Correlating Vertical Skeletal Patterns With ABO Blood Grouping System: A Cross-Sectional Study

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ABSTRACT

Introduction: This study was conducted to correlate vertical facial patterns with ABO blood groups and also to evaluate the differences in distribution of ABO blood groups among males and females with different vertical facial patterns.

Materials and Methods: 162 subjects (66 males and 96 females) were randomly selected from the OPD of a tertiary care hospital (age-12-30 years). Standard pretreatment records for each individual were taken. The individuals were divided into 03 vertical skeletal facial patterns using Frankfurt Mandibular Plane Angle (FMA) as Group 1- Hypodivergent FMA <23 degrees (57 individuals), Group 2- Normodivergent FMA 23-27 degrees (60 individuals), Group 3- Hyperdivergent FMA >27 degrees (45 individuals).

Results: The mean ± SD of age in Group 1, Group 2 and Group 3 was 17.89 ± 2.33 years, 17.25 ± 3.57 years and 17.53 ± 3.60 years respectively (P-value>0.05). The blood group distribution of cases studied did not differ significantly between group of male and female cases studied (P-value>0.05). The blood group distribution of cases studied differed significantly between group 1 and 2 (P-value<0.05) but did not differ between groups 1 and 3 as well as between groups 2 and 3 (P-value>0.05). A+ blood group was more prevalent in horizontal growth pattern and B+ in vertical and average growth patterns (P-value<0.05).   of population to validate the findings of this study**.**

Key words: Slot dimensions, slot profile, machining inaccuracy.

INTRODUCTION

Maxillofacial deformities either major or minor are of common occurrence. In India, prevalence of around 43.6 to 85.6% has been reported pertaining to Angle's class I malocclusion. Amongst Angle's class II and class III malocclusion the prevalence differs from 3.8% to 9.7% and 0.6% to 4.1% respectively [1,2].

Skeletal growth pattern plays a very important role in predicting the outcome of any orthodontic treatment. Intervention in the form of growth modification or ortho-surgical correction depends largely upon skeletal growth pattern depicted by the individual. Different skeletal patterns are associated with age, sex and the genetic make up of an individual [3].

Familial tendencies towards deformities like retrognathic or prognathic mandible generally point towards hereditary influence. Facial characteristics are generally multifactorial in origin making it difficult to predict genetic pattern in a given situation, but epidemiology has helped in revealing association among such characteristics or diseases which ultimately helps in its recognition and treatment [3].

The size, shape or position of jaws have been associated with inheritance, as shown by various studies. Inheritance of such features in a child shows that genetics play a very important role in the overall phenotype. On the contrary, controversy still exists as though whether genetics or environmental factors or both play a role in determination of growth pattern [4].

In 1901, ABO blood group system was the first and the most important system to be defined [5]. Antigens expressed in the erythrocyte glycocalyx depict blood group phenotypes which is a genetic expression [6].Long arm of chromosome 9 encodes the gene for blood grouping which shows two main antigens, A and B. The presence or absence of these antigens results in A, B, AB, and O blood groups [7].

Correlation of blood group with various diseases and its relationship with oral conditions as depicted in various studies has been considered an important human genetic trait. [8] Weber and Pastern et al have found a positive correlation between ABO blood group and periodontal disease [9]. Ghesari et al has also found that in Iranian population, blood group B is strongly associated with maxillofacial deformities and blood group A showed the least association [3].

Table 1: Inter-group comparison of mean age of cases studied								
	Group 1 (n=57)		Group 2 (n=60)		Group 3 (n=45)		P-value (Inter-Group)		
	Mean	SD	Mean	SD	Mean	SD	Group 1 v Group 2	Group 1 v Group 3	Group 2 v Group 3
Age (years)	17.89	2.33	17.25	3.57	17.53	3.60	0.999[NS]	0.999[NS]	0.999[NS]

P-value by analysis of variance (ANOVA) with Bonferroni's correction for multiple group comparisons. P-value<0.05 is considered to be statistically significant. NS-Statistically non-significant.

MATERIAL AND METHODS

Sample size calculation was done with a confidence interval of 95% and level of significance set at 0.05. The study sample consisted of 162 subjects (66 males and 96 females) which were randomly selected from the OPD of a tertiary care hospital, Pune with age ranging from 12-30 years.

