

The Relationship Between Dental Malocclusions, Fingerprints and Blood Group in Patients attending Orthodontic Clinic in Benin City

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ABSTRACT

Background: Literature evidence suggests a relationship between dermatoglyphic patterns, blood group system and the development of dental malocclusion. The wide variations observed have been suggested to be due to genetic and environmental influences. More research to ascertain the relationship between malocclusion with fingerprints and blood group in Nigerians is essential. The objective of the study was to assess the relationship between dental malocclusion with fingerprints and blood group in a Nigerian population.

Methods: A total of 205 patients, aged 13-40 years, attending the Orthodontic clinic of the University of Benin Teaching Hospital, Benin City who met the inclusion criteria were selected. Their dental malocclusion was determined using Angle's classification, Fingerprints of both hands were taken using a Bio scanner, while blood samples were collected to determine their ABO blood group. Fingerprint patterns of arches, loops and whorls were assessed and grouped.

Results: More than half of the patients (62.0%) had Angle's Class I malocclusion. The fingerprint patterns of left thumb, right thumb and right index finger had significant relationship with the different classes of dental malocclusion ($P = <0.001, 0.009$ and 0.0410) respectively. However, there was no significant association between blood group and dental malocclusion.

Conclusion: There is a relationship between dermatoglyphic pattern and dental malocclusion. No significant relationship was found between dental malocclusion and blood group. Dermatoglyphic patterns of some digits show predictive values when compared to others.

Keywords: Dental, blood group, fingerprint, malocclusion

INTRODUCTION

Malocclusion may be defined as a significant deviation from what is defined as normal or ideal occlusion (Houston et al., 1992; Daskalogiannakis 2000; Kaur et al., 2016,). The aetiology of dental malocclusion is multifactorial and independent, which makes classification and systematization of malocclusion even more complex and difficult (Petrovi et al., 2013). It ranges from environmental and functional factors to hereditary factors

(Hassan & Rahimah, 2007). Oral habits, hormonal disorders, trauma and disease, early loss of first permanent molars or premature loss of deciduous incisors also play a role in malocclusion (Sharma, 2015).

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At present, malocclusions are ranked third in order of priorities among the problems of dental public health worldwide (Rasool et al., 2016). It is estimated that approximately 1.2 million people in the United States have an extreme dentoskeletal anomaly (Nishio & Huynh, 2016). Approximately 60% have a class II malocclusion, 25% have a class III malocclusion, and around 15% have a mix of dentoskeletal irregularities (Adnan & Koshak 2017). Class III malocclusion is thought to be one of the most complex as well as challenging orthodontic problems to deal with. The prevalence of class III malocclusion in North Indian population is up to 3.4% while the prevalence of class III malocclusion in Caucasians varies from 0.8 to 4.0% and rises to 13% in Japanese and Chinese populaces (Adnan & Koshak 2017). In a study by daCosta, a prevalence of Angle's class I malocclusion was 84.0%, Angle's class II malocclusion was 1.7% while 2.0% had Angle's class III malocclusion among school children in Northern Nigeria (daCosta, 1999). In South-western Nigeria Onyeaso found that Class I malocclusions was 50%, 14% had Class II malocclusions, while 12% had Class III malocclusion (Onyeaso, 2004). The orthodontist must have sound knowledge of dental occlusion and the underlying skeletal relationship of the patient to arrive at correct diagnosis and treatment plan for the malocclusion (Rasool et al., 2016). Dermatoglyphic investigation being convenient, inexpensive and non-invasive, has been applied in many fields including dentistry as a diagnostic tool to unveil genetic factors related to many oral diseases (George et al., 2017). And also, for exploring the genetic associations of malocclusion (Jindal 2015). A study by Reddy et al found a significant association between different malocclusions and specific types of ridge pattern (Reddy et al 2013). The ulnar loop pattern was predominant in subjects with all types of malocclusions, high frequencies of plain arches and whorls were found in subjects with classes III and II malocclusions (Jindal, 2015). Research using dermatoglyphics to predict and compare malocclusions (class I, class II division 1, division 2 and class III malocclusions) found the craniofacial class II divisions 1 and 2 malocclusion patterns were associated with an increased frequency of arch type and ulnar loop type and a decreased frequency of whorl type (Reddy et al., 1997; George 2017). Kaur et al reported a relationship between dermatoglyphics and dental malocclusion, which showed that ulnar loop fingertip pattern was common in children with ideal occlusion (73.3%) while the whorl fingertip pattern was commoner in

