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Exploring the Relationship Between ABO Blood Groups and Periodontal Health

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Abstract:
Background and Objectives:
Periodontitis is the most prevalent disease affecting large amount of population all over the world. The clinical expression of periodontitis differs according to pathological bacterial composition, host immune mechanism and other local and systemic factors. Genetic predisposition may influence host defense mechanism. ABO blood groups are most consistent genotype in human blood system so we can corelate them with periodontal status of individual to find any relation. The present study was designed to describe if there is any relationship between ABO blood groups and periodontal disease in people.

Material and Methods:
This investigation was carried out on 100 subjects. The subjects had been interviewed on socio-economic background. They were examined clinically for plaque index, gingival index, probing pocket depth and accordingly subjects were categorized into Group 1 (Healthy); Group 2 (Periodontitis). Blood samples were collected to identify ABO blood group.

Results:
The blood group distribution within both the groups was determined to indicate no significant change. From the data we found that higher frequency of periodontal disease is prevalent in blood group O.

Conclusion:
ABO blood groups may constitute as a risk factor in development of periodontal disease.

I. INTRODUCTION

The normal periodontium consists of gingiva, periodontal ligament, cementum and alveolar bone and it provides support to maintain teeth in function. Periodontitis is characterized by rapid tissue destruction including both soft and hard tissues. [1]

Periodontitis is most prevalent disease affecting large amount of population all over the world.[2] Bacterial plaque has been suggested as primary aetiology of periodontal disease. The clinical expression of periodontitis differs according to pathological bacterial composition, host immune mechanism and other local and systemic factors.

Local factors favour plaque accumulation and maturation and systemic factors like diabetes, smoking and others Genetic predisposition may influence the host defence mechanism.[3] So we should consider genetic factors also to co-relate disease status and distribution. ABO blood groups are most consistent genotype in human blood system so we can co-relate these genotypes with periodontal status of individual to find any relation in a particular region.

Although many blood group systems have been identified, the ABO system, first human blood group system, discovered by Landsteiner is most widely used blood group system. The other two important blood group systems are the Rhesus (Rh) and the MN system. ABO and Rh systems are determined by nature of different proteins present on the cell membrane of red blood cells and they have major clinical significance in blood transfusion. ABO blood grouping system is based on the antigens present on the surface of red blood cells that form an integral part of the cell membrane of red blood cells. These antigens are also present in plasma and other body fluids. ABO blood group system and recognition of blood groups by red cell agglutination method became the scientific basis for safely practicing the blood transfusion.[4]

Karl Landsteiner in 1900, first discovered the ABO blood grouping system, and found three different blood groups (A, B and O), depending on the type of antigen present on the surface of red blood cells, type A or type B. These antigens (agglutinogens) are inherited, so a person may have one antigen, may have neither of them or may have both the antigens simultaneously.[5]

Blood group O, A, B or AB is determined by two genes, one on each paired chromosome. These genes can be any one of three types, but only one type on each chromosome: type O, type A or type B. The type O gene is functionless. The six possible combinations of genes are OO, OA, OB, AA, BB or AB. A person with genotype OA or AA produces type A antigens so has blood type A. Genotypes OB or BB give type B blood. Genotype OO produces no antigens and has blood group O and genotype AB give type AB blood.[5]

The other major blood system is Rh (Rhesus) factor system. According to Rh system, if red blood cells present the Rh antigen, then it's Rh+ve or Rh -ve if Rh antigen is absent. ABO and Rh blood group system is determined by nature of different proteins present on the surface of erythrocytes.[5]

Immunohistochemical studies have suggested that A/B antigens are present on spinous cells in the non-keratinized oral epithelium of persons with blood group A and B. Basal cells express precursor structures and spinous cells that are more differentiated express A or B antigens. Antigens act as receptors for infectious agents so the presence or absence of these antigens can be associated with various diseases and anomalies. Blood group O persons express a fucosylated variant (Ley) of the precursor structure and they do not have A or B gene coded glycosyltransferase.[9]

Blood type secretor genes are present on chromosomes no. 11 and 19. A person's secretor gene is independent of his blood type. Most of the people (80-85%) have blood type antigens that float freely in their body fluids like saliva, mucus and semen. Non-secretors are those who do not secrete blood type antigens in other fluids except blood.[6]

It has been assessed that less than 20% of variability in severity of periodontal disease can be justified by quantity of specific bacteria in disease associated plaque. Apart from that genetic factors play an important role in severity and distribution of periodontal lesions in individuals.[7]

The characteristic features of chronic periodontitis are plaque accumulation, inflammation of periodontium and loss of periodontal attachment and loss of alveolar bone. Periodontitis can be localised (involving less than 30% of teeth) or generalised (involving more than 30% of teeth) and depending upon the severity of periodontal disease it can be mild, moderate or severe.[8]

