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ABO and Rh Blood Group System and Periodontal Disease - A Prevalence Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author VS designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors SG, AK, ZS and KV managed the literature searches and authors VS and SG guided the principle author in structuring the article and author PA managed in collecting and analyzing the data. All authors read and approved the final manuscript.

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ABSTRACT

Background: Varied literature is documented exploring the relationship between ABO blood group and prevalence of oral and dental diseases. The aim of this study was to investigate the correlation of periodontal disease with "ABO" blood groups and Rhesus factor.
Materials and Methods: A total of 684 systemically healthy subjects who were non smokers were selected by chance. Subjects with known blood group who had at least 20 teeth, were included in the study and the blood groups were confirmed from their medical records. Based on the periodontal parameters like clinical attachment loss (CAL) and bleeding on probing (BOP) the subjects were divided into three groups: healthy, gingivitis and periodontitis. The percentage distribution of ABO blood groups and Rhesus factor among the groups was tabulated.
Results: There was an increased prevalence of gingivitis in subjects with blood group 'A' and periodontitis in subjects with blood group 'O', while subjects with blood group 'B' had healthy

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periodontium. There was higher prevalence of gingivitis in Rh positive group.
Conclusion: A significant relationship between blood typing and periodontal disease was determined in this study. Further research into this is indicated.

Keywords: ABO blood group; clinical attachment loss; gingivitis; periodontitis.

1. INTRODUCTION

Periodontitis is a progressive destructive change, leading to loss of bone and periodontal ligament due to extension of inflammation. It is asynchronous and episodic in nature, with tissue destruction resulting from the host response to bacterial antigens and irritants, resulting ultimately to tooth loss in susceptible people. Dental biofilm, also known as plaque is considered as the main etiological factor for initiation and progression of periodontal diseases [1]. The inflammatory response in periodontal disease includes the activation of leucocytes, neutrophils, t-lymphocytes and plasma cells and the release of antibodies, lipopolysaccharides and chemical inflammatory mediators that include cytokines, chemokines and C-reactive protein. Lipopolysaccharides are present in gram-negative bacteria cell walls and act as powerful stimulants for the complex host response. The level of periodontal destruction depends on the balance between destructive and protective inflammatory mediators. Periodontal pathogens all play a role in initiation of periodontal disease but response to pathogens determines the disease progression.

Consequently, it is important to emphasize the significance of the role of genetic factors in the etiology of periodontal disease and to trace any innate factors associated with it. The history of investigations regarding the relation between blood groups, Rhesus (Rh) factor and dental diseases goes back to 1930. At the turn of the 19^{th} century, Landsteiner first described the existence of serologic differences between individuals, allowing him to classify people into one of four groups depending on whether their red cells contained agglutinogen 'A', agglutinogen 'B', neither 'A' nor 'B' (O) or both 'A' and 'B' (AB) [2]. This discovery led to a series of serologic, genetic and immunochemical studies that are continuing even at the present time. The ABO and the Rh are the most commonly used blood group systems for transfusion and organ transplantation. The antigens of the ABO system are an integral part of the red cell membrane, which is also found in plasma and other body fluids. The presence or absence of certain antigens has been associated with various diseases and anomalies, with antigens also acting as receptors for infectious agents [3,4].

The predisposition of specific blood group phenotypes to certain diseases may be attributed to this. For example, gall stones, cholitis [5], tumors of salivary glands [6], pancreas and ovaries [7] are more prevalent in individuals with blood group 'A'. Diabetes mellitus is more prevalent in subjects with blood group 'A' and 'O' [8]. This has contributed to large accumulation of literature with equal amount of controversy.

For the past few decades, research has been focused on systemic conditions and their role in the pathogenesis of periodontitis. Varied literature has been available to assess the relation between ABO blood group and prevalence of oral and dental diseases. Among the literature available few studies support the association whereas others could not find any relation, which could be due to the geographical diversity among the population groups.

Accordingly this research examines data from sufferers of periodontal disease and their corresponding blood types, to find out if there is an association, correlation and/or possible predisposition of A,B,O-blood types and the Rhesus factor to developing gum disease. The cohort used was derived from the Karad population, Maharashtra, India.

