

## Correlation of ABO Blood Group Phenotype and Rhesus Factor with Periodontal Disease: An Observational Study

### Abstract

**Background:** The knowledge of the ABO blood group phenotype of the patients and their correlation with the periodontal disease maybe important in the development of early treatment strategies, and it would be helpful to target non-responding areas to periodontal therapy of the susceptible individuals. **Aims:** The present study was conducted to determine whether there was any correlation between periodontal diseases and ABO blood groups and Rh factor. **Material and Method:** This study was carried out on 537 subjects attending Faculty of Dental Sciences OPD in BHU. Subjects were divided into three groups: group I (healthy subjects), group II (subjects with gingivitis), and group III (subjects with periodontitis) based on periodontal examination (Gingival index, Bleeding Index, Probing pocket depth and clinical attachment level). ABO Blood grouping were done and correlated with the periodontal status of study subjects. Statistical Analysis: Data was analyzed using the statistical software namely Statistical Package for the Social Sciences (SPSS, Version 16, IBM Analytics) and Systat 8.0. **Results:** In this study, there was a greater prevalence of gingivitis in blood group O and periodontitis in blood group B. The blood group AB showed the least prevalence of periodontal diseases. Similarly gingivitis and periodontitis were significantly higher among Rhesus positive groups when compared with Rhesus negative groups. **Conclusion:** Considering the results of this study, it can be concluded that ABO blood groups and Rh factor could be a risk factor for the development of periodontal disease.

**Keywords:** Blood group, gingivitis, periodontitis, rhesus factor

### Introduction

Periodontal disease comprises a heterogeneous group of infectious diseases caused by the interaction of plaque bacteria and the host. This interaction results in destruction of the supporting alveolar bone and connective tissue. It is known that the periodontal disease can vary with respect to bacterial etiology, host response, and clinical disease progression. Disease onset and progression reflect the balance between homeostasis and destruction of the periodontal tissues.<sup>[1]</sup>

Although bacterial plaque has been implicated as the primary etiology of periodontal disease, there are several local and systemic factors which may modify both microbial and host components. Local factors may favor plaque accumulation and maturation while systemic factors such as diabetes, smoking, and genetic predisposition may modulate and decrease the host protective response. The extent and severity of periodontal disease is

predicted to be controlled by the quality and quantity of the host response that is modulated by systemic disease<sup>[2]</sup> and genetic predisposition.<sup>[3]</sup> It is interesting to emphasize the role of genetic factors in patients with periodontal disease and to find whether any innate factor is also associated with it. However, if any relationship between blood groups and periodontal disease can be established, it can be concluded that the presence of particular blood group antigen has somehow increased the susceptibility to the disease.

Several blood grouping systems have been identified so far, the most commonly used blood grouping system is ABO system that is discovered by Landsteiner and Weiner.<sup>[4]</sup> The other important blood grouping systems are the Rhesus (Rh) and the MN system. ABO and Rh systems have major clinical significance and determined by the nature of different proteins present on the surface of red blood cells. Landsteiner described the existence of serologic differences between individuals, and classify people into four

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DOI: 10.4103/ccd.ccd\_307\_17

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**How to cite this article:** Gautam A, Mittal N, Singh TB, Srivastava R, Verma PK. Correlation of ABO blood group phenotype and rhesus factor with periodontal disease: An observational study. *Contemp Clin Dent* 2017;8:253-8.

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groups depending on whether their red cells contained agglutinin A, agglutinin B, neither A nor B (O), or both A and B (AB).