children with class II malocclusion (49.38%) (Kaur et al., 2016). Another study reported a statistically significant association between dermatoglyphic patterns of the left hand first digit (thumb) and type of dental malocclusion among young adult Malaysians. Class III malocclusion and class I normal occlusion were predominantly seen in subjects with loop patterns in their left thumb, while high frequency of whorl pattern was observed in subjects with class I malocclusion (Shetty et al 2019). Several dermatoglyphic findings claim a very high degree of accuracy in their prognostic ability from the dermal features (Divyashree et al., 2016). Dermatoglyphic patterns are relevant to orthodontics because they share the developmental time during the intrauterine period, with the development and completion of dental hard tissue and jaw bases (Charles et al., 2018). Dermatoglyphic analysis can be used as an indicator of malocclusion at an early age, during the growth periods of a developing malocclusion that will aid the development of treatment to establish favourable occlusion (Kaur et al., 2016). It will also help to intercept the malocclusion before it attains severe form (Divyashree, et al 2016). The relationship between the ABO blood group system and some oral diseases has been one of the most important human genetic traits (Al-Khatieeb et al., 2018). The strongest association between ABO blood group system and malocclusion was reported to be highest in blood group B, and least in blood group AB (Sharma et al., 2015). The strongest association between ABO blood group system and malocclusion was reported to be highest in blood group B, and least in blood group AB (Sharma et al., 2015; Tariq et al 2019). Dermatoglyphic and ABO blood group studies done in association with malocclusion yielded diverse results, which could be due to the fact that numerous other factors such as ethnic and racial variations, congenital, environmental and other local factors can also influence the development of malocclusions (Greenberg, 2002; Fathin et al., 2015; Karthick et al., 2015; Nishio & Huynh 2016). More research is essential to ascertain the relationship between dental malocclusion with fingerprints and the blood groups in Nigerian population. This study is relevance to the field of orthodontics particularly in preventive and interceptive orthodontics, for early diagnosis and correction of deviated growth patterns of the jaws. The objective of this study was to assess the relationship between fingerprint pattern and blood group with dental malocclusion in Nigerians.

MATERIALS AND METHODS

Study design: This was a prospective cross-sectional study.

Study population and location: Patients seeking orthodontic treatment between the ages 13 to 40 years old that met the selection criteria. The study was carried out in Orthodontic clinic of the Department of Orthodontics, University of Benin Teaching Hospital, Benin City.

Inclusion criteria:

1. Patients with no history of orthodontic treatment.
2. Patients aged 13 years to 40 years old.
3. All patients that attended orthodontic clinic, who gave written informed consent to participate in the study.
4. Patients without periodontal disease that may affect the positioning of the teeth.
5. Patients with full complement of teeth, excluding third molars.
6. All subjects were of Nigerian descent.

Exclusion criteria:

1. Patients with malformation syndromes or other craniofacial abnormalities associated with maxilla and mandible, patients with facial asymmetry and acquired skeletal defects.
2. Patients with congenital or acquired deformities of the fingers and amputated fingers.
3. Patients with skin diseases, with wound or scars on the fingers.
4. Patients with periodontal condition that may affect the positioning of the teeth.
5. Patients with previous extraction of teeth particularly first molar.

Sample size determination and selection

The sample size was calculated using quantitative

data formula: $n = \left[z \frac{\alpha}{2} \sigma \right]^2 = [13.62]^2 = 185.55 = 186$

Where n is the sample size, a 95% degree of confidence interval corresponds to $\alpha=0.05$, z the standard normal deviation, E the margin of error $E=1$ and standard deviation=6.95 (George et al., 2017).

SAMPLE COLLECTION AND EVALUATION

The procedure was explained to the patients and a written informed consent was obtained from them or their parents or caregiver with due consideration to ethical issues and confidentiality of blood group and fingerprint records. Every patient was examined clinically on a dental chair by the researcher using mouth mirror and probe. The dental malocclusion was determined using Angle's classification.