2. MATERIALS AND METHODS

Subjects were selected from the outpatient Department of Periodontology at School of Dental Sciences, KIMSDU Karad from Jan 2015 to April 2015. The research protocol was initially submitted to the institutional ethical committee and review board of KIMS deemed university (KIMSDU). The ethical clearance was obtained from KIMSDU before commencing the study. A total of 684 systemically healthy subjects inclusive of both genders, aged between 20 to 55 years were selected by chance. Subjects with known blood group who had at least 20 teeth, excluding the third molars were included in the study and the blood groups were confirmed from their medical records.

Subjects who were unable to perform routine oral hygiene and smokers, alcoholics, any previous history of antibiotic therapy and any periodontal treatment within 6 months prior to examination were excluded from the study. Subjects who were suffering from any systemic diseases or conditions that could aggravate periodontal manifestations were also excluded.

A standardized case proforma consisting of details of each subject such as name, age, gender, past dental history, medical history were recorded. Full mouth periodontal examination excluding the 3rd molars was conducted for all patients. Four sites were examined for each tooth (mesio-buccal, buccal, disto-buccal and palatal). Bleeding on probing (BOP), and clinical attachment loss (CAL) i.e; distance from cemento enamel junction to base of the sulcus was measured using graduated William's periodontal probe. Gingival index by Loe and Silness (1963) was used to assess the gingival status.

Based on the clinical parameters study population was segregated into three groups:

Group I (Healthy): Subjects displayed no attachment loss, and no signs of gingivitis.

Group II (Gingivitis): Subjects displayed no attachment loss, but displayed signs of gingivitis i.e. bleeding on probing, and changes in colour and consistency.

Group III (Periodontitis group): Periodontitis subjects who exhibited clinical attachment loss (CAL) 3 mm in two or more non-adjacent teeth or those who exhibited cal 5 mm in 30.0% of teeth [9].

2.1 Statistical Analysis

The number of subjects in each study groups and the ABO blood groups was tabulated and the percentage distribution was calculated in each study groups. Chi-square analysis was done to know the differences between the frequencies. A P value of < 0.05 was considered significant for the statistical test conducted.

3. RESULTS

Of the total 684 subjects, 372 were males and 312 were females. Mean age in male subjects was 37.2±12.7 years and in females it was 29.01±10.6 years.

There is more predominance of females (71.6%) in healthy group. While males predominated in gingivitis (59.01%) and periodontitis (80%) groups (Table 1).

The predominance of blood group 'B' (29.82%) is more in this geographic location (Karad, Maharashtra, India), followed by blood groups 'O' (29.23%) and 'A' (28.65%), and 'AB' (12.28%). (Table 2).

There was an increased predominance of healthy periodontium in subjects with blood group 'B'. Whereas, there was an increased prevalence of gingivitis in subjects with blood group 'A' and periodontitis showed increased prevalence in subjects with blood group 'O' (Table 3).

There is more predominance of subjects with Rh positive group than those with Rh negative group and the prevalence of gingivitis was higher in Rh positive group (Table 4).

4. DISCUSSION

Though presence of microorganisms is a crucial factor in inflammatory periodontal disease, the progression of disease is also related to host-based risk factors. Periodontal diseases are now acknowledged to be multifactorial nature where genetics also plays an important role [10]. ABO blood group system is the most investigated erythrocyte antigen system, and owing to ease of identifying their phenotypes, they have been implicated as genetic markers in their association studies with various diseases [11]. Studies from the 1950s demonstrated association of blood group 'O' with duodenal ulcer disease, while gastric ulcer and gastric carcinoma are associated with blood group 'A' [12]. The possibilities of prevalence of certain oral diseases like dental caries, denture stomatitis and maxillofacilal deformties in some blood group phenotypes have been investigated earlier [13,14].

There was higher prevalence of gingival and periodontal disease among blood group A and O respectively in our study sample. The findings of this study are similar to previous studies where gingivitis was predominantly seen in subjects with blood group A Rh- positive while periodontitis was predominantly seen in subjects with 'O' Rh-positive [15-18]. Contrary to the findings in this study, periodontitis was predominantly seen in subjects with blood group B Rh-positive [19].

