

## Association of ABO Blood Groups with Occlusal Pattern among Orthodontic Patients of Kathmandu District

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**Received:** October 15, 2018; **Published:** November 12, 2018

### Abstract

**Background:** The malocclusion and blood groups both are related to genetic components, hence it can be hypothesized that blood groups have an association with malocclusions. Some studies showed the relationship whereas others could not find any relationship that may be due to geographic diversity of the population.

**Objective:** The aim of this study was to find out the relationship between ABO blood groups and occlusal pattern among orthodontic patients of Kathmandu district.

**Materials and Methods:** In this cross sectional study, a total of 385 participants (age range from 13 - 45 years) were selected among the orthodontic patients who came for orthodontic treatment in private orthodontic clinics. After obtaining written consent, occlusal relationship were assessed and malocclusions were classified into three groups according to Angle's classification. Blood group of all the participants was recorded.

**Results:** The study found that among the total of 385 participants, 162 (42.07%) were male while 223 (57.93%) were female and the mean age was  $16.31 \pm 4.38$  years. Class I malocclusion was the most common type of malocclusion (85.72%) followed by Class II malocclusion (12.20%) while Class III malocclusion (2.08%) was the least among the orthodontic patients. The prevalence of blood group O patients was highest (32.20%) followed by blood group B (30.64%), blood group A (29.88%) and blood group AB (7.28%). Statistical analysis with Chi-square test showed that association of blood groups with various types of malocclusion was statistically non-significant ( $P > 0.005$ ).

**Conclusion:** The evaluation of the relationship between blood group and malocclusions revealed that blood groups have no association with various types of malocclusions. This suggest, there was no genetic influence of ABO blood group on malocclusion. Hence, the type of malocclusion cannot be predicted in the respective blood group.

**Keywords:** ABO Blood Groups; Malocclusion; Association; Orthodontic Patients

### Introduction

Malocclusion has been shown to affect oral health, increased prevalence of dental caries and can cause temporomandibular joint disorders. The etiology of malocclusions is multi-factorial and is not attributed to a single specific cause. Etiology include general factors like genetic and hereditary components, abnormal pressure habits and nutritional deficiencies while local factors like tooth

decay, supernumerary teeth and premature loss of primary teeth. Among these etiologies, genetics plays a significant role in causing malocclusions.

The relative role of genetic and environmental factors in the etiology has been a matter of discussion and controversy in orthodontics [1].

Studies can reveal relationships between malocclusions and some genetic characteristics or accompanied diseases, that help to recognize and treat them. Relationship between the ABO blood group system and some oral diseases such as malocclusions is one of the important genetic characteristics. With the discovery of ABO blood groups and some enzyme polymorphs, it could be possible to determine the zygosity of twins, which are especially helpful in twin studies concerning the role of heritability of malocclusion [1,2].

The ABO blood group system is the first and the most important system defined in 1901 by Karl Landsteiner [3] (who received a Nobel Prize in 1930 and together with Weiner; he discovered Rh system in 1940). Landsteiner first described the existence of serologic differences between individuals and classify people into four groups depending on whether their red cells contained agglutinin or not. The presence or absence of these antigens results in the four blood groups: A, B, AB, and O which are present on the 9th chromosome and inherited co-dominantly [4].

The malocclusion and blood groups both are related to genetic components, hence it can be hypothesized that blood groups have an association with malocclusions. Results of the various studies showed that some diseases like dental caries [5], salivary gland tumors [6], chicken pox [7], malaria [8], oral cancer [9], hematological malignancies [10], ischemic heart disease [11], cholera [12] etc. were found to have significant association with blood groups.

Weber and Pastern [13] first studied the association of ABO blood group with periodontal disease. Kaslick, *et al.* [14] study showed significantly less aggressive periodontitis patients with blood group O and more patients with blood group B. Study of Roberts [15], describe the relationship between ABO blood group and susceptibility to chronic disease as family predisposition on genetic basis. Koregol, *et al.* [16] study concluded that blood group A showed a significantly higher percentage in the gingivitis group, blood group O showed a higher percentage in the periodontitis group and blood group AB showed the least percentage of periodontal diseases.