Standard pretreatment records for each individual were taken including patient's history (name, age, gender, blood group), malocclusion assessed by study models and lateral cephalogram recorded on NewTom GiANO HR 3D Ceph CBCT machine taken by same operator. Prior informed

Plane (FMA) angle [10]. Based on values of FMA, patients were divided into three groups-

- Group 1- Hypodivergent FMA <23 degrees (57 individuals with 24 males and 33 females)

- Group 2- Normodivergent FMA 23-27 degrees (60 individuals in total with 30 males and 30 females)

- Group 3- Hyperdivergent FMA >27 degrees (45 individuals in total with 12 males and 33 females)

Entire data was collected, compiled in MS Excel sheets and subjected to statistical analysis.

Table 2: Inter-Group Gender Distribution Of Cases Studied								
	Group 1 (n=57)		Group 2 (n=60)		Group 3 (n=45)		P-value (Inter-Group)		
Gender	n	%	n	%	n	%	Group 1 v Group 2	Group 1 v Group 3	Group 2 v Group 3
Male	24	42.1	30	50.0	12	26.7	0.751[NS]	0.476[NS]	0.296[NS]
Female	33	57.9	30	50.0	33	73.3			
Total	57	100.0	60	100.0	45	100.0			

P-value by Chi-Square test. P-value<0.05 is considered to be statistically significant. NS-Statistically non-significant.

consent was taken from the patients.

Inclusion criteria consisted of patients who agreed to sign informed consent and presented with medical records containing information on blood group. Exclusion criteria included previous trauma/ surgery related to jaw bone, history of previous orthodontic/ orthognathic surgery affecting jaws, history of pathology or any other systemic disease/ condition or syndrome affecting jaw growth.

Lateral cephalograms were manually traced by one trained orthodontist. 40 cephalograms were retraced after one week by the same observer to assess intra- observer reliability. The vertical skeletal facial patterns of the patients were evaluated by using Tweed's method of measuring Frankfurt Mandibular

STATISTICAL ANALYSIS

Statistical analysis for the study was done using Statistical Package for Social Sciences (SPSS ver 21.0, IBM Corporation, USA) for MS Window. The inter-group statistical comparison of distribution of categorical variables across this study was done using Chi-Square test. The inter-group statistical comparison of means of continuous variables was done using analysis of variance (ANOVA) with Bonferroni's correction for multiple group comparisons.

The blood group distribution of cases studied did not differ significantly between group of male and female cases studied (P-value>0.05) (Table 3, Figure 3).

Of 57 cases in Group 1, majority of cases had blood group A+ (15 cases, 26.3%). Of 60 cases in Group 2, majority of cases had blood group B+ (39 cases, 65.0%). Of 45 cases in Group 3, majority of cases had blood group B+ (24 cases, 53.3%).

group but also its distribution can affect the nature of health and disease. Studies have suggested that inheritance of ABO blood group is autosomal in nature with A and B blood group co-dominant over O. Immunohistochemical studies have

Table 3: Inter-gender distribution of blood groups

Blood Group	Male (n=66)		Female (n=96)		
	n	%	n	%	P-value
A+	15	22.7	15	15.6	0.829[NS]
B+	30	45.5	42	43.8	
B-	0	0.0	3	3.1	
AB+	15	22.7	21	21.9	
O+	6	9.1	15	15.6	
Total	66	100.0	96	100.0	

P-value by Chi-Square test. P-value<0.05 is considered to be statistically significant. NS-Statistically non-significant.

The blood group distribution of cases studied differed significantly between groups 1 and 2 (P-value<0.05). The blood group distribution of cases studied did not differ significantly between groups 1 and 3 as well as between groups 2 and 3 (P-value>0.05) (Table 4, Figure 4).
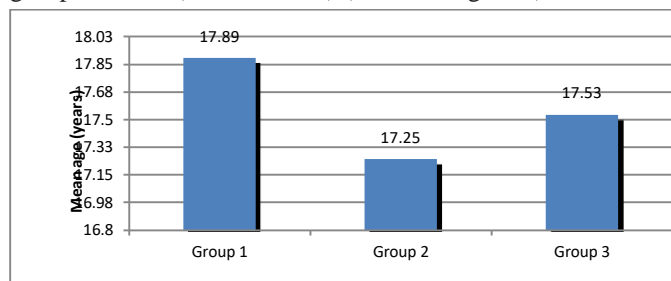
demonstrated persons with blood group O do not express a fucosylated variant in the precursor structure of epithelium and on the contrary, blood group A/B/AB show their respective antigens in spinous cells of the non-keratinized oral epithelium [11]. So, presence of a relation between pathologies and specificity of blood groups has been hypothesized as though some part of the blood group antigen can affect the overall organisation of tissues.