Despite the fact the four types of phenotypes of the ABO blood group system can be found in human populations, the frequency of each type of blood group varies remarkably among human population based on their geographical locations. Variations do occur in different parts of the world. It was evaluated that in Africa, Australia and among native Americans, the percentage of individuals having blood group O exceeds 60%. In Europe, blood group A is most common with 40-60%, and blood group type B is least prevalent with 8-12%. Variations in frequency of blood grouping may also occur in different areas if a country. Some studies have suggested that blood group B was more prevalent in Northern India, whereas blood group O more common in South India.[3]

In different parts of the world, many studies have been conducted to analyse the possible association of ABO blood grouping with various systemic diseases. According to some studies, diabetes mellitus has been found to be more prevalent in individuals with blood groups A and O. Few studies have concluded that individuals with blood group A have been found to be more vulnerable to colitis, gall stones, tumours of salivary glands, tumours of pancreas and ovary as well as oral cancer. Few other studies have also reported association of non-a blood groups with high risk of ischemic heart disease and also of developing severe symptoms of atherosclerosis.[3]

Several studies have been carried out to find out any possible relationship between ABO blood grouping and occurrence of periodontal disease. But results of these studies showed a lot of variance.[8] Few studies have showed that individuals with blood group B have been found to be more prone to developing more severe form of chronic periodontitis. Few other studies stated that gingivitis was more common in individuals with blood group A and periodontitis was more prevalent in blood group O.[10] Few studies have stated association between juvenile and non-juvenile periodontitis and haemoglobin type A.[11]

Knowledge of ABO blood group type of patients and their relationship with status of periodontal disease is of utmost importance in the development of treatment strategies and disease prevention. So, this study was conducted to find the relationship of ABO blood grouping with periodontal status and to determine whether they can be the risk factors for periodontal disease.

II. MATERIALS & METHODS

The present study was a single centre clinical observational study conducted at the Department of Periodontology and Oral Implantology, Baba Jaswant Singh Dental College and Hospital, Ludhiana, Punjab. Before initiating the study each participant who satisfied the inclusion and exclusion criteria were informed about the study protocol. A thorough medical and dental history was taken and a written consent was obtained from all participants before clinical periodontal examination and blood sampling. Ethical clearance was obtained from the institutional Ethical review committee.

The present study consisted of 100 participants divided into two groups, Periodontally Healthy Patients (50 patients) and Chronic Periodontitis Patients (50 patients). Complete oral examination was carried out using mouth mirror and UNC-15 periodontal probe. Four sites were examined for each tooth (mesio-buccal, buccal, disto-buccal and palatal/lingual).Probing Pocket Depth and Clinical Attachment Loss (CAL) was measured using UNC-15 periodontal probe.

Patients who met the following inclusion criteria were selected for the study –

- Patient's age ranging from 20 years to 40 years.
- Subjects had at least 20 teeth and had received no periodontal treatment in last 3 months.
- Similar socio-economic status.
- Healthy group had patients that displayed less than 3 mm probing depths, no radiographic bone loss.
- Periodontitis group showed periodontal pocket depths more than 4 mm (generalized), radiographic bone loss.

The Exclusion criteria were –

- History of systemic diseases, pregnancy.
- Smokers.
- With previous history of antibiotic therapy.

Investigations

Blood Samples were collected using sterile disposable lancet and finger prick method. The blood grouping was done using slide agglutination method (visual method).

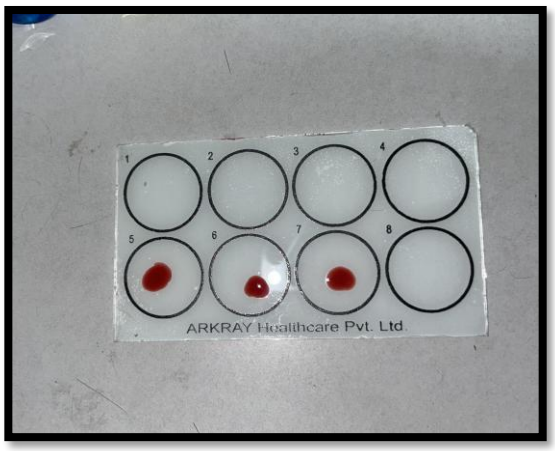
Statistical Analysis – Statistical Analysis was performed using 23.0 version of Statistical Package for Social Sciences (SPSS). The two proportion Z test was used to determine statistically significant differences between the study groups.