Only few studies have been conducted to determine the relationship between ABO blood group and the oral and dental diseases. Some studies showed the relationship whereas others could not find any relationship that may be due to geographic diversity of the population. Due to the lack of information on the relationship of blood groups with occlusal pattern of Nepalese orthodontic patients, this study was conducted to fill this lacuna and hoped that these findings will be beneficial for future research.

### Aim of the Study

The aim of this study was to find out the relationship between ABO blood groups and occlusal pattern among orthodontic patients of Kathmandu district.

### Materials and Methods

Three hundred eighty five participants (age range from 13 - 45 years) were selected among the orthodontic patients who came for orthodontic treatment treated by same orthodontist (author) in private orthodontics clinics of Kathmandu District. Sample size for this study was determined by using  $n = Z^2pq/d^2$ , where  $Z = 1.96$ , value of  $p$  is taken as 0.5,  $q = 1-p = 0.5$ , allowable error ( $d$ ) = 0.05 and  $n$  is required sample size. Based on these parameters, the required sample size was 384.16 hence, total 385 patients were selected.

Inclusion criteria of this study were patients who came for orthodontic treatment in Orthodontics clinic, Kathmandu, Nepal with identified blood group and who gave consent to this study and have all the permanent teeth present in each arch (except third molars), and in a sufficient state of eruption. Patients were excluded who had previous orthodontic treatment and had systemic disease or Craniofacial anomalies/Congenital syndrome. Also participants who were unaware of their blood group and those who were not willing to share the information were excluded from the study.

Informed written consent was taken from patients or their parents. Blood group of the patient was noted in the data sheet from registered laboratory report or driving license provided by Government of Nepal.

Ethical approval were obtained from institutional review committee of Institute of Medicine before conducting this study.

All individuals were evaluated by a single operator (author), and occlusal relationships were evaluated at centric occlusion, which was achieved by asking the subject to swallow and then to bite on his/her teeth together.

It was categorized according to Angle's classification of malocclusion [17], i.e. Class I, Class II and Class III malocclusions.

It was categorized as Class I malocclusion when bilateral Angle's Class I molar relationship (mesio-buccal cusp of maxillary first permanent molar occluding in the buccal groove of mandibular first permanent molar) with one or more of these characteristics: Crowded incisors or labial canines, protruded maxillary incisors, anterior end to end occlusion or anterior cross bite, unilateral or bilateral posterior cross bite, mesial drift of molars, anterior or posterior open bite, deep anterior overbite. Class II malocclusion when bilateral Angles Class II molar relationship (disto-buccal cusp of maxillary first permanent molar occluding in the buccal groove of mandibular first permanent molar) with proclined maxillary incisors and increased overjet or with retroclined maxillary central incisors and proclined lateral incisors. Class III malocclusion when bilateral Angles Class III molar relationship (mesio-buccal cusp of maxillary first permanent molar occluding in the inter-dental space between mandibular first and second permanent molars) with end to end incisor relationship or with normal incisor relationship or with incisors in cross bite relationship.

Data obtained were transferred to MS-excel sheet. The data were double entered and analyzed in SPSS software version 21.0. (Armonk, NY: IBM Corp.) with confidence level set at 95% ( $P < 0.05$ ) to test for significance. The prevalence of occlusal pattern in blood groups was descriptively analysed. Chi-square test was used for the association of categorical data and blood groups. Forty (80) patients were selected randomly to determine the errors associated with measurement for intraobserver reliability. Kappa coefficients were performed to assess the reliability (0.93).

## Results

This cross sectional study found that among the total of 385 participants, 162 (42.07%) were male while 223 (57.93%) were female (Figure 1) and the mean age was  $16.31 \pm 4.38$  years.

Out of 385 respondents, most of them were of the age group 13 - 18 years i.e. 45.72%, from the age group 19 - 25 years there were 33.25% respondents and from the age group of more than 25 years there were only 21.03%.

