



Original Research Article

Association of ABO blood group with malocclusion severity – A cross-sectional study

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Abstract

Background: Malocclusion is defined as irregularity of teeth and it is one of the worldwide dental health priorities. The etiology of malocclusion is multifactorial. Although there are numerous types of research in relevance, still there is a paucity of the research on association of ABO blood groups with malocclusion severity in the population of Namakkal district, India.

Aim and Objective: The study aims to find out whether there is any association between the ABO blood group and malocclusion severity among the population of Namakkal district using the Dental Aesthetic Index (DAI).

Materials and Methods: The study was performed among 400 patients who reported to the Department of Orthodontics and Dentofacial Orthopedics, with the age group of 15 to 28 years. Subjects were equally divided among their respective blood groups. Descriptive analysis was performed using SPSS (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp). ANOVA was done to find out the association between malocclusion severity and ABO blood groups.

Results: The association showed statistical significance (A>O>B>AB) among the blood groups.

Conclusions: Prompt diagnosis, early intervention, and treatment planning would aid in the reversal of malocclusion. Periodic dental attendance during the developmental stages will help in achieving this.

Keywords: Agglutination methods, Namakkal district, Dental aesthetic index, ABO blood groups, Malocclusion

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1. Introduction

Any deviation from the ideal or normal occlusion is referred to as malocclusion.¹ Following periodontitis and dental caries, it is the third most prevalent oral illness that affects people.² There are two types of malocclusions: inherited and acquired. A major contributing factor to malocclusion is genetics.³ Research on twins and families has demonstrated that malocclusion is heritable, with a higher heritability for the skeletal components of the malocclusion and a low to moderate heritability for the dental components.⁴ However, it is challenging to anticipate the hereditary pattern of malocclusion with precision because of the multifactorial aspects of face development.⁵ Thus, the current research was done to find out how malocclusions and a few other hereditary features relate to one another. ABO blood type is one such significant genetic characteristic and also literature

has revealed its association with several oral diseases like periodontitis, gingivitis, salivary gland tumor etc.⁶

One of the most significant blood group systems is the ABO system. It was established in 1901 by Karl Landsteiner, who also founded the Rh system in 1940 with Weiner and was awarded the Nobel Prize in 1930.⁷ The ABO system consists of two antigens, A and B, that are either secreted into the body's fluids such as plasma, or are found on cell membranes. There are four blood groups or blood types based on the presence or lack of these antigens: A, B, AB, and O. These antigens are inherited codominants and are located on the 9th chromosome. Globally, the ABO system's distribution forms are combined. Rarely racial variations in the blood group distribution also occur as well.⁸

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Blood group associations with dental malocclusions can be theorized because both the malocclusion and blood groups are linked to hereditary components. Studies examining the relationship between ABO blood types and other systemic illnesses have revealed substantial associations between blood groups and several illnesses, including hematological malignancies, salivary gland tumors, mouth cancer, and dental caries. According to a recent report, the B group has the highest rate of COVID-19 infection, whereas the O group has the lowest incidence.

When Koregal et. al.⁹ assessed the relationship between ABO blood types and gingivitis, they discovered that patients with blood group A had a higher prevalence of gingivitis. Additionally, they also found a strong correlation between ABO blood types and periodontitis, with individuals of blood group A having a higher prevalence of periodontitis.

Gheisari, et al.¹⁰ conducted a cross-sectional study among Iranian population in 2008 to determine the relationship between blood groups and maxillofacial deformities. They discovered that the individuals with blood group B had fewer maxillofacial deformities. These investigations' findings demonstrated a strong correlation between blood types and craniofacial disorders.

A statistical finding was found in a cross-sectional study conducted by Sharma R et al. in 2015. The study was to evaluate the relationship between ABO blood groups and dental malocclusion. It revealed that a greater prevalence of malocclusions was noted in blood group B and the least prevalence of malocclusion in blood group AB.¹¹

When Rashid A. et al. (2019) researched to find out the relationship between blood groups and malocclusion in the Egyptian population, they discovered that there was a significant correlation, with blood group A having the highest prevalence of malocclusion, followed by blood groups O and B, and AB having the lowest prevalence.¹²

The authors have hypothesized and assessed the relationship between ABO blood groups and dentoskeletal malocclusion because both conditions have a strong genetic basis. In children belonging to a particular blood group, the results can be used to predict future growth patterns and the development of dental malocclusions if such an association is found. The ability to diagnose and avert developing malocclusions at an early stage is the clinical significance of understanding the inheritance of specific dental and skeletal patterns. Hence, the purpose of this study is to find out whether there is any association between the ABO blood group and malocclusion severity among the population of Namakkal district since no relevant study was done till now in the Southern population of India.

2. Materials and Methods

A total of 400 subjects in the age group of 15-28 years who reported to the Department of Orthodontics and Dentofacial

Orthopedics were recruited for this study. Clearance from the institutional ethical committee was obtained before starting the study. Separate proforma was used to record the patient's name, age, sex, blood group, and malocclusion severity.