The distribution patterns of ABO and Rh systems are complex around the world. However, variations may occur in different areas within one country. It was reported that blood Group O was found to be more common in India although studies have reported that blood Group O was more prevalent in South India while blood Group B was common in Northern India.<sup>[5,6]</sup> When the rate of Rh positive is considered, it was reported to be about 94.61% in Indian population.<sup>[7]</sup>

Roberts<sup>[8]</sup> discussed the relationship between ABO blood group and susceptibility to chronic disease as an example of genetic basis for family predisposition. In India and Western countries, many studies have been conducted to find the relationship between ABO blood group and various systemic diseases. In some studies, blood Group A individuals have been reported to be more prone to gall stones, colitis,<sup>[9]</sup> oral cancer<sup>[10]</sup> tumors of salivary glands,<sup>[11]</sup> and tumors of the pancreas as well as ovary.<sup>[12]</sup> Diabetes mellitus may be highly prevalent in participants of blood Groups A and O.<sup>[13]</sup> Reports of the studies have suggested that non-O blood groups are associated with the risk of ischemic heart disease and of developing severe manifestations of atherosclerosis.<sup>[14,15]</sup> Results from Farmingham study<sup>[16]</sup> and several other studies indicated that the incidence of ischemic heart disease might be higher in participants of blood Group A.

Several studies have been conducted in the field of medicine. Surprisingly, limited number of studies has been conducted to determine the association of ABO blood group with periodontal diseases.<sup>[17-27]</sup> Some researchers claimed that there was relationship between ABO blood group and periodontal diseases, whereas others could not find any, which could be attributed to the geographic diversity in the population groups. The studies by Koregol *et al.*<sup>[18]</sup> and Demir *et al.*<sup>[19]</sup> showed that gingivitis was more common in blood Group A and periodontitis was more common in blood Group O, while another study by Al Ghamdi<sup>[20]</sup> showed that blood Group B was found to be at greater risk for periodontitis. In a study carried out by Arowajolu *et al.*,<sup>[21]</sup> it was stated that there was a relationship between juvenile and nonjuvenile periodontitis and hemoglobin Type A. Knowledge of the ABO blood groups of patients and their association with the severity of periodontal disease may be important in the development of early treatment strategies and prevention of the disease.

## Materials and Methods

The participants for the study were selected from patients reporting to the Outpatient Department of Periodontics, Faculty of Dental Sciences, Banaras Hindu

University (BHU), Varanasi, for dental health reasons. The study comprised 537 participants, inclusive of both sexes, aged between 20 and 55 years, selected on a random basis. The purpose of the study and methodology were explained to the participant. Only those participants who give consent for the study were included after obtaining an informed consent.

The participants having at least 20 teeth excluding the third molars were included in the study while participants who were unable to perform routine oral hygiene, alcoholics, smokers, pregnant female, those with previous history of antibiotic therapy within the past 6 months, those who have received periodontal treatment within 6 months before examination, participants suffering from any systemic diseases, and participants with those conditions which could aggravate periodontal manifestations were excluded from the study.

The clinical and periodontal examination was carried out after the participant had been interviewed. Participants were divided into three groups: group I (healthy participant), Group II (patients with gingivitis), and Group III (patients with periodontitis) based on periodontal examination. Periodontal examination consists of gingival index, bleeding index, probing pocket depth, and clinical attachment level. Healthy participants displayed periodontal pocket depth <3 mm, attachment loss <3 mm, and no clinical sign of gingivitis. The gingivitis patients displayed periodontal pocket depth <3 mm, attachment loss <3 mm, but displayed signs of gingivitis (gingival bleeding, red color gingiva, gingival contour, position, and loss of stippling). Periodontitis patients exhibited at least one site with periodontal pocket depth more than 4 mm and attachment loss more than 3 mm.

- Group I: Consisted of 222 patients with healthy periodontium
- Group II: Consisted of 134 patients with gingivitis
- Group III: Consisted of 181 patients with periodontitis.

Group I consisted of the participants selected randomly from patients who reported our faculty with reasons other than periodontal diseases such as orthodontic reasons, teeth extraction, prosthodontic reasons, and dental caries.

During the investigation, all the participants were referred to blood bank for determination of blood group and Rh factor.