Table 1. Percentage distribution of samples according to gender

Subjects	Healthy		Gingivitis		Periodontitis	
	N(240)	%	N(244)	%	N(200)	%
Males	**68**	**28.3**	**144**	**59.01**	**160**	**80**
Females	172	71.6	100	40.9	40	20

Table 2. Distribution of blood groups among the subjects

Blood group	N	(%)
O	200	29.23
A	196	28.65
B	204	29.82
AB	84	12.28

Table 3. Percentage distribution of ABO blood groups in the study groups

Blood group	Healthy		Gingivitis		Periodontitis	
	240(n)	%	244(n)	%	200(n)	%
O	56	23.3	44	18	100	50
A	68	28.3	88	36.6	40	20
B	84	35	72	29.5	48	24
AB	32	13.3	40	16.39	12	6

The chi-square statistic is 67.1771. The p-value is < 0.001 and is significant

Table 4. Percentage distribution of Rhesus factor in the study groups

Rh factor	Healthy		Gingivitis		Periodontitis	
	240(n)	%	244(n)	%	200(n)	%
Rh positive	224	93	240	98	180	90
Rh negative	16	7	4	2	20	10

The chi-square statistic is 14.4036. The p-value is <0.001 and is significant

In this study, subjects with blood group B showed a higher frequency of healthy periodontium, which are contrary to some earlier studies which reported a higher frequency of blood groups A, B and AB in subjects with healthy periodontium. [19,20].

The distribution of Rh factor in the present study subjects showed a significantly higher percentage of Rh-positive than Rh-negative factor. Periodontal parameters were significantly better in Rh positive group than Rh negative group. Similar findings were reported by several authors who stated that there were no significant differences in periodontal parameters between Rh positive and Rh negative groups [15-18]. They mentioned that there was prevalence of better periodontal health in Rh negative group which is contrary to the findings of our study.

The tissue localization of the histo-blood group antigens has shown that the antigens in the tissues correspond to the erythrocyte blood group. The tissue expression is dependent on the secretor status of the individual, which may be a factor influencing the development of oral manifestations of systemic diseases in the stratified epithelium [21]. The expression of histo-blood group antigens depends on the state of cellular differentiation and maturation, and there is a sequential elongation of the terminal carbohydrate chain during the life span of the cell. Basal cells express short carbohydrate chains like a/b precursors, whereas ‘a’ or ‘b’ antigens may be seen in the spinous cell layer. The expression of blood group antigens is influenced by the variation in the differentiation between keratinized versus nonkeratinized epithelium. Expression of ‘a’ or ‘b’ antigens in keratinized squamous epithelium is only seen in very few and highly differentiated cells, leaving the precursor h antigen expressed on most spinous cells. In contrast, in the nonkeratinized epithelium of the buccal mucosa, the precursor h is expressed only on a few parabasal cells, whereas expression of ‘a’ and ‘b’ antigens is seen in most spinous cells. Expression of the a/b transferases and the availability of a substrate for

the transferase regulate the expression of a/b antigens in oral tissues [15].

Literature suggests the role of fringe genes a cell differentiation protein, regulates epithelial differentiation. These transmembrane proteins initiate elongation of carbohydrate residues attached to notch receptors, and are involved in communication associated with cell differentiation. Sequential expression of carbohydrates is demonstrated during epidermal differentiation particularly in mice. In addition blood group antigen related carbohydrates are found to be expressed in specific structures such as taste buds, tongue papillae and gingival junctional epithelium [17].

Occurrence of gingivitis and periodontitis is the result of many factors and the probable genetic influence demonstrates a small facet of multifactorial etiology of this disease. The genetic factors may alter oral ecology and the process of periodontal diseases. Genetic differences in immune cell development and antigen presentation may contribute to the susceptibility to infectious diseases. The detailed information on the function of gingival epithelium, particularly junctional epithelium, and its interaction with the surface antigens on red blood cells may provide new insights into periodontal diseases. The limitations of the present study are certain confounding factors like the role of female sex harmones and viral co infections have not been considered.

5. CONCLUDING REMARKS

A significant relationship between ABO and Rh blood group system and periodontal disease was determined in this study. Patients with blood group 'A' could be a risk factor for gingivitis and blood group 'O' a risk factor for periodontitis. Similarly Rhesus positive group is considered a risk factor for gingivitis. Further multicenter collaborative studies including diverse population groups to explore the genetic basis are required to confirm and investigate the biological plausibility explaining the association between ABO and Rh blood group system and periodontal disease.

CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this original research and accompanying images.

ETHICAL APPROVAL

The research protocol was initially submitted to the institutional ethical committee and review board of KIMS deemed university (ref no: KIMSDU/IEC/01/2015). The ethical clearance was obtained from KIMSDU before commencing the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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