The fingerprints recording was done by the researcher, the hands of the subjects were cleaned by the researcher with soap and water and dried with sterile gauze. The impression of individual digits was made by placing the bulb of the digits onto the surface of the bioscanner. The fingerprints were recorded with IBS software and analyzed using the classification by Galton in 1892 (Greenberg 2002; Kaur et al., 2016).

The blood test of the individual was done to determine their ABO blood group by the researcher in conjunction with a medical laboratory scientist (Gupta, 2018). Using antisera, A, B and D with blood sample from the participants. The presence of agglutination with antiserum A confirmed blood group A. The presence of agglutination with antiserum B confirmed blood group B. The absence of agglutination on both antisera A and B confirmed blood group O and the presence of agglutination on both antisera A and B confirmed blood group AB. The presence of agglutination with antiserum D confirmed Rhesus positive blood group. The absence of agglutination with antiserum D confirmed Rhesus negative blood group. The patient's blood group was determined and recorded on a data collection form.

Data analysis

Statistical Package for Social Sciences (SPSS) version 21.0 was used for analysis at 95% confidence interval and test for significance set at ($p<0.05$). The data was initially entered into Microsoft Excel windows 2008 package. They were checked for correctness and exported to the SPSS program. For this study, the independent variables were fingerprints and blood group while the dependent variable was dental malocclusion. Frequency tables and figures with percentages were used to present both independent and dependent variables. The relationships between the independent and dependent variables were assessed using the Pearson Chi-square and Fishers exact test (as appropriate) for associations between categorical variables, and the Kendall's tau-b test for correlation of ordinal variables. For the purpose of regression analysis, a model was created to predict more severe degrees of malocclusion (defined as Angel's class II and III) by multivariate logistic regression using variables that demonstrated p-values <0.10 on bivariate testing.

Ethical considerations

Ethical approval (protocol number: ADM/E22/A/VOL. VII/14682) for this study was obtained from the Ethics and Research Committee, University of Benin Teaching Hospital, Benin City, Edo State, Nigeria. Informed consent was obtained

from study participants or their parents/ caregiver for minors; by filling the informed consent form and the minor gave assent before they were recruited into the study.

RESULTS

Sociodemographic characteristics

A total of 205 participants were examined and among them, 121 (59.0%) were females and 84 (41.0%) were males. The mean age was 24.86 ± 7.02 and the age ranged from 13 – 40 years and the most common age group was 21 – 25 years (28.8%). Majority of the patients had blood group O 143 (69.8%); the ulnar loop was the most common dermatoglyphic pattern 1266 (61.8%) while the Angle’s class I 127(62.0%) was the most common dental malocclusions.

Association of dermatoglyphic patterns according to Angle’s malocclusion types are shown in Table 2. Arch was most seen in the left fifth finger, thumb and right fifth finger of individuals with Angle’s

class I malocclusion. left index and middle finger of individuals with Angle’s class III malocclusion. Radial loop was most seen in the left index finger and right index finger of individuals with Angle’s class I and III respectively. However, it was absent in the left fifth finger, left middle finger, right fourth finger and right thumb of individuals with Angle’s class II or III. Ulnar Loop pattern was most seen in the right fifth finger, left fifth finger and right middle finger of participants having Angle’s Class I malocclusion. Whorl pattern was seen more in the right thumb finger of individuals with Angle’s Class II, right fourth finger of individuals with Angle’s Class I malocclusion, left thumb and index finger of individuals with Angle’s Class III. Significant association exists between Angle class III malocclusion with whorl pattern of left thumb (p = 0.004) and ulnar loop of right thumb (p = 0.008). Ulnar loop pattern of right index finger (p = 0.041) is associated with Angle class I malocclusion.

Table 1: Distribution of patients’ characteristics

Characteristics	Frequency (N = 205)	(%)
Age group (in years)		
13 – 15	16	7.8
16 – 20	46	22.4
21 – 25	59	28.8
26 – 30	41	20.0
31 – 35	19	9.3
36 – 40	24	11.7
Gender		
Male	84	41.0
Female	121	59.0
Blood group		
A	29	14.1
B	24	11.7
AB	9	4.4
O	143	69.8
Rhesus 'D' factor		
Positive	187	91.2
Negative	18	8.8
Dermatoglyphic pattern (*N=2,050)		
Arch	210	10.2
Radial loop	71	3.5
Ulnar loop	1266	61.8
Whorl	503	24.5
Angle’s classification		
I	127	62.0
II	29	14.1
III	49	23.9