Figure 1- Inter-group comparison of mean age of cases studied.

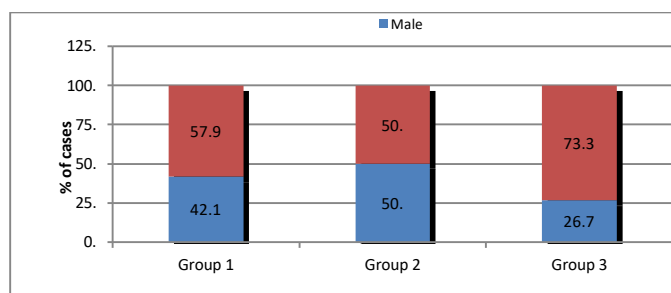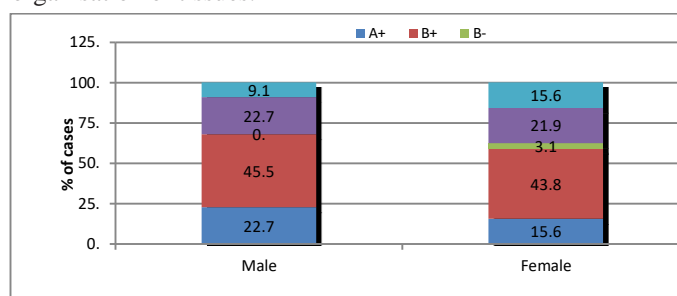**Figure 3-** Inter-gender distribution of blood groups.

Figure 2- Inter-group gender distribution of cases studied.

DISCUSSION

ABO expression is by producing antigens. The presence or absence of these antigens not only describes a person's blood
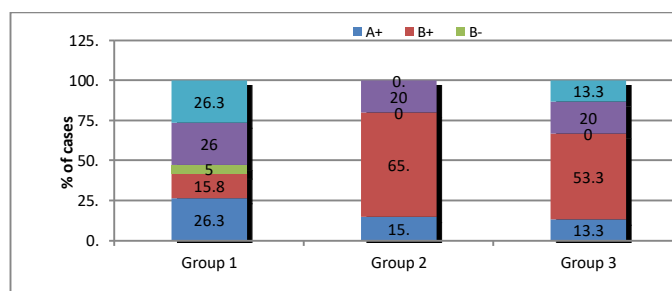

Figure 4- Inter-group distribution of blood group of cases studied.

Blood grouping is mainly used for blood transfusion but statistical correlation of blood groups and some specific diseases has been studied for a long time. Several studies have suggested that ABO blood groups are associated with developing manifestations of ischemic heart disease and atherosclerosis [12]. O blood group has been associated with 14% and 4% reduced risk of squamous cell carcinoma and

ABO blood groups and skeletal growth pattern. It was observed that blood group A+ is more prevalent in patients with a horizontal growth pattern. Blood group B+ is more prevalent in average and vertical growth patterns. Least occurrence was associated with blood group B- in all the three groups studied. Comparison between studies similar to ours couldn't be done because of the lack of evidence relating to this matter but a genetic predisposition can be suspected.

Table 4: Inter-group distribution of blood group of cases studied									
	Group 1 (n=57)		Group 2 (n=60)		Group 3 (n=45)		P-value (Inter-Group)		
Blood Group	n	%	n	%	n	%	Group 1 v Group 2	Group 1 v Group 3	Group 2 v Group 3
A+	15	26.3	9	15.0	6	13.3	0.012*	0.202[NS]	0.411[NS]
B+	9	15.8	39	65.0	24	53.3			
B-	3	5.3	0	0.0	0	0.0			
AB+	15	26.3	12	20.0	9	20.0			
O+	15	26.3	0	0.0	6	13.3			
Total	57	100.0	60	100.0	45	100.0			

P-value by Chi-Square test. P-value<0.05 is considered to be statistically significant. *P-value<0.05, NS-Statistically non-significant.

basal cell carcinoma, respectively. Its association with reduced risk of pancreatic cancer has also been reported [13]. According to Glass et al, blood group O individuals show increased risk of infection with cholera [14].