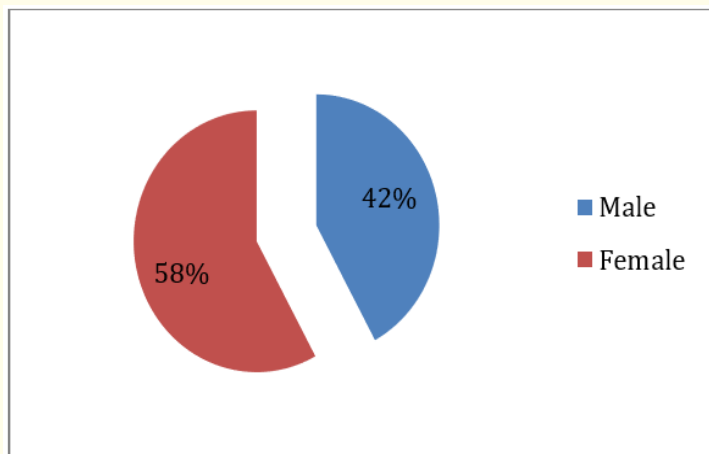


Figure 1: Frequency of gender distribution.

In the present study, the prevalence of blood group O patients was highest (32.20%) followed by blood group B (30.64%) then blood group A (29.88%) while the prevalence of blood group AB patients was least (7.28%) (Figure 2).

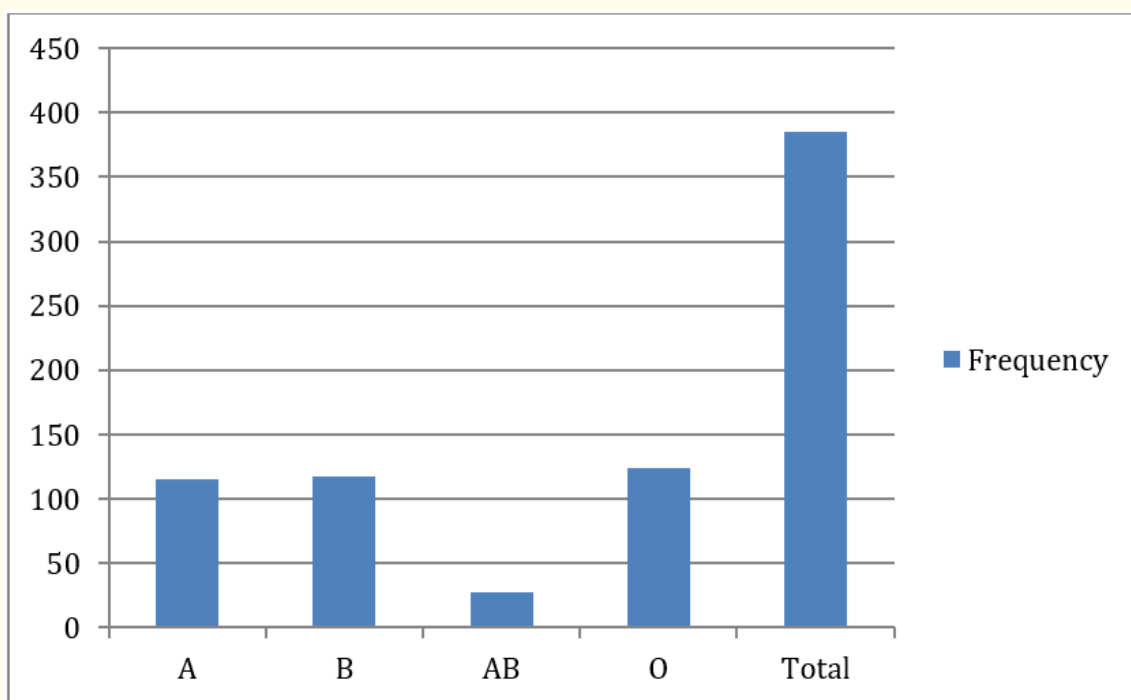


Figure 2: Blood group distribution

Almost 95.85% of the populations were Rhesus group positive and 4.15% were Rhesus group negative.