When considered in categories, the ulnar loop pattern was the commonest among all classes of dental malocclusion. The proportion of participants with a whorl fingerprint pattern on the left thumb appeared to increase as the class of dental malocclusion increased. This relationship

was confirmed on the Kendall’s tau-b test which demonstrated a weak positive correlation of fingerprint patterns of the left thumb with increasing classes of dental malocclusion which was statistically significant ($\tau_b = 0.136$, $p = 0.029$). There were a greater proportion of arch patterns

(50%) in the left ring finger than whorls (18%) in Angle's class III compared to those in Angle's class I (35.7% vs 70%, respectively), even though this was not statistically significant ($p=0.105$). However, overall, there appeared to be a weak negative correlation of fingerprint patterns of the left ring finger with increasing classes of dental malocclusion that was statistically significant ($\tau_b = -0.151$, $p = 0.024$). The fingerprint patterns on the other digits of the left hand did not appear related to the classes of dental malocclusion in the study participants ($p>0.05$).

In the right hand, all participants with a radial loop on their thumbs had Angle's class I dental

malocclusion and there were significantly more radial loops than other fingerprint patterns in that class ($p=0.008$). Also, an overall weak, but positive correlation of fingerprint patterns of the right thumb with increasing classes of dental malocclusion was observed, and this was statistically significant ($\tau_b = 0.140$, $p=0.016$). There was a decrease in proportion of whorl pattern of the right ring finger as the class of Angle's malocclusion increased which demonstrated a weak negative correlation of fingerprint patterns of the right ring finger with increasing classes of dental malocclusion which was statistically significant ($\tau_b = -0.137$, $p = 0.025$) (Table 3)

Table 2: Association between finger dermatoglyphic patterns and dental malocclusion

Name	Pattern	class I	class II	class III	P-value
Left fifth finger	Arch	6 (4.7)	0 (0)	0 (0)	0.132
	radial loop	2 (1.6)	0 (0)	0 (0)	
	ulnar loop	105 (82.7)	23 (79.3)	47 (95.9)	
	Whorl	14 (11.0)	6 (20.7)	2 (4.1)	
Left fourth finger	Arch	5 (3.9)	2 (6.9)	7 (14.3)	0.105
	radial loop	4 (3.1)	0 (0)	4 (8.2)	
	ulnar loop	83 (65.4)	21 (72.4)	29 (59.2)	
	Whorl	35 (27.6)	6 (20.7)	9 (18.4)	
Left index finger	Arch	19 (15.0)	6 (20.7)	11 (22.4)	0.095
	radial loop	4 (3.1)	0 (0)	0 (0)	
	ulnar loop	79 (62.2)	19 (65.5)	27 (55.1)	
	Whorl	25 (19.7)	4 (13.8)	11 (22.4)	
Left middle finger	Arch	19 (15.0)	6 (20.7)	11 (22.4)	0.681
	radial loop	4 (3.1)	0 (0)	0 (0)	
	ulnar loop	79 (62.2)	19 (65.5)	27 (55.1)	
	Whorl	25 (19.7)	4 (13.8)	11 (22.4)	
Left thumb	Arch	25 (19.7)	2 (6.9)	6 (12.2)	0.004
	radial loop	3 (2.4)	5 (17.2)	0 (0)	
	ulnar loop	57 (44.9)	8 (27.6)	19 (38.8)	
	Whorl	42 (33.1)	14 (48.3)	24 (49.0)	
Right fifth finger	Arch	7 (5.5)	0 (0)	0 (0)	0.109
	radial loop	0 (0)	0 (0)	2 (4.1)	
	ulnar loop	108 (85.0)	27 (93.1)	45 (91.8)	
	Whorl	12 (9.4)	2 (6.9)	2 (4.1)	
Right fourth finger	Arch	3 (2.4)	3 (10.3)	2 (4.1)	0.133
	radial loop	2 (1.6)	0 (0)	0 (0)	
	ulnar loop	80 (63.0)	20 (69.0)	38 (77.6)	
	Whorl	42 (33.1)	6 (20.7)	9 (18.4)	
Right index finger	Arch	15 (11.8)	5 (17.2)	8 (16.3)	0.041
	radial loop	6 (4.7)	4 (13.8)	5 (16.3)	
	ulnar loop	71 (55.9)	12 (41.4)	16 (32.7)	
	Whorl	35 (27.6)	8 (27.6)	17 (34.7)	
Right middle finger	Arch	11 (8.7)	7 (24.1)	5 (10.2)	0.050
	radial loop	0 (0)	0 (0)	1 (2.0)	
	ulnar loop	102 (80.3)	20 (69.0)	33 (67.3)	
	Whorl	14 (11.0)	2 (6.9)	10 (20.4)	
Right thumb	Arch	19 (15.0)	3 (10.3)	1 (2.0)	0.008
	radial loop	7 (5.5)	0 (0)	0 (0)	
	ulnar loop	55 (43.3)	8 (27.6)	28 (57.1)	
	Whorl	46 (36.2)	18 (62.1)	20 (40.8)	