2.2. The participant's inclusion and exclusion criteria are as follows

Every permanent tooth in each arch (third molars excluded), and in a sufficient state of eruption, meaning the cusp tip or entire crown is visible in the oral cavity and patients in the age range of 15 to 28 were included in the study.

Subjects with systemic illness or congenital syndrome, craniofacial deformities, prior orthodontic treatment, and extracted teeth were excluded.

2.2. Study design

1. Observational type of study design.
2. Sample Size = 400.
3. Sample size calculation was based on the results of Gupta SP¹³ Using alpha (α) level of (5%) and (β) level of 20% i.e. Power = 80%. Calculation yielded a sample size of 400 cases.

2.3. Blood testing techniques

2.3.1. Blood grouping principle

A person's red blood cells are treated with commercially available anti-serum that contains known agglutinins to cause a reaction to yield the person's blood group. Followed by, the slide is visually inspected to determine whether clumping and hemolysis (agglutination) of red blood cells-which is brought on by an antigen-antibody reaction-are present or absent.^{14,15}

2.3.2. Procedure of blood testing

Tile method was used to find out the blood groups. Dry tiles were separated into A (also known as antiagglutinins), B (also known as beta agglutinins). Following an aseptic finger prick, one drop each of antisera A and B was applied and combined with a two different toothpick to create a red cell suspension, and 8 to 10 minutes were allowed to pass. This was then prepared for each participant allocated to the study.^{11,16} The antisera and red cell suspension were combined. Subsequently, the two antisera-red cell mixtures on the slide were examined visually to assess if agglutination (clumping or hemolysis) had occurred. The agglutination of red cells was proven to have occurred as coarse separation of the cells in isolated clumps, or red precipitates of cells.^{12,17}

2.3.3. Determination of malocclusion severity using DAI index.

Using a specially created survey proforma and the WHO's Oral Health Survey: Basic Methods (1997) as a guide, the 10 components of the DAI (Dental Aesthetic Index) were used to evaluate each person's malocclusion severity and need for orthodontic treatment. Each subject was allocated to a single

operator for evaluation, and occlusal relationships were assessed at central occlusion, which was attained by having the subject bite and swallow concurrently. Under natural daylight, an oral examination was conducted with the use of a mouth mirror, William's probe, divider, and metal ruler. The individuals' name, age, sex, blood group, and DAI characteristics were recorded on a data collection form. The data's confidentiality and anonymity were preserved. Informed consent was obtained from the study population after giving the information sheet.

2.3.4. The severity of malocclusion and treatment needs was classified and interpreted based on DAI scores as stated below

1. < 26: Little or no treatment need
2. 26-30: Treatment is elective
3. 31-35: Treatment highly desirable
4. >35: Treatment mandatory

2.4. Statistical analysis

Data obtained was analyzed using Statistical Package for Social Sciences (SPSS) software version 25.0 (SPSS Inc., Chicago, USA). A descriptive analysis was performed. ANOVA was performed to find the presence of any

statistically significant difference if prevailed between the groups. Statistical significance was determined at $P < 0.05$.

3. Results

The current study was done to find out the association between ABO blood group and malocclusion severity. The comparison revealed that the subjects with the need of mandatory treatment (DAI SCORE >36), were higher for the blood groups A (9.5%) and O (8.25%). Blood groups AB (9%) and B (8%) had their maximum number of study participants in little or no treatment needed (DAI SCORE <25) category. Also, mean $\pm$ S.D was found to be higher among the A blood group (32.08 ± 6.934) and least in AB (29.28 ± 7.730). (**Table 1**)

ANOVA test done between the blood groups revealed that there was statistical significance (0.001*) between the blood groups since p value is significant (0.001) (**Table 2**).

The multiple comparisons done between the blood groups with post hoc reveal that significant variations are seen in the comparison between the groups with group A showing the highest malocclusion severity in the study population followed by group O, B and AB. (**Table 3**)

Table 1: Comparison of blood groups with DAI index

Blood group	DAI score			Mean $\pm$ S.D
	Scores	Number	Frequency	
O	< 25	15	3.75%	32.08 ± 6.934
	26-30	24	6%	
	31-35	28	7%	
	>36	33	8.25%	
A	< 25	15	3.75%	33.96 ± 8.348
	26-30	19	4.75%	
	31-35	28	7%	
	>36	38	9.5%	
B	< 25	32	8%	30.10 ± 8.704
	26-30	22	5.5%	
	31-35	21	5.25%	
	>36	25	6.25%	
AB	< 25	36	9%	29.28 ± 7.730
	26-30	22	5.5%	
	31-35	18	4.5%	
	>36	24	6%	

Table 2: ANOVA – between the blood groups A, B, AB and O.

