Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 5 May 2023

Review Article

Association Of ABO Blood Groups with Malocclusion: A Narrative Review

Anup Kanase*, Shruti Mathur, Tulika Tripathi and Priyank Rai

Department of Orthodontics and Dentofacial Orthopaedics, Maulana Azad Institute of Dental Science, New Delhi, India

***Corresponding Author:** Anup Kanase, Department of Orthodontics and Dentofacial Orthopaedics, Maulana Azad Institute of Dental Science, New Delhi, India.

DOI: 10.31080/ASOR.2023.06.0739

Received: March 10, 2023

Published: April 23, 2023

Abstract

Malocclusion has a multifactorial aetiology and can be attributed to local as well as general factors. Genetics plays a significant role in aetiology of malocclusion. Malocclusion is considered as a quantitative genetic trait with continuous graded distribution in the population. Association between various oral diseases with ABO blood groups have been established in the past. ABO blood groups are one of the most important human genetic traits that follows Mendalian inheritance. Since both the ABO blood groups and malocclusion are genetic traits, authors have carried out studies to assess if association between the two exists. The purpose of this narrative review is to enumerate studies that have assessed the association between dental, skeletal malocclusions with the ABO blood groups.

Keywords: Skeletal Malocclusion; Dental Malocclusion; ABO Blood Groups

Introduction

Malocclusion is the third most common oral disease affecting individuals after dental caries and periodontitis [1]. Malocclusion is defined as an appreciable deviation from the ideal occlusion that may be considered aesthetically or functionally unsatisfactory [2]. Malocclusion has multifactorial origin and several local and general factors attribute to malocclusion. Genetics is one of the significant etiological factors of malocclusion [2,3]. Twin and familial studies have provided evidence for heritability of malocclusion and have reported greater heritability for skeletal components of malocclusion whereas low to moderate heritability for dental component of malocclusion [5,6]. However, due to the multi-factorial characteristics of facial development, it is difficult to do exact prediction of the genetic pattern of malocclusion [10-12]. Thus, studies were carried to determine the relationship between malocclusions and some other genetic traits. ABO blood group is an important genetic trait and is reportedly associated with several oral diseases like periodontitis, gingivitis, salivary gland tumor etc. [23-26].

The ABO blood group system was first defined by Karl Landsteiner in 1901 [7,8]. ABO blood group system consists of two main antigens which are present on the cell membranes or secreted into the plasma and other fluids of the body. The presence or absence of these antigens results in the four blood groups or blood types: A, B, AB, and O. The genes for these antigens are present on the 9th chromosome and are inherited co-dominantly [9]. Since both malocclusion & ABO blood groups have strong underlying genetic etiology, authors have hypothesized & evaluated the correlation between ABO blood groups & dentoskeletal malocclusion [10-22]. If such association exists, the results can be utilized to infer future growth patterns and developing dental malocclusions in children with a specific blood group. The clinical significance of knowing the inheritance of certain dental and skeletal patterns is that we can then use this information to diagnose and intercept developing malocclusions at an early stage.

The objective of this article is to discuss and enumerate various studies that investigated the relation between ABO blood groups and various types of malocclusions. Second objective is to discuss whether ABO blood groups has more significant association with dental malocclusion or components of skeletal malocclusion.

What is the rationale behind association of malocclusions and ABO blood groups?

Association of ABO blood groups with various craniofacial deformities and oral diseases have been reported in the past. Koregal., *et al.* investigated relationship between ABO blood groups and Gingivitis and found that patients with blood group A had higher percentages in gingivitis group. They also reported significant association between ABO blood groups & periodontitis with greater percentage of periodontitis in blood group A patients [23]. Vivek., et al. reported significant relationship between periodontitis and O blood group [24]. Other authors have also reported association between ABO blood groups & risk of oral cancer with Blood group B at higher risk of developing oral cancern [25]. In 2008, Gheisari., et al. carried a cross-sectional study in Iranian population to identify association between blood groups and maxillofacial deformities and found that maxillo- facial deformities have greater incidence of association with blood group B and fewer deformities in blood group A individuals. The results of these studies showed that blood groups have significant association with craniofacial diseases [16].

