment levels.

ABO blood grouping was performed in all the subjects using agglutination method with Eryscreen reagent (Tulip Diagnostics (Po) Ltd, Goa, India). Peripheral blood was collected by finger prick method under complete aseptic condition. One drop of antiserum A is placed on one end of the slide, while another drop of antiserum B is on the other end of the slide. Then, a drop of whole blood is placed over each of antiserum A and B and then mix uniformly with a mixing stick. The slide is gently rocked, back and forth. The presence or absence of agglutination is observed under light microscope after two minutes (Fig. 2). Clumping indicates the presence of antigen A and B on the surfaces of RBCs. Presence of clumping with antisera A indicates the presence of antigen A, thereby refers to the blood group A. Similarly, clumping with antisera B indicates the presence of antigen B, and clumping with both antisera A and B indicates the presence of both antigens A and B, that refers to the blood group B and AB, respectively. Again, absence of clumping with both antisera A and B indicates the lack of both antigens in RBCs, thereby refers the blood group O.

Data were analyzed with Chi-Square test, value of 0.05 was considered significant for all statistical test conducted.

Observations And Results

The study was conducted on 310 subjects. Blood groups A, B, AB and O consisted of a total of 23.87% (n = 74), 35.16% (n = 109), 9.67% (n = 30) and 31.29% (n = 97) subjects, respectively, in each group. Blood group B (35.16%) and O (31.29%) were found to be more common and was found to be statistically significant, as shown in Table I.

The frequency distribution of the ABO blood groups in the subjects with healthy periodontium, chronic gingivitis and periodontitis is shown in Table II. It reveals that 40 % of the subjects with healthy periodontium belong to blood group O followed by group A (29%), B (21%) and AB (10%). In group II, 40% of the subjects with chronic gingivitis found to be of blood group B, followed by group O (26%), A (23%) and AB (11%). Again, in group III, 39% of the subjects with chronic periodontitis belong to the blood group B, followed by group O (30%), A (22%) and AB (9%). From the data, a higher frequency of periodontal diseases is seen in the subjects with group B. Again, healthy periodontium was observed in subjects with blood group O. Present findings indicate that subject with blood group AB are at lower risk of developing periodontal diseases (11% and 9% for gingivitis and periodontitis, respectively).

The differences in occurrence of chronic gingivitis in blood group B compared to that of blood group A and AB was found to be statistically highly significant ($p < 0.01$), though the difference in between blood group B and O is not significant statistically. Again, the observation of the occurrence of chronic periodontitis in blood group B compared to that of blood group AB was found to be statistically highly significant ($p < 0.01$), though the differences in between blood group B and O, and again between blood group B and A were not significant statistically.

Discussion

The presence of microorganisms is a crucial factor in inflammatory periodontal diseases, but the progression of disease is related to host-based risk factors. Thus, the paradigm of pathogenesis of periodontitis is shifting and it highlights their multifactorial nature, though the exact etiopathogenesis is not established yet [1, 2].

All human populations share the same blood systems, though they differ in the frequencies of specific types racially and geographically, even in different areas within a small country [5, 20]. On the other hand, racial variation of periodontal disease is well documented [1]. Therefore, the question arises whether distribution of ABO blood subgroup is related to the distribution of periodontal disease. However, not many studies are available on the association of ABO blood group systems and oral diseases, particularly periodontal disease. Few studies showed a positive correlation between ABO blood group types and development of oral diseases [4, 22, 23], while few have observed negative correlation [17, 18]. The present study was conducted to evaluate the relationship between ABO blood subgroups and periodontal diseases in the light of the above data.

In the present study, gingivitis and periodontitis are observed in a relatively higher percentage in individuals with blood group B followed by group O and A. This observation regarding frequency distribution of ABO blood subgroup in association of chronic periodontitis is in support of previous observations and again, contradicts few of them. Our finding supports the observation of Al Ghambi (2009) [4], (Singh *et al.*, 2011) [22] and Gautam *et al.*, (2017) [23] who observed that periodontitis is more likely to be common in individuals with blood group B. However, greater propensity for periodontal diseases in individuals with blood group O was shown by others[16, 24, 25], while in group A and B by Kaslick *et al.*, (1980) [19]

and Pai *et al.*, (2015) [15]. In contrast, few observed no relationship between periodontitis and blood groups [17, 18, 27].

The frequency distribution of ABO blood subgroup in association of chronic gingivitis is varied. Our observation that the subjects with B blood group show greater propensity to develop gingivitis supports the observation of previous studies [22, 26, 27]. Mortazavi *et al.*, (2015) explained the fact that people having blood group B are at 3.9-fold higher risk to develop gingivitis [27]. In contrast, other investigators observed a relatively higher percentage of gingivitis in the subjects with blood group A [16, 23]. Again, a relatively high percentage of moderate/severe gingivitis in blood group B and A [15] and in blood group O reported in the literature [23]. Furthermore, Kaslick et al (1980) [19] in a study of ABO blood groups, Human Leukocyte Antigen (HLA), and periodontal disease in young adults explained that people with gingivitis had a higher proportion of blood group AB and a smaller percentage of type O. In contrast, some authors did not find any relationship between periodontal disease and types of blood groups [17, 18].