	Sum of squares	Mean square	F	P Value
Between the groups	112.372	3.211	3.015	0.001*
Within the groups	387.628	1.065		

* p value <0.05 statistically significant

Table 3: Post hoc showing multiple comparisons among the groups

Blood group	Blood group	Mean Difference	Standard Error	p value
O	A	-4.680	1.125	0.001*
	B	-0.820	1.125	0.886
	AB	-2.800	1.125	0.063
A	O	4.680	1.125	0.001*
	B	3.860	1.125	0.004*
	AB	1.880	1.125	0.341
B	O	0.820	1.125	0.886
	A	-3.860	1.125	0.004*
	AB	-1.980	1.125	0.295
AB	O	2.800	1.125	0.063
	A	-1.880	1.125	0.341
	B	1.980	1.125	0.295

* p value <0.05 statistically significant

4. Discussion

Malocclusion defined as irregularity of teeth is a condition when left untreated would result in several other serious conditions like dental caries and periodontal diseases. Although many habits like thumb sucking and tongue thrusting are involved in causing malocclusion, genetics plays a major role. The occurrence of malocclusion in the population follows a continuous graded distribution, indicating that it is a quantitative genetic trait.⁴ Additionally, blood groups are qualitative characteristics that follow the principles of Mendelian inheritance. So, the current study was conducted to evaluate the correlation between malocclusion severity and ABO blood groups, as previous literature had already established a connection between oral diseases and ABO blood groups in various other regions across the globe.

A study conducted in Chennai (2018) revealed that there exists a statistically significant relation between blood groups and development of Early Childhood Caries (ECC) in children who were < 71 months of age.¹⁸ In 2017, based on the articles published from 1977 to 2016, literature review was done to find out the association between ABO blood grouping and periodontal disease. Results showed that Chronic periodontitis was common among blood group O.¹⁹ When research was done to find the relationship of blood group with level of cooperation of paediatric dental patients in 2022, it was found that blood group B has certain behaviour traits as dental fear and anxiety along with poor cooperation.¹⁶ Literature has also witnessed several studies till day, assessing the association of dental & skeletal malocclusions with ABO blood groups in various kinds of populations.

In view of malocclusion, a study done in Iraq to find the association of ABO blood group and Rhesus factor with dental malocclusion in 2018, showed that there was no significant association between malocclusion and blood groups.¹⁹ And also, the percentage of occurrence of malocclusion was highest in O Rh+ve, followed by A Rh+ve, B Rh+ve, B Rh-ve, AB Rh+ve, A Rh-ve, and O Rh-ve. This

finding is in contrast to the findings of the current study. This difference may have been occurred due to geographic diversity and racial variation.

A study conducted by Sharma R et al in Jaipur, India (2015)¹¹ to find out the association between blood groups and malocclusion revealed that the prevalence was higher in B, followed by A>O>AB. The study by Rashid A et.al¹² (2019), to find the association between blood groups and malocclusion in Egyptian population revealed, A>O>B>AB. This finding was similar to the current study where the percentage of malocclusion severity is highest among A blood group, (9.5%) with mandatory orthodontic treatment (DAI>36) followed by O, B, and AB.

Another study in India (Mysore, 2020) by Gupta P et al.¹³ revealed that the association of blood group and malocclusion was O>A>B>AB. Shokor et al in 2015,²⁰ evaluated the craniofacial morphology with genetic influence of ABO blood group in Malaysian orthodontic patients, and found that there was no genetic influence of ABO blood group with craniofacial morphology.

Schnibben CL²¹ at Chicago, assessed the relation of Class II division 1 dental malocclusion with the blood group and revealed that a statistical significance was present showing the presence of Class II malocclusion more in blood group A. Whereas, the results of the study by Fiannery et.al,²² in the same country revealed that there is no association of Class III dental malocclusion and blood group.

A common finding seen in the study done in Jaipur, Egypt, and Mysore is that the malocclusion severity was least among AB blood group which is also a similar finding of the current study. Thus, the contrasting results in the different research work may be due to many factors like geographic differences, racial and ethnic variations among the different populations for distribution of ABO blood groups as well as dentoskeletal malocclusions. Multicenter collaborative studies involving diverse population groups are necessary to investigate this relationship more thoroughly on a global scale in order to definitively establish their etiogenic role.

Hence, in future the economic burden can be reduced by identifying the presence of risk in severity of malocclusion development through which prevention or early diagnosis and treatment can be initiated.

One limitation of this study is that more specific associations could have been revealed by increasing the sample size of different ethnic origins. Other limitation is that grouping with Rh factor in particular could have also yielded better results.

5. Conclusion

Hence, in this study, a statistically significant difference between the blood groups and malocclusion severity in the population of Namakkal district was found. Results revealed that percentage of malocclusion severity was highest among a blood group, followed by O, B, and AB. To appreciate the potential for genetic and/or environmental manipulation in orthodontic therapy, more accurate research instruments and methods are needed to advance knowledge and understanding. A more thorough investigation is thus necessary, as there should be additional differentiations and other factors taken into account. Finally, creating awareness to the public about the importance of correcting malocclusion, early diagnosis and intervention with prompt treatment planning would not only help patients to improve their profile aesthetically but also aid in improved masticatory efficiency.

6. Source of Funding

None.

7. Conflict of Interest

None.

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