## Statistical analysis

Data were analyzed using the statistical software, namely, Statistical Package for the Social Sciences (SPSS, Version 16, IBM Analytics) and Systat 8.0. Microsoft word and Excel have been used to generate graphs and tables.

Chi-square tests have been used to test the significance of the prevalence of blood groups. The odds ratio has been used to find the strength of relationship between prevalence.

## Results

During the investigation, 537 patients attending the Outpatient Clinic of Faculty of Dental Sciences, Institute of Medical Sciences, BHU, for a period of 6 months were examined for the prevalence of blood group and to find if any association exists between the occurrence of periodontitis and specific blood groups.

Table 1 shows frequency distribution of the ABO blood groups in 537 participants and prevalence of blood group and Rh factor. Blood Groups A, B, AB, and O consisted of a total of 132 (24.58%), 168 (31.29%), 60 (11.17%), and 177 (32.96%) participants, respectively, in each group [Figure 1]. Blood Group O (32.96%) and blood Group B (31.29%) were more common and the result was statistically significant [Table 1]. It is evident from the table that 498 (92.74%) participants were Rh positive and 39 (7.26%) participants were Rh negative.

The population of this study consisted of 537 participants, out of which 222 (41.34%) were healthy, 134 (24.95%) were gingivitis, and 181 (33.71%) were periodontitis patients [Table 2].

Table 2 shows frequency distribution of the ABO blood groups in patients with respect to periodontal status. It can be seen from the table that there is a relatively high percentage of blood Group O (36.57%) and A (30.60%) patients in gingivitis and relatively high percentage of blood Group B (39.78%) and O (33.15%) patients with periodontitis [Figure 2]. There was a statistically significant association between blood group and the periodontal status of the study participants.

Table 3 shows the difference in the prevalence of Rh factor among those study participants who had a healthy periodontium. It is evident from the table that 93.24% of the study participants who had a healthy periodontium were Rh positive against 6.76% who were Rh negative and this was statistically significant.

The difference in the Rh factor in those study participants diagnosed as having gingivitis and periodontitis is given in Tables 4 and 5, respectively. Of the total 134 patients who had gingivitis, 126 (94.03%) participants were Rh positive

**Table 1: Frequency distribution of blood group and rhesus factor in study population**

	n (%)	$\chi^2$ , df	P
Blood group			
A	132 (24.58)	38.04, 3	<0.001
B	168 (31.29)		
AB	60 (11.17)		
O	177 (32.96)		
Rh factor			
Rh positive	498 (92.74)	27.32	<0.001
Rh negative	39 (7.26)		

Rh: Rhesus

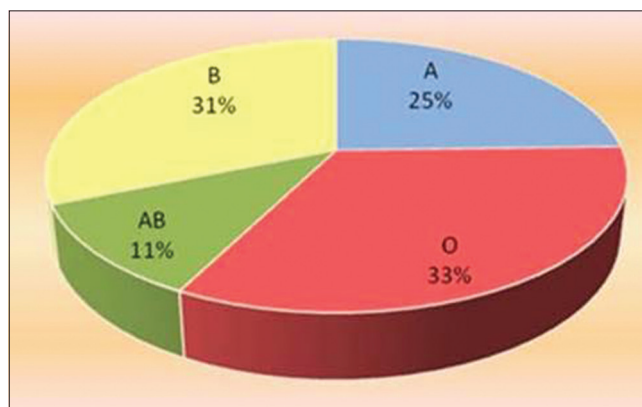


Figure 1: Distribution of blood group in study population

**Table 2: Frequency distribution of blood group in healthy, gingivitis, and patients with periodontitis**

Blood group	Periodontal status			$\chi^2$ , df	P
	Healthy (%)	Gingivitis (%)	Periodontitis (%)		
A	58 (26.13)	41 (30.60)	33 (18.23)	16.56, 6	0.011
B	64 (28.83)	32 (23.88)	72 (39.78)		
AB	32 (14.41)	12 (8.96)	16 (8.84)		
O	68 (30.63)	49 (36.57)	60 (33.15)		
Total	222 (41.34)	134 (24.95)	181 (33.71)		
P	<0.05	<0.01	<0.001		