The result of the study showed that Class I malocclusion was the most common type of malocclusion (85.72) followed by Class II malocclusion (12.20) and Class III malocclusion (2.08) was the least among the orthodontic patient as depicted by table 1.

Occlusal pattern	Frequency	Percentage
Class I malocclusion	330	85.72
Class II malocclusion	47	12.20
Class III malocclusion	8	2.08
Total	385	100

Table 1: Occlusal pattern distribution.

The prevalence of subjects with blood groups A,B, AB and O were distributed as 30.9% (102), 32.73% (108), 6.97% (23) and 29.4% (97) respectively among the Class I malocclusion patients while distributed as 25.53% (12), 17.02% (8), 8.51% (4) and 48.94% (23) respectively among the Class II malocclusion and distributed as 12.5% (1), 25% (2), 12.5% (1) and 50% (4) respectively among the Class III malocclusion (Table 2).

		Malocclusion			Total	p-value
		Class I malocclusion	Class II malocclusion	Class III malocclusion		
Blood group	Blood group A	102 (30.9%)	12 (25.53%)	1 (12.5%)	115	0.097* (> 0.005)
	Blood group B	108 (32.73%)	8 (17.02%)	2 (25%)	118	
	Blood group AB	23 (6.97%)	4 (8.51%)	1 (12.5%)	28	
	Blood group O	97(29.4%)	23 (48.94%)	4 (50%)	124	
Total		330 (100%)	47 (100%)	8 (100%)	385	

Table 2: Blood group distribution in various occlusal pattern.

\*: Statistically non-significant.

Although, a relatively high percentage of individuals with blood group B (32.73%) was observed in Class I malocclusion group, blood group O in Class II malocclusion group (48.94%) and Class III malocclusion group (50%). While statistical analysis with Chi square test showed the association of blood groups with various types of malocclusion as statistically non-significant (P > 0.005) that means there is no association between blood group and types of malocclusion.

### Discussion

This is the cross sectional study that gives the important information about malocclusion and blood groups. All the subjects were clinically assessed by a single operator to assess the occlusal pattern to minimize inter-operator bias. Malocclusion is a multifactorial disease and the etiology of the disease not been clearly established yet with genetic factors probably playing a major role. As the malocclusion and blood groups both are related to genetic components, it can be hypothesized that blood groups have an association with malocclusions. The purpose of this study was to identify such a possibility and to correlate ABO blood group and malocclusion in orthodontic patients of Kathmandu district, Nepal.

Several reports have suggested that ABO blood groups, specifically O blood groups are associated with the risk of ischemic heart disease and of developing severe manifestations of atherosclerosis [11,18-20]. Compared to non-O group (A, AB and B) individuals, O group individuals have a 14% reduced risk of squamous cell carcinoma and 4% reduced risk of basal cell carcinoma. It is also associated with a reduced risk of pancreatic cancer [21]. The B antigen links with increased risk of ovarian cancer. Gastric cancer has reported to be more common in blood group A and least in group O.

According to Glass, *et al.* [12] those in the O blood group have an increased risk of infection with cholera, and have more severe infections.

Reid and Bird [22] and Hadley [23] have shown the relationship between blood group and congenital cataract in the Asian race. Blood group an individuals have been reported to be more susceptible to gall stones, colitis [24] and tumors of salivary glands [25], pancreas and ovary [26].

Cardiovascular diseases are more prevalent in blood groups A, O and non-O [20,27,28]. Diabetes mellitus may be higher in subjects of blood groups A and O [29]. Along with these findings, the ABO groups have been suspected of having a role in causation of infertility and fetal loss, but reports were found to be conflicting [30].

Several studies have been carried out in the field of medicine, but limited research has been made to investigate the association between ABO blood groups and occurrence of oral diseases. Few reports claimed that there was a relation of blood groups an increased incidence of oral diseases, whereas some others could not confirm these findings, which may be attributed to geographical diversity in the population [16,31-33].