Fisher's exact test

Most of the individuals with blood group A (62.0%), blood group B (54.0%), AB (56.0%) as well as blood

group O (64.0%) had Angle's class I malocclusion. There was no statistically significant association

between blood group and dental malocclusion ($p = 0.120$) in Table 4

Table 5; In terms of the Rhesus, most of the individuals who were positive (61.5%) had Angle's class I malocclusion; Angle's class I malocclusion was equally dominant in individuals with negative rhesus (66.7%). there was no statistically

significant association between rhesus and Angle's malocclusion ($p = 1.000$).

Most of the participants had blood group O, with the least blood group being blood group AB. There was no significant association between the study participants' Angle's malocclusion across their ABO blood groups ($p = 0.120$).

Table 3: Correlation of dermatoglyphic patterns of study participants with categories of dental malocclusion

Digit	Dermatoglyphic Pattern	Angle's class I $N=127$ n (%)	Angle's class II $N=29$ n (%)	Angle's class III $N=49$ n (%)	Kendall's tau (τ_b)	p-value
Left Thumb	Arch	25 (19.7)	2 (6.9)	6 (12.2)	0.139	0.024
	radial loop	3 (2.4)	5 (17.2)	0 (0)		
	ulnar loop	57 (44.9)	8 (27.6)	19 (38.8)		
	Whorl	42 (33.1)	14 (48.3)	24 (49.0)		
Left Index finger	Arch	20 (15.7)	1 (3.4)	11 (22.4)	0.011	0.862
	radial loop	10 (7.9)	6 (20.7)	3 (6.1)		
	ulnar loop	57 (44.9)	13 (44.8)	16 (32.7)		
	Whorl	40 (31.5)	9 (31.0)	19 (38.8)		
Left Middle finger	Arch	19 (15.0)	6 (20.7)	11 (22.4)	-0.028	0.675
	radial loop	4 (3.1)	0 (0)	0 (0)		
	ulnar loop	79 (62.2)	19 (65.5)	27 (55.1)		
	Whorl	25 (19.7)	4 (13.8)	11 (22.4)		
Left Ring finger	Arch	5 (3.9)	2 (6.9)	7 (14.3)	-0.151	0.024
	radial loop	4 (3.1)	0 (0)	4 (8.2)		
	ulnar loop	83 (65.4)	21 (72.4)	29 (59.2)		
	Whorl	35 (27.6)	6 (20.7)	9 (18.4)		
Left Fifth finger	Arch	6 (4.7)	0 (0)	0 (0)	0.032	0.57
	radial loop	2 (1.6)	0 (0)	0 (0)		
	ulnar loop	105 (82.7)	23 (79.3)	47 (95.9)		
	Whorl	14 (11.0)	6 (20.7)	2 (4.1)		

Table 3: Correlation of dermatoglyphic patterns of study participants with categories of dental malocclusion (contd.)