Malocclusions are a quantitative genetic trait with continuous graded distribution in the population [5,6]. ABO blood groups are qualitative traits with typical Mendalian inheritance [5,6]. Since, literature had reported association between oral diseases & ABO blood groups, further studies were then conducted to assess the association between malocclusions & ABO blood groups.

Does dental malocclusion have any association with ABO blood groups?

Sharma R et al, 2015 carried out cross sectional study to evaluate the relationship between ABO blood groups and dental malocclusion & found statistically significant association of ABO blood groups with dental malocclusions with greater prevalence of malocclusions in the blood group B and least prevalence of malocclusion in blood group AB. [10]. Rashid A et al. in 2019 investigated relationship between blood groups and maloc- clusion in Egyptian population also found significant association between blood group and dental malocclusion with prevalence of malocclusion greatest in blood group A followed by O, B and least prevalent in AB [12]. Gupta P also found significant co-relation between ABO blood groups with dental malocclusions in population of Mysuru [11].

Tariq et al found significant association between dental malocclusion & ABO blood groups in population of Lahore. They further reported gender wise association difference between the classes of dental malocclusion and ABO blood group [13].

Does skeletal malocclusion have a greater association with ABO blood groups than dental malocclusion?

Various twin and familial studies were carried out regard- ing the inheritance pattern of malocclusion and have established that there is a stronger genetic component of skeletal component of craniofacial form while the dental malocclusions are primarily acquired with low heritability [6]. Studies on lateral cephalograms of fraternal and identical twins have concluded that there is a stronger genetic component of heritability for the vertical skeletal cephalometric measurements than anteroposterior skeletal cephalometric measurements [6]. Various authors like Rathi *et al*, Dattani *et al*, Ghiseri *et al*, John G have reported association between skeletal malocclusions and ABO blood groups [16,21,22]. However, Shokor *et al*, Flannery *et al*. did not find significant association between skeletal malocclusions and ABO blood groups [18,19].

Which component of skeletal malocclusion has more association with ABO blood groups: Sagittal component or vertical skeletal parameters?

Association of ABO blood groups with sagittal malocclusion:

John G investigated association between sagittal malocclusion and ABO blood group and reported significant association between Yen angle and ABO blood group [22]. Similar association was found by Ghieseri *et al*. between maxillofacial deformities and ABO blood groups [16]. Rathi *et al.* also reported that there may be association between sagittal malocclusions and ABO blood groups however they did not find any correlation between ANB angle and ABO blood groups [21].

Association of ABO blood groups with vertical facial patterns

Dattana S *et al.* 2018, conducted study in Maharashtrian population to find correlation between Vertical growth pattern and ABO blood group types and found correlation between vertical skeletal parameters and ABO blood groups & found significant correlation between vertical skeletal parameters and ABO blood groups [20].

Is there a consensus between association of dentoskeletal malocclusions and ABO blood groups?

Several authors have assessed the association of dental & skeletal malocclusions with ABO blood groups in different populations. Gupta SP, Al- Khatieeb *et al*. found no significant association between dental malocclusion and ABO blood groups [14,15]. Studies by Schnibben *et al*, Flannery *et al*, Shokor *et al*. evaluated association of sagittal cephalometric parameter ANB angle with blood groups but reported no association between the two [17-19]. Similarly, John G reported no significant association between vertical skeletal parameters and ABO blood groups [22]. The contrasting results in the different investigations may be due to the geographic differences, racial and ethnic variations among the different populations for distribution of ABO blood groups as well as dentoskeletal malocclusions.

What is the genetic basis of dental and skeletal malocclusions?