III. Results

The current study was undertaken on 100 subjects. Table 1 shows frequency of diseased cases (periodontitis) is highest i.e. 34% in O blood group followed by 20% in AB blood group and lease number of subjects with periodontitis in A blood group.

Group-I Patients; PPD < 3mm

Group-II Patients; PPD > 3mm



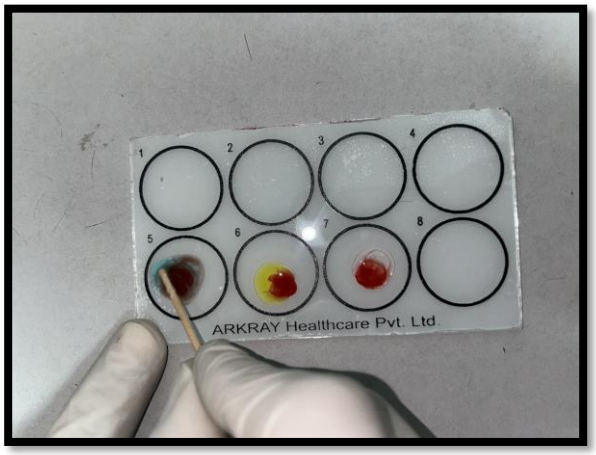
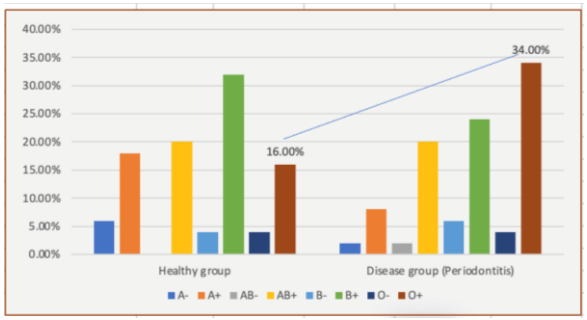


Table: Proportion of study subjects on the basis of blood group among healthy and disease group

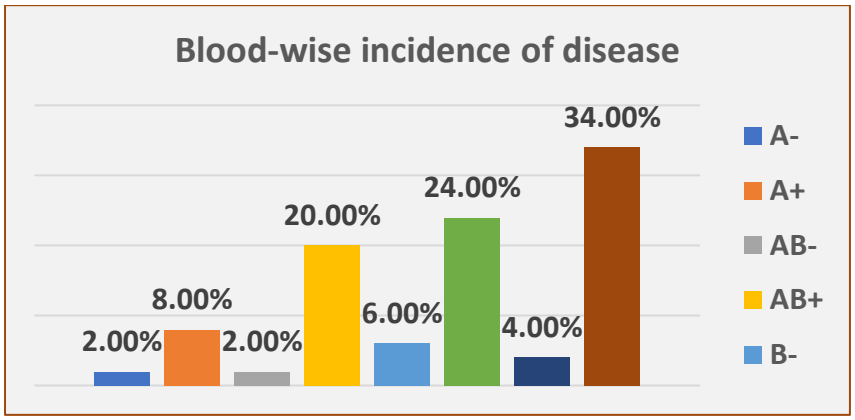
Blood group	Healthy group		Disease group (Periodontitis)		Z-score	Sigificance
	n	%	n	%		
A-	3	6.00	1	2.00	1.021	NS
A+	9	18.00	4	8.00	1.487	NS
AB-	0	0.00	1	2.00	1.005	NS
AB+	10	20.00	10	20.00	0.000	NS
B-	2	4.00	3	6.00	0.459	NS
B+	16	32.00	12	24.00	0.891	NS
O-	2	4.00	2	4.00	0.000	NS
O+	8	16.00	17	34.00	2.078	S
Total	50	100.00	50	100.00		

Test applied: Z-test (two proportion)
The Z-value ≥1.96 is signficant at 5 % level of probability
S Stands for signficant

Interpretation: The percent distribution of study subjects on the basis of blood groups has been compared between healthy and disease group. The percent share of study subjects with O+ differ signficantly between healthy and disease group. Out of total 50 subjects, 34 % has been reported in disease group as compared to 16 % in healthy group, respectively.