Vivek, *et al.* [34] found that subjects with blood group O and Rh positive had a greater propensity for periodontitis. Gheisari, *et al.* [35] in their study showed that among different blood groups; those with blood group B were found to have a greater likelihood of association with maxillofacial deformities and the probability of the association of such deformities was found to be the least with blood group A. Demir, *et al.* found the significant association of different ABO blood groups in the rates of colonization of numbers of periodontal pathogens that are the main etiologic agents of periodontal diseases [36]. It has also been reported that blood group A seems to have an association with oral pathologies such as dermatophytosis [37].

Blood groups and Rh antigen, both are hereditary. Gene for ABO antigens is present on the 9<sup>th</sup> chromosome and Rh antigen gene is on the 1st chromosome [38].

The alleles were termed A (production of A antigen), B (production of B antigen), and O (no antigen production) [39]. The presence or absence of certain antigens has been associated with various diseases and deformities, with antigens also acting as receptors for infectious agents [40]. Blood group O persons who do not have the A and B gene-coded glycosyltransferase express a fucosylated variant (Ley) of the precursor structure [41].

It was reported that blood group 'A' has a wider distribution among Eskimos, 'B' in Chinese and Indians, the group O in Americans, Canadian Indians, Czechoslovakians and Kenyans.

The distribution of ABO blood group varies regionally, ethnically and from one population to another. In the present study, the ABO blood group typing showed the same trend of prevalence as in the general Nepali population (O > B > A > AB) [42,43]. This study shows the highest frequency of blood group O (32.20%), followed by B (30.64%), A (29.88%) and least with AB (7.28%).

In Rhesus system, this study shows frequency of Rh-positive was 95.85%, while only 4.15% was Rh-negative. These figures are similar to the other studies [44-47] While this finding is little higher than the findings of Pramanik, *et al.* [48], Chapagain, *et al.* [49] and Shrestha, *et al.* [42] who found only 0.8%, 0.14% and 2.7% of rhesus negative groups.

In this study, although a relatively high percentage of individuals with blood group B (32.73%) was observed in Class I malocclusion group, blood group O in Class II malocclusion group (48.94%) and Class III malocclusion group (50%). While Statistical analysis with chi-square test showed the relationship of blood groups with malocclusion as statistically non-significant ( $P > 0.005$ ), indicating that there is no association between malocclusions and blood groups.

The results of this study is in accordance with the study of Shokor, *et al.* [50] that there was no genetic influence of ABO blood group in relation to variation in craniofacial morphology and hence, the type of malocclusion cannot be predicted in the respective blood group. While study by Sharma, *et al.* [51] showed divergent results that blood groups have an association with malocclusions with prevalence of malocclusions being highest in blood group B, followed by A, O and AB in Jaipur population.

In this study, there is no significant association between various types of malocclusion with ABO blood groups. These might be due to environmental variation and other factors.

Genetic factors appeared to govern the basic skeletal form and size, however, environmental factors have much more influences on the bony elements [16,52]. In another study stated that genetically-influenced facial types and growth patterns, environmental factors also played an important role [53]. It has been found by several investigators that different ethnic groups have different dentofacial patterns [54,55].

Long-term multicenter collaborative studies with diverse population groups with greater sample size and inclusion of healthy control are suggested to make more comprehensive assessment for definitive establishment of their association between blood group and malocclusion.

### Conclusion

In this study, the results obtained showed a higher fraction of blood group O (32.20%) followed by B (30.64%) then A (29.88%) and least with blood group AB (7.28%) among orthodontic patients. Statistical analysis with Chi-square test revealed that blood groups have no association with various types of malocclusions. This suggest that there was no genetic influence of ABO blood group on malocclusion. Hence, the type of malocclusion cannot be predicted in the respective blood group. The derived results can be used as a stepping stone in order to focus the research on correlation between the blood group antigens and development of malocclusion targeting highly susceptible individuals and developing customized treatment strategies.

### Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

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**Volume 17 Issue 12 December 2018**

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