Digit	Dermatoglyphic Pattern	Angle's class I $N=127$ n (%)	Angle's class II $N=29$ n (%)	Angle's class III $N=49$ n (%)	Kendall's tau (τ_b)	p-value
Right Thumb	Arch	19 (15.0)	3 (10.3)	1 (2.0)	0.140	0.016
	radial loop	7 (5.5)	0 (0)	0 (0)		
	ulnar loop	55 (43.3)	8 (27.6)	28 (57.1)		
	Whorl	46 (36.2)	18 (62.1)	20 (40.8)		
Right Index finger	Arch	15 (11.8)	5 (17.2)	8 (16.3)	-0.046	0.448
	radial loop	6 (4.7)	4 (13.8)	5 (16.3)		
	ulnar loop	71 (55.9)	12 (41.4)	16 (32.7)		
	Whorl	35 (27.6)	8 (27.6)	17 (34.7)		
Right Middle finger	Arch	11 (8.7)	7 (24.1)	5 (10.2)	0.001	0.988
	radial loop	0 (0)	0 (0)	1 (2.0)		
	ulnar loop	102 (80.3)	20 (69.0)	33 (67.3)		
	Whorl	14 (11.0)	2 (6.9)	10 (20.4)		
Right Ring finger	Arch	3 (2.4)	3 (10.3)	2 (4.1)	-0.137	0.025
	radial loop	2 (1.6)	0 (0)	0 (0)		
	ulnar loop	80 (63.0)	20 (69.0)	38 (77.6)		
	Whorl	42 (33.1)	6 (20.7)	9 (18.4)		
Right Fifth finger	Arch	7 (5.5)	0 (0)	0 (0)	-0.030	0.623
	radial loop	0 (0)	0 (0)	2 (4.1)		
	ulnar loop	108 (85.0)	27 (93.1)	45 (91.8)		
	Whorl	12 (9.4)	2 (6.9)	2 (4.1)		

A Kendall's tau-b correlation was run to determine the relationship between ABO blood group and dental malocclusion in the study participants. A weak, negative and statistically nonsignificant correlation was found between ABO blood group and dental malocclusion. ($\tau_b = -0.050$, $p = 0.451$). Most of the participants were Rhesus positive.

Dental malocclusion related negatively and weakly with rhesus antigen positivity, though this was not statistically significant ($\tau_b = -0.020$, $p = 0.703$). (Table 6). Further analyses were carried out to explore prediction of dental malocclusion in this cohort (Table 7).

Table 4: Association between ABO Blood Group and Dental Malocclusion

Characteristics	Angles molar relationship			Total n (%)	Fisher's exact p-value ¹
	class I n (%)	class II n (%)	class III n (%)		
ABO Blood group					0.12
Blood group A	18 (62.0)	3 (10.0)	8 (28.0)	29 (100.0)	
Blood group B	13 (54.2)	2 (8.3)	9 (37.5)	24 (100.0)	
Blood group AB	5 (56.0)	4 (44.0)	0 (0.0)	9 (100.0)	
Blood group O	91 (64.0)	20 (14.0)	32 (22.0)	143 (100.0)	
Total	127 (62.0)	29 (14.0)	49 (24.0)	205 (100.0)	

Table 5: Association between Rhesus Blood Group and Dental Malocclusion

Characteristics		Angles molar relationship			Total n (%)	Fisher's exact test p-value ¹
		class I n (%)	class II n (%)	class III n (%)		
Rhesus group	Blood					1.000
Positive		115(61.5)	27(14.4)	45(24.1)	187(100.0)	
Negative		12 (66.7)	2 (11.1)	4 (22.2)	18 (100.0)	
Total		127 (62.0)	29 (14.0)	49 (24.0)	205(100.0)	

Table 6: Correlation of participants' blood groups with categories of angle's malocclusion

Blood Group	Angle's class I N=127 n (%)	Angle's class II N=29 n (%)	Angle's class III N=49 n (%)	Kendall's tau (τ_b)	p-value
A	18 (14.2)	3 (10.3)	8 (16.3)	-0.050	0.451
B	13 (10.2)	2 (6.9)	9 (18.4)		
AB	5 (3.9)	4 (13.8)	0 (0)		
O	91 (71.7)	20 (69.0)	32 (65.3)		
Rhesus D pos	115 (90.6)	27 (93.1)	45 (91.8)	-0.025	0.703
Rhesus D neg	12 (9.4)	2 (6.9)	4 (8.2)		

Variables that demonstrated a p-value of <0.10 in bivariate analysis were selected and put in a model to predict higher classes of dental malocclusion. They included the ABO blood group, left thumb, index and ring fingers and right thumb, index, ring and fifth fingers. After adjusting for confounders, an ulnar loop fingerprint pattern on the left index finger and right index and ring fingers, independently predicted higher classes of dental malocclusion.