Genomic wide association and molecular studies have reported significant association of various genetic pathways and sagittal malocclusion and vertical facial patterns. Genes like ACTN3 and MYO1H are reportedly associated with vertical skeletal pattern [26]. Also, association of ABCA4-ARHGAP 29 locus have been associated with vertical facial phenotypes like skeletal open bites and deep bites [27]. Sagittal Class II and Class III malocclusions have also been associated with SNPs of genes like COL1A1, FGFR2, MYO1H [27]. It has also been observed that SNPs of FGFR2 were associated with increased risk of developing skeletal Class II and Class III [27]. Certain genes like KAT6B and HDAC4 are found to be expressed more in skeletal class III whereas deficiency of RUNX2 is associated with Skeletal Class II [28].

In the past, studies have reported that dentoalveolar traits of malocclusion are primarily acquired with lower heritability. However, there is molecular evidence that has shown correlation between genes like EDA and XEDAR dental crowding and MSX1 gene with dental patterning [6,27].

Is there any molecular evidence regarding the association between ABO blood groups and dentoskeletal malocclusions?

Literature has contrasting views regarding the association of dentoskeletal malocclusions with ABO blood groups. These studies were assessing the association between dentoskeletal malocclusions & ABO blood groups at an epidemiological level. However, there is lack of molecular evidence to support any associations between SNPs of skeletal & dental malocclusions with alleles of ABO blood groups.

Future scope

Studies have reported statistically significant association between dentoskeletal malocclusions and ABO blood groups at population level but there is lack of data regarding any correlation/association between the genotypes of the dental and skeletal malocclusions with alleles of ABO blood groups. Hence, in future studies we may focus on molecular analysis to ascertain association between SNPs of dental, sagittal malocclusions and vertical facial patterns with ABO blood group alleles.

Conclusion

- Studies have shown significant association of dental malocclusion with ABO blood groups. But several authors have also reported contrary results. The varying results in the different investigations were because of the geographic differences, racial and ethnic variations among the different populations for ABO blood groups and malocclusions.
- Evidence from twin and familial studies have strongly suggested greater component of heritability for skeletal malocclusion as compared dental malocclusions with a stronger genetic component of variability for the vertical skeletal cephalometric measurements than anteroposterior skeletal cephalometric measurements. Studies have investigated the association of Sagittal and vertical malocclusion with ABO blood groups but there is no consensus regarding the association between ABO blood groups and skeletal malocclusions.
- So far, the studies have investigated the association between ABO blood groups at an epidemiological level. But, in order to have conclusive evidence regarding the association between ABO blood groups and dentoskeletal malocclusions, further investigations may focus on molecular level to assess whether there is any association between SNPs of dentoskeletal malocclusions with ABO blood group alleles.

Bibliography

1. Alhammadi MS., *et al*. "Global distribution of malocclusion traits: A systematic review". *Dental Press Journal of Orthodontics* (2018): 40-e41.

2. Houston WJ., *et al*. "A textbook of orthodontics". Wright (1992).

3. Kharbanda OP. "Orthodontics: Diagnosis and Management of Malocclusion and Dentofacial Deformities, E-Book". *Elsevier Health Sciences* (2019).

4. Agarwal SS., *et al*. "An overview of malocclusion in India". *Journal of Dental Health, Oral Disorders and Therapy* 3.3 (2015): 00092.

5. Mossey PA. "The heritability of malocclusion: Part 1-Genetics, principles and terminology". *British Journal of Orthodontics* 26.2 (1999): 103-113.

6. Mossey PA. "The heritability of malocclusion: part 2. The influence of genetics in malocclusion". *British Journal of Orthodontics* 26.3 (1999): 195-203.

7. Daniel G. "Human blood groups. 2nd edition". Oxford: Blackwell (2002): 3-8.

8. Schwarz HP and Dorner F. "Karl Landsteiner and his major contributions to haematology". *British Journal of Haematology* 121.4 (2003): 556-565.