Blood group	Disease group (Periodontitis)		P-value
	n	%	<0.0001
A-	1	2.00	
A+	4	8.00	
AB-	1	2.00	
AB+	10	20.00	
B-	3	6.00	
B+	12	24.00	
O-	2	4.00	
O+	17	34.00	
Test applied: Chi-square			



IV. Discussion

Periodontal Diseases including gingivitis and periodontitis, are serious infections that if left untreated, may lead to loss of teeth. The principal cause of periodontal diseases is bacterial plaque. However, with the increase in understanding of the etiology of periodontitis, it is concluded that periodontal diseases are multifactorial. With advances in research, it was understood that apart from the common etiological agents and environmental factors, certain unknown factors did play a role in the development of periodontal disease. Thus, the focus of determining the disease susceptibility changed to genetics.[13]

Periodontal disease is the most common disease affecting mankind. The various risk factors for the periodontal disease have been identified and preventive strategies aimed at reducing the disease. Very few studies have tried to elucidate the association between blood group. The identification of this particular association may open new arenas in the prevention of periodontal disease.[13]

Various studies have concluded that there is variation in the distribution of ABO blood group antigens, secretor status and susceptibility to infectious agents among population belonging to different regions and races. Several studies have been conducted in various parts of India to find any relationship between ABO blood groups and periodontal diseases. In the present study, the correlation between ABO blood group and severity of periodontal disease has been investigated in this particular region of Ludhiana, India.

In dentistry, Weber and Pastern were the first to study the association of various ABO blood groups with periodontal diseases.[14] In the present study, 100 subjects were taken randomly, divided in two groups of 50 each, patients with normal periodontium and patients of chronic periodontitis. The present study showed greater propensity of periodontal disease among individuals with blood group O, while the propensity was least among AB blood group individuals. The results of the study are in accordance with the study conducted by Arati et al[9] on 1220 subjects and reported that Blood group A showed a significantly higher percentage in the gingivitis group and blood group O showed a higher percentage in the periodontitis group. Whereas the blood group AB showed the least percentage of periodontal diseases.[9]

However, In results of the study by Aravind T et al, it was determined that there was a relatively higher percentage of B blood group in patients with gingivitis and periodontitis and higher percentage of O blood group in patients with healthy periodontium.[17]

In other study Kaslick et al (1971)[12] reported that aggressive periodontitis is associated more in blood group-B, but significantly less with blood group-O. Similarly, Kaslick et al (1980) found that periodontitis patients were more likely to have A or B blood groups.[12]

Ali S T[10] found significant relationships 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.[10]

Demir et al[4], Vivek S et al[13] and Koregol et al[9] conducted a similar study that concluded that individuals with blood group O and Rh +ve had a superior predisposition for periodontitis. While Aravind et al[17] stated that there was a relatively increased percentage of the B blood group in subjects with gingivitis and periodontitis while the subjects of O blood group had higher percentage healthy periodontium. Pradhan et al stated that there is no correlation between ABO blood group and periodontal disease.[15]

The tissue localization of the histological blood group antigens has shown that the antigens in the tissues correspond to the erythrocyte blood group, but the tissue expression is dependent on the secretor status of the individual. Secretor status is secretion of blood group antigens ABO (H) which may be a factor influencing the development of systemic oral diseases in the stratified epithelium. The expression of 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 that are A/B precursors, whereas A or B antigens may be seen in the spinous cell layer. Variation in the differentiation patterns

between keratinized versus nonkeratinized epithelium influences the expression of blood group antigens. Keratinized squamous epithelium may express A or B antigens in only a few and highly differentiated cells leaving the precursor H antigen expressed on most spinous cell layer cells. In contrast, in the nonkeratinized epithelium of the buccal mucosa, the precursor structure H is expressed only on a few parabasal cells, whereas expression of A and B antigens is seen in most spinous cells. The expression of A/B antigens in oral tissues is, thus, regulated by the expression of the A/B transferases and the availability of a substrate for the transferase.[16]

It is difficult to propose a specific reason, why patients with particular blood group are found in increased frequency in Healthy and Chronic periodontitis particularly. Possible mechanisms regarding the effects of ABO blood group antigens in developing risk of periodontal disease are

• Antigens of the ABO blood group system, also act as receptors for infectious agents.
• Secretion of ABO antigens into the saliva i.e., Secretor status probably inhibits the ability of bacteria to attach to teeth surfaces i.e., bacterial aggregation and thus biofilm formation. This is because many of these bacteria have surface lectins, which they use to attach to body surface and are often ABO specific.[10]

The ABO specificity of different bacteria is well established and antibody titres to those specificities vary with the host blood type. Specific antibody secretion would be expected to be low or undetectable to antigens recognized as "self" and perhaps, more importantly, high to antigens recognized as "non- self".

This study indicates some probable corelation between blood group genotype and periodontal health. This study indicates that further studies with larger sample size and different geographical regions should be conducted. Also, studies at molecular levels should be considered to find more accurate reasons.

V. Conclusion

Consequently, significant relations were determined between ABO blood types and periodontal condition. Considering the results of our study, it can be concluded that ABO blood groups could constitute a risk factor on the development of periodontal disease. However, long term studies with increased sample size are required for assessment of effects of ABO groups on periodontal disease.

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