Those with ulnar loops on their left index fingers had 5.4 times the odds of higher classes of dental

malocclusion compared to a whorl pattern (OR – 5.4, 95% CI: 1.4 – 20.7). Similarly, the odds of higher classes of dental malocclusion were about 5 times those with the ulnar loop than those with a whorl fingerprint pattern on their ring fingers (OR – 4.9, 95% CI: 1.6 – 15.5). Conversely, possessing an ulnar loop pattern compared to a whorl pattern on the right index finger independently predicted a lower class of dental malocclusion (OR – 0.16, 95%CI: 0.04 – 0.60) (Table 7)

Table 7: Multivariate analysis of predictors of dental malocclusion in study participants

Variable	Adjusted Odds Ratio	95% Confidence Interval	p-value
ABO Blood Group			
A	0.59	0.21 – 1.67	0.315
B	1.19	0.47 – 3.05	0.715
AB	2.36	0.44 – 12.79	0.320
O	1.000		
Left thumb			
Arch	2.01	0.31 – 12.89	0.460
Radial loop	8.03×10^8	0.00 – ∞	0.999
Ulnar loop	0.49	0.18 – 1.35	0.167
Whorl	1.000		
Left index finger			
Arch	2.26	0.30 – 16.87	0.425
Radial loop	1.44	0.31 – 6.79	0.641
Ulnar loop	5.43	1.43 – 20.67	0.013
Whorl	1.000		
Left ring finger			
Arch	4.80×10^8	0.00 – ∞	0.998
Radial loop	0.91	0.11 – 7.55	0.934
Ulnar loop	0.35	0.12 – 1.08	0.068
Whorl	1.000		
Right thumb			
Arch	0.00	0.00 – ∞	0.998
Radial loop	0.00	0.00 – ∞	0.999
Ulnar loop	1.36	0.51 – 3.65	0.540
Whorl	1.000		
Right index finger			
Arch	0.23	0.02 – 2.67	0.237
Radial loop	1.72	0.37 – 7.92	0.487
Ulnar loop	0.16	0.04 – 0.60	0.006
Whorl	1.000		
Right ring finger			
Arch	5.27×10^9	0.00 – ∞	0.999
Radial loop	0.00	0.00 – ∞	0.999
Ulnar loop	4.92	1.56 – 15.49	0.006
Whorl	1.000		
Right fifth finger			
Arch	0.00	0.00 – ∞	0.998
Radial loop	1.62×10^9	0.00 – ∞	0.999
Ulnar loop	0.61	0.24 – 1.58	0.308
Whorl	1.000		

DISCUSSION

Genetic and environmental factors play a role in the development of malocclusion that can affect the general health of patients depending on its degree of severity (Prakash et al., 2020). The link between finger prints and dental occlusion is related to the development of dermal patterns which occurs during the same period as the development of dentition and the palate (Lakshmi, 2013). It is established that any factor active during, the critical time of genetic expression is bound to

affect all structures developing at that time (Lakshmi, 2013). Thus, the deviation from normal occlusion due to extraneous factors at the time of development could also reflect in the dermal patterns (Lakshmi, 2013). Both orofacial structures and the epidermal ridges are derivatives of ectoderm of the embryonic tissue (Prakash et al., 2020). Understanding this biology may play a role in early diagnoses and treatment plan, thereby decreasing the burden of the condition in orofacial region (Prakash et al., 2020).

This study assessed the relationship between dental malocclusions and fingerprints with blood group as against the background of the role of genetic and environmental factors in the development of malocclusion.

In this study, the patients were predominantly females which could be because females are more aesthetically conscious than males, and this agrees with other studies which have reported that females are more concerned about aesthetics (Monica & Getty 2018, Ndukwe 2022) and the patients were mostly within the age group of 21-25 years. Most of the individuals had Angle's class I malocclusion and the least being class II malocclusion. This is comparable with the study by daCosta on the prevalence of malocclusion among a population of Northern Nigerian school children (daCosta 1999). The most common dermatoglyphic pattern seen among study participants was ulnar loop, followed by whorl, arch and radial loop and is like previous findings in Nigeria by Mohammed et al in the Kanuri ethnic group. Also, Ujaddughe et al, in their assessment of dermatoglyphic patterns and sex distribution in Esan ethnic group of Edo state, observed that the loop pattern had the highest frequency followed by whorl, arch and double whorl (Ujaddughe et al 2015). These findings suggest a variable prevalence of fingerprint patterns in Nigerians. Blood group O and Rhesus positive were most predominant among the participants with AB and Rhesus negative being the least prevalent. This was in concordance with other studies done in Nigeria (Odokuma et al., 2007; Enosolease & Bazuaye 2008; Kooffreh et al 2015). who found Blood group O to be most prevalent and AB to be the least prevalent in the ABO blood group and Rhesus positive to be most prevalence in the Rhesus blood group system.