**Table 3: Frequency of rhesus factor in participants with healthy periodontium**

Blood group	Periodontal status		Rh factor		$\chi^2$ , df	P
	Healthy (%)		Rh positive (%)	Rh negative (%)		
A	58 (26.13)		54 (26.09)	4 (26.67)	1.45, 3	0.69
B	64 (28.83)		58 (28.02)	6 (40)		
AB	32 (14.41)		31 (14.98)	1 (6.67)		
O	68 (30.63)		64 (30.92)	4 (26.67)		
Total	222 (41.34)		207 (93.24)	15 (6.76)		

Rh: Rhesus

**Table 4: Frequency of rhesus factor in patients with gingivitis**

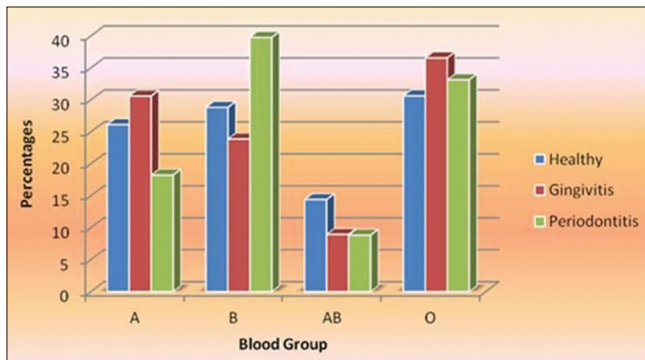
Blood group	Periodontal status	Rh factor		$\chi^2$ , df	P
	Gingivitis (%)	Rh positive (%)	Rh negative (%)		
A	41 (30.60)	38 (30.16)	3 (37.50)	3.75, 3	0.34
B	32 (23.88)	31 (24.60)	1 (12.50)		
AB	12 (8.96)	10 (7.94)	2 (25)		
O	49 (36.57)	47 (37.30)	2 (25)		
Total	134	126 (94.03)	8 (5.97)		

Rh: Rhesus

**Table 5: Frequency of rhesus factor in participants with periodontitis**

Blood group	Periodontal status	Rh factor		$\chi^2$ , df	P
	Periodontitis (%)	Rh positive (%)	Rh negative (%)		
A	33 (18.23)	32 (19.39)	1 (6.25)	6.61, 3	0.005
B	72 (39.78)	66 (40)	6 (37.50)		
AB	16 (8.84)	12 (7.27)	4 (25)		
O	60 (33.15)	55 (33.33)	5 (31.25)		
Total	181 (100)	165 (91.16)	16 (8.84)		

Rh: Rhesus

**Figure 2: Percentage distribution of blood group in healthy, gingivitis, and patients with periodontitis**

and 8 (5.97%) participants were Rh negative. It is evident that out of 181 periodontitis patients, 91.16% were Rh positive and 8.84% were Rh negative.

## Discussion

Periodontal diseases, including gingivitis and periodontitis, are infections that, if left untreated, can lead to tooth mobility and further tooth loss.<sup>[28-31]</sup> The presence of microorganisms of dental plaque is a crucial factor for inflammatory periodontal disease, but the progression of disease is modified by host-based risk factors such as sex, age, education, oral habits, smoking, socioeconomic status, presence of any systemic disease, and genetics.<sup>[32]</sup> Genetic variations may act as risk or protective factors for certain conditions, including periodontitis. The genetic factors alter the oral ecology and the process of periodontal disease.<sup>[3]</sup> That may suggest a correlation between periodontal diseases and some innate factor like blood groups, which may act as risk factor for progression of periodontal diseases. Very few studies have been conducted

to elucidate the association between blood group, Rh factor, and periodontal disease in the Indian population. The identification of such association may open new arenas in the prevention of periodontal disease. The present study has focused on the relationship between periodontal disease and blood group.