9. Lewis M., *et al*. "Genetic linkage analyses of chromosome 9 loci ABO and AK1". *Cytogenetic and Genome Research* 22.1-6 (1978): 452-455.

10. Sharma R., *et al*. "Association of ABO Blood Groups with Malocclusion in Population of Jaipur, India: a prospective study". *International Journal of Scientific Study* 2.11 (2015): 45-51.

11. Gupta P., *et al*. "Correlation of ABO and Rh Blood Group with Dental Malocclusion in Population of Mysuru". *Dental Hypotheses* 11.2 (2020): 47.

12. Rashid A and El Feky H. "Correlation between ABO Blood Groups and Malocclusion in a sample of Egyptian Populations: A cross sectional study". *Egyptian Dental Journal* 65 (2019): 875-880.

13. Tariq B., *et al*. "Gender wise association between dental malocclusion classes and ABO blood group system". *Dentistry* 9.532 (2019): 2161-1122.

14. Al-Khatieeb MM., *et al*. "Association of ABO blood group and rhesus factor with dental malocclusion in a population of Baghdad, Iraq". *International Journal of Medical Research and Health Sciences* 7 (2018): 165-169.

15. Gupta SP. "Association of ABO blood groups with occlusal pattern among Orthodontic patients of Kathmandu district". *Journal of Institute of Medicine Nepal* 17.12 (2018): 2119-2129.

16. Gheisari R., *et al*. "The association between blood groups and maxillofacial deformities". *Indian Journal of Plastic Surgery* 41.02 (2008): 138-140.

17. Schnibben Charles Louis. "A Study of the Relationships of the ABO Human Blood Groups, the Rh Factor and Hereditary Malocclusions of the Skeletal Type, Class II, Division 1" (1968). Master's Theses. Paper (1969): 2251.

18. Flannery Patrick Michael. "The Abo Human Blood Groups and Skeletal Class IIi Malocclusions". *Master's Theses* (1969): 2363.

19. Shokor FF., *et al*. "Craniofacial morphology with genetic influence of ABO blood Group in malaysian orthodontic patients". *International Journal of Pharma and Bio Sciences* 6.4 (2015): 412-418.

20. Datana SS and Bhandari S. "Correlating Vertical Skeletal Patterns with ABO Blood Grouping System: A Cross-Sectional Study". *Journal of Contemporary Orthodontics* 3.3 (2019): 33-37.

21. Rathi A., *et al*. "Association of ABO blood group with crowding among patients with different malocclusions". *Journal of Dentistry Defence Section* 14.1 (2020): 4.

22. Johns G. "Association of blood groups with malocclusion". *International Dental Journal of Student's Research* 9.3 (2021): 133-139.

23. Koregol AC., *et al*. "ABO blood groups and Rhesus factor: An exploring link to periodontal diseases". *Indian Journal of Dental Research* 21.3 (2010): 364.

24. Vivek S., *et al*. "Association of ABO Blood Group and Rh factor with periodontal disease in a population of Virajpet, Karnataka: A cross-sectional study". *Journal of International Oral Health: JIOH* 5.4 (2013): 30.

25. Mortazavi H., *et al*. "ABO blood groups in oral cancer: a first case-control study in a defined group of Iranian patients". *Asian Pacific Journal of Cancer Prevention* 15.3 (2014): 1415-1418.

26. Cunha A., *et al*. "Genetic variants in ACTN3 and MYO1H are associated with sagittal and vertical craniofacial skeletal patterns". *Archives of Oral Biology* 97 (2019): 85-90.

27. Da Fontoura CG., *et al*. "Candidate gene analyses of skeletal variation in malocclusion". *Journal of Dental Research* 94.7 (2015): 913-920.

28. Huh A., *et al*. "Epigenetic influence of KAT6B and HDAC4 in the development of skeletal malocclusion". *American Journal of Orthodontics and Dentofacial Orthopedics* 144.4 (2013): 568-576.