The ulnar loop was the most dominant pattern across all types of Angle's malocclusion. Arch was most seen in the left fifth finger, left thumb and right fifth finger of individuals with Angle's class I malocclusion. The left and right fifth fingers of individuals with Angle's class II or III did not have any arch pattern which contrasted with Reddy et al, (2013) who reported the absence of radial loops in class III groups as compared to other groups. A significant relationship was found between Angle's class III malocclusion with whorl pattern of left thumb and between Angle's class II malocclusion and whorl pattern of right thumb. The ulnar loop pattern of the right index finger was associated with Angle's class I malocclusion. Tikare et al. (2010) in contrast reported no association between dental malocclusion and dermatoglyphic patterns

although they noted high frequencies of whorl pattern in individuals with classes I and III malocclusions. The difference in these findings may be because of variations in sample size, differences in protocol for recording fingerprint patterns, ethnic and racial variations.

The ulnar loop pattern on the left index finger and right index and ring fingers, have showed a relationship between dermatoglyphic patterns and dental malocclusion. The presence of ulnar loop in comparison to whorl pattern on left index or right ring fingers was associated more with Angle's II and III classes of dental malocclusion. But the presence of ulnar loop on the right index finger when compared with whorl pattern was more associated with Angle's class I malocclusion. A similar association was found by Shetty et al (2019) but with the loop pattern of the left thumb in their study among Malaysian students. This association between dermatoglyphic patterns and dental malocclusion was also established in previous study by Alam et al, where they concluded that there was a significant association between dermatoglyphic patterns and malocclusion. Particularly, with an increased frequency of radial loops and arches in Class III malocclusion (Alam & Nahar, 2019).

There was no significant association between blood groups and dental malocclusion in this study. This finding agrees with Gupta's reports (2018) on association of ABO blood groups in India, where he found no association between ABO blood groups and occlusal pattern. It is also in contrast to the findings in other studies (Gheisari 2008; Sharma 2015; Tariq 2019; Gupta 2020) who found an association between ABO blood group and dental malocclusion. These findings suggest that a regional and racial basis in variation may play a role in the association of blood group and dental malocclusion.

The dermatoglyphic patterns of individuals remains constant throughout life, from birth till death and has been found to have a relationship with malocclusion although, requires more research to be done. This easy, accessible, inexpensive, useful, reliable, and non-invasive method may be a useful tool if employed in clinical settings to aid early assessment of risk for dental malocclusion. This might aid early preventive and interceptive orthodontic management of malocclusion if established, especially in developing countries with enormous populations and limited health budgets. In addition, the practice of routine recording of fingerprints of patients in the orthodontic clinic along with other

orthodontic records will go a long way in assisting forensic investigations and anthropology studies.

CONCLUSION

This study was able to show that there is a relationship between dermatoglyphic pattern with dental malocclusion. The whorl pattern of left thumb was associated with Angle's class III malocclusion, the whorl patterns of right thumb and ulnar pattern of right index finger were associated with Angle's class II malocclusion and Angle's class I malocclusion respectively. There was no significant relationship between blood group and dental malocclusion.

The dermatoglyphic patterns of some digits show predictive values, this relationship could be further studied in more races and in larger populations before being employed as a diagnostic aid for identifying malocclusion problems at an early age for timely orthodontic intervention.

RECOMMENDATION

The dermatoglyphic patterns show promise of being a predictive tool in dental malocclusion thus, more research in different races and in larger sample populations is needed to further determine the extent of its use. The inclusion of participants with normal occlusion in future studies will aid comparison as well as test the specificity and sensitivity of dermatoglyphic patterns as a tool.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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