The relationship of some blood group phenotypes to certain oral diseases has been investigated earlier. It has been suggested that particular blood group and a tendency toward caries might be constitutional characters that were not related to race although the blood Group O and good teeth were less common in civilized people than in primitive races.<sup>[17]</sup> In some studies, there are high percentage of blood Group O and low percentage of blood Group A in caries immune group.<sup>[33,34]</sup> In a study, individuals of blood Group O were found to be more susceptible to denture stomatitis.<sup>[35]</sup> A study by Gheisari *et al.* shows that maxillofacial deformities were greater with blood Group B and were least with blood Group A, suggestive of ABO blood groups as one of the etiologic factors for these deformities.<sup>[36]</sup>

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. In Western parts of India like in Ahmedabad by Patel *et al.*,<sup>[37]</sup> studies done in Surat by Mehta and Swadas<sup>[38]</sup> and Giri *et al.* in Maharashtra<sup>[39]</sup> showed blood Group B is the most common followed by O, A, and AB which is in contrast with this study. In this study, 177 (32.96%) of patients were of Group O, 132 (24.58%) were of Group A, 168 (31.29%) were of Group B, and only 60 (11.17%) were of Group AB. In the present study, blood Group O is the most predominant, followed by Group B and Group A, which is in agreement with studies by Das *et al.*<sup>[5]</sup> in South Indian population, and also, the finding regarding



Rh negativity was almost similar to that from this study. However, this study is in contrast with the study done by Demir *et al.* in which A blood group (48.5%) and O blood group (30.3%) were more common.<sup>[19]</sup>

In the present study, it was found that 498 (92.74%) of the study population were Rh positive and only 39 (7.26%) were Rh negative. A significant association of periodontitis with Rh factor was seen with more individuals being Rh positive as compared with Rh negative. This is in contrast to a study done by Demir *et al.*<sup>[23]</sup> 2009 which showed that no significant difference was found regarding the distribution of Rh factor. The results of this are similar to study done by Agrawal *et al.*<sup>[7]</sup>

In the present study, it was determined that there was a relatively higher percentage of blood Group O in patients with gingivitis and a relatively higher percentage of blood Group B in patients with periodontitis. This is similar to a study done by Arowojolu.<sup>[21]</sup> This is in contrast to study by Kaslick *et al.*<sup>[25]</sup> in which gingivitis patients having a larger percentage of AB types and a smaller percentage of O Types, and the periodontosis group showed a trend toward more A and B blood groups and a smaller percentage of O groups than the controls. However, a study by Pai *et al.* found that periodontitis patients were more likely to have blood Groups B and A.<sup>[22]</sup> In a study by Demir *et al.*, a relatively higher percentage of A group patients was found in gingivitis group and relatively higher percentage of O group patients was found in periodontitis group.<sup>[19]</sup>

In this study and various other studies that reported on ABO blood group and periodontal disease correlation, a difference is found in the percentage and frequency distribution of A, B, AB, and O blood group in different periodontal status. It is difficult to explain a hypothesis on why participants with particular blood group are found in increased frequency in healthy, gingivitis, and periodontitis groups. However, periodontal disease is caused by multiple factors, and the genetic influence demonstrates a small facet of multifactorial etiology of the disease. Since most of these studies are carried out on a small sample size, it will be too early to conclude the definite association between the two entities, until universal figures are made available.

## Conclusion

In this study, there was a greater prevalence of gingivitis in blood Group O and periodontitis in blood Group B. The blood Group AB showed the least prevalence of periodontal diseases. Considering the results of our study, it can be concluded that ABO blood subgroups and Rh factor could constitute a risk factor on the development of periodontal disease. Further, long-term studies with larger sample size are needed to confirm this correlation and investigate the biological plausibility to explain this association.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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