The present study has shown the least propensity for periodontal diseases in individuals with blood group AB (11% and 9% for gingivitis and periodontitis, respectively), supporting the findings of Koregol *et al.*, (2010) [16], Singh *et al.*, (2011) [22] and Vivek *et al.*, (2013) [25]. In contrast, Kaslick et al., (1980) observed a higher proportion of gingivitis in blood group AB and a smaller percentage in group O [18]. These differences in findings may be attributed to difference in sample size, study design, races, and geographic localization. More elaborate studies involving different countries and even in various ethnical groups in a country are warranted to shed more light on this area of conflicts and to reach conclusive results. Notably, Pourfathollah (2004) pointed out that frequency of blood group O and B have increased 1.3% during 20 years from 1982 to 2001 among Iranian population [28], which may have an influence on prevalence of blood groups and subsequently, the various disease processes.

It is very difficult to explain the reason of prevalence of healthy gingiva and periodontal diseases in particular blood groups. Possible mechanisms regarding the effects of ABO blood antigens in developing periodontal diseases are shown as follows:

• ABO specificity of different bacteria is well-established and antibody titers to those specificities vary with the host blood type, suggesting that genetic factors may alter oral environment and the process of periodontal disease [3].

• Secretion of the ABO antigens into the saliva probably inhibits the bacteria to attach to teeth surfaces due to presence of surface lectins, which they use to attach to body surface and are often ABO specific [4].

• Antigens of ABO system act as receptors for infectious agents. The various ABO blood groups might show significant differences in the number of colonization of periodontal pathogens, main etiologic agents of periodontal diseases [24].

Conclusion

From the observations made in the present study, we may draw conclusions that subjects with blood group ‘B’ are more susceptible to periodontitis, while with group ‘AB’ are more stable and resistant. Considering the findings of present study, it may be suggested that ABO blood groups could constitute a risk factor on the development of periodontal disease. Since this study proposed group B as a possible non-modifiable risk factor for gingivitis and periodontitis, therefore, people with this blood group should be advocated to consider oral health to reduce controllable risk factors such as dental plaque as a preventive measure. This will make it possible to better-

understand the risk factors of diseases of the periodontal tissues and to predict the effective methods of prevention and treatment of periodontal diseases.

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Table I: Frequency distribution of the ABO blood types in study group

Blood groups	**No**	**%**
A	74	23.87
B	109	35.16
AB	30	9.67
O	97	31.29
Total	310	

Table II: Frequency distribution of the ABO Blood groups in the subjects with healthy periodontium and chronic gingivitis and chronic periodontitis.

Blood groups	Group I		Group II		Group III		Total
	No	%	No	%	No	%	
A	20	29	18	23	36	22	74
B	14	21	32	40	63	39	109
AB	7	10	9	11	14	9	30
O	27	40	21	26	49	30	97
Total	68		80		162		310

Figure 1:

	Group A	Group B	Group AB	Group O
Red blood cell type	A	B	AB	O
Antibodies in Plasma	Anti-B	Anti-A	None	Anti-A and Anti-B
Antigens in Red Blood Cell	A antigen	B antigen	A and B antigens	None

Figure 1: ABO blood group antigens present on red blood cells and IgM antibodies present in the serum

Figure 2:

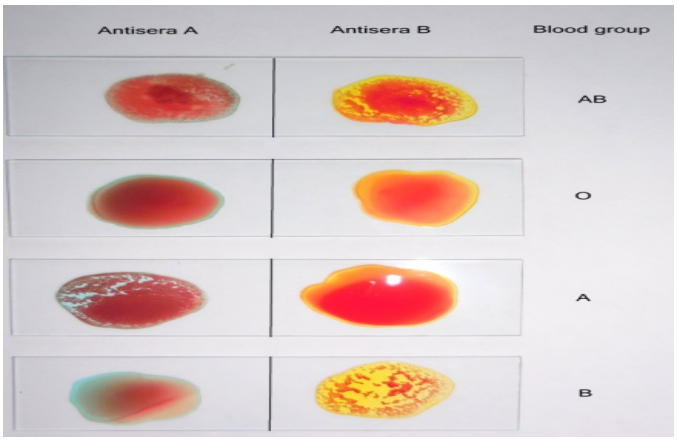

Figure 2: Reaction of whole blood with antiserum A and B. Note the identification of ABO blood group based on the presence or absence of two different antigens, A and B, on the surface of the red blood cell. The four blood types in this grouping, A, B, AB, and O, are determined by and named for these antigens. Type AB indicates the presence of both antigens; type O, the absence of both. Corresponding antibodies, anti-A and anti-B agglutinins, can be found in the plasma of type O blood. The plasma components of type A and type B blood are, respectively, devoid of anti-A and anti-B agglutinins; both agglutinins are absent from type AB blood plasma.

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