A large number of studies in medicine have associated blood groups with various diseases but its correlation in dentistry has limited research. Only a few studies have been reported correlating blood groups and oral diseases [15]. Kaslick et al in 1971 had shown an association of periodontitis with blood grouping [16]. Subjects with blood group O+ have been linked with increase incidence of periodontitis [17]. According to Gheisari et al, among different blood groups, blood group B has been significantly associated with maxilofacial deformities whereas blood group A has least prevalence [3]. According to Sharma et al, prevalence of malocclusion was seen highest in blood group B and AB having the least prevalence [15]. Shokor et al had conducted a study evaluating craniofacial morphology with ABO blood group to find a genetic correlation in Malaysian population and he concluded that no association could be appreciated, thus, prediction of malocclusion with blood grouping is not possible [18].

Our study was undertaken to find an association between

On associating differences in males and females, our study showed no statistically significant difference within the three groups which was in contradiction to the study done by Tariq et al who had suggested that a gender association exists between the various classes of malocclusion and blood grouping [8].

CONCLUSION

From the findings of this study, it is concluded that:

- A correlation may exist between vertical facial growth patterns and ABO blood grouping system.

- A+ blood group is more prevalent in horizontal growth pattern and B+ is more prevalent in vertical and average growth patterns.

- B- blood group is least associated with vertical skeletal facial growth patterns.

Multicentric studies are required with larger sample size representing various groups of population to validate the findings of this study.

REFERENCES

1.   Agarwal SS, Jayan B, Chopra SS. An Overview of

Malocclusion in India. J Dent Health Oral Disord Ther. 2015;3:560-1.

2. Panhalkar P. Prevalence of malocclusion among school children in western Maharashtra. Int J Appli Dent Sci. 2018;4: 39-44.

3. Gheisari R, Ghoreishian M. The association between blood groups and maxillofacial deformities. Indian J Plast Surg. 2008;41:138-40.

4. Mossey PA. The heritability of malocclusion: part 2. The influence of genetics in malocclusion. Br J Orthod. 1999;26: 195-203.

5. Daniel G. Human blood groups. 2nd ed. Oxford: Blackwell; 2002. p. 3-8.

6. Silva KCP, Messias TS. Male individuals with Robin Sequence: emerging significant association with ABO and RhD blood group phenotypes. Hematol Transfus Cell Ther. 2018;40:354–7.

7. Reid ME, Denomme GA. DNA-based methods in the immunohematology reference laboratory. Transfus Apher Sci. 2011;44:65–72.

8. Tariq B, Habib K, Riaz S, Ilyas M. Gender wise association between dental malocclusion classes and ABO blood group system. Dentistry. 2019;9: 4-8.

9. Weber R, Pastern W. Uber die Frage der konstitutionellen Bereitschaft zur sog Alveolar-pyorrhoe. Dtsch Mschr Zahnerlk. 1927;45:704-9.

10. Tweed, Charles H. Frankfort-Mandibular Plane Angle in orthodontic diagnosis, classification, treatment planning and prognosis: Am J Orthod Oral Surg: 1946;32:175-221.

11. Greenwalt TJ. A short history of transfusion medicine. Transfusion 1997;37:550-63.

12. Akhund IA, Alvi IA, Ansari AK, Mughal MA, Akhund AA. A study of relationship of ABO blood groups with myocardial infarction and angina pectoris. J Ayub Med Coll Abbottabad 2001;13:25-6.

13. Wolpin BM, Kraft P, Gross M, Helzlsouer K, Bueno-de-Mesquita HB, Steplowski E. Pancreatic cancer risk and ABO blood group alleles: Results from the pancreatic cancer cohort consortium. Cancer Res 2010;70:1015-23.

14. Glass RI, Holmgren J, Haley CE, Khan MR, Svennerholm AM, Stoll BJ.Predisposition for cholera of individuals with O blood group. Possible evolutionary significance. Am J Epidemiol 1985;121:791-6.

15. Sharma R, Preethi PN, Nagarathna C, Navin HK. Association of ABO blood groups with malocclusion in population of Jaipur, India: A Prospective Study. Int J Sci Stud 2015;2:45-51.

16. Kaslick RS. Investigation of periodontosis with periodontitis: Literature survey and findings based on ABO blood groups. J Periodont 1971;42:420-7.

17. Vivek S, Jain J, Simon SP, Battur H, Supreetha S, Haridas R. Association of ABO blood group and Rh factor with periodontal disease in a population of Virajpet, Karnataka: A cross-sectional study. J Int Oral Health 2013;5:30-4.

18. Shokor FF. Craniofacial morphology with genetic influence of ABO blood Group in Malaysian orthodontic patients. Int J Pharma Bio Sci. 2015;6:412-8.