Dermatoglyphic Pattern and Types of Malocclusion among Individuals visiting A Medical Institution of Nepal

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ABSTRACT

Introduction: Dermatoglyphics is the dermal ridge configuration of digits, palms and soles that might have a potential role in predicting the anomalies related to orofacial regions. The relation of fingerprint pattern with malocclusion is studied because the development of teeth and its associated structures coincide with the development of epidermal ridges during embryogenesis.

Objective: The objectives were to identify the dermatoglyphic pattern, types of malocclusion and to establish their association among individuals visiting a medical institution of Nepal.

Materials and Method: A cross-sectional study was conducted among 210 individuals of 16-24 years visiting a medical institution of Nepal. Oral examination for malocclusion and record of finger prints were done. Proportion and percentage of dermatoglyphic patterns and types of malocclusion were calculated. Chi-square test was done for determining the association of dermatoglyphic pattern with malocclusion using Statistical Package of Social Sciences (SPSS) version 20 software with significance level set at $P < 0.05$.

Result: Many individuals (92, 43.8%) had Angle's Class I, followed by Class II (83,39.5%) and Class III (35, 16.7%) malocclusion. Dermatoglyphic pattern commonly found was loop (1079), followed by whorl (785), and arch (236). Most of the individuals with class I and II malocclusion had at least one loop pattern than those with class III; their proportional difference being statistically significant (P=0.020).

Conclusion: The study concluded that Class I was the most common type of malocclusion among the study participants. The most predominant fingerprint was loop pattern and was associated with Class I and II malocclusion.

Keywords: Dermatoglyphic pattern; fingerprint; malocclusion.

INTRODUCTION

Dermatoglyphics is the study of ridge patterns of skin and their configurations on fingers, palms, and soles.[1] It is used as diagnostic and research tool in many fields as in identification of individuals by forensic experts and in association with various medical conditions.[2-6] Moreover, the association of fingerprint with dental conditions and pathologies like precancerous and cancerous lesions in the oral cavity,[7] dental caries,[8] and dental anomalies like

cleft lip and palate,[9] and malocclusion[10-11] have been established through various studies.

The development of teeth and its associated structures coincide with the development of epidermal ridges during the sixth to 13th week of intrauterine life. This forms the basis of studying the association of dental anomalies with fingerprint pattern.[12] Hereditary and environmental factors lead to deviation from normal occlusion that may also set off specific features in fingerprint thus reflecting the changes in dermal pattern.[13]

Studies have reported varying results of dermatoglyphic pattern in individuals with different malocclusion type in different countries.[10-11] Therefore, present study was carried out to identify the dermatoglyphic pattern and the type of malocclusion among individuals visiting a medical institution of Nepal. This study also attempts to establish association of dermatoglyphic pattern with different types of malocclusion.

MATERIALS AND METHOD

A cross-sectional study was conducted among 210 individuals including patients, visitors, staffs, students, and interns between the age group of 16-24 years visiting Kathmandu Medical College, Sinamangal and Duwakot, Nepal, from April to June 2020, after obtaining ethical approval. Convenience sampling technique was used for selecting the sample. The sample size was calculated with reference to the study done by Shetty et al,[14] using formula $n=Z^2pq/e^2$, where Z=1.96 at 95% confidence interval, p=prevalence (15.48%), q=100-p, e=permissible error (5%) and adding 5% of non-response rate.

Figure 1: Arch type.

Figure 2: Whorl type.

Figure 3: Loop type.

Informed consent was received from the participants before oral examination and record of finger prints. Individuals with all permanent teeth present in each arch (excluding third molars) were included. Those with previous history of orthodontic treatment in either arch or with a history of trauma or surgical procedures done in the orofacial region, and large coronal restorations that might have altered both coronal shape and size were excluded.

Intraoral examination was done to assess the types of malocclusion following Angle's classification according to which participants were grouped into Class I, Class II, and Class III malocclusion.[15] The fingerprints of both the hands of the participants were recorded by the ink and roller method as suggested by Cummins and Midlo.[16] At first, the hands of the participants were cleaned and dried. Then, duplicating ink was applied to the distal phalanges of all the fingers of both hands and the fingerprint impressions were obtained on a white proforma sheet with blocks for each finger. In this way, the fingerprints of all 10 fingers were recorded. In case of unsatisfactory prints, the procedure was repeated. The fingertip patterns were analysed according to the classical method and configurational types.[17] The impressions were assessed for fingerprint pattern such as arch (Figure 1), whorl (Figure 2) and loop (Figure 3) patterns. Arch pattern is composed of ridges which pass across the finger with slight bow distally with no triradii. The shape of whorl pattern area may be either circular or elliptical and have two triradii. The loop pattern possesses only one triradius. Twist site of ridges is called head of the loop. From the opposite extremity of the pattern, the ridges flow to the margin of digits.

The data obtained were entered in a Microsoft Excel Sheet and then subjected to statistical analysis. Proportion, percentage for dermatoglyphic patterns and malocclusion were calculated. Chi-square test was done to find out the association of dermatoglyphic pattern with malocclusion using Statistical Package of Social Sciences (SPSS) version 20 software with significance level set at $P < 0.05$.

RESULT

In the current study, 210 participants were examined and among them, 146 (69.5%) were females and 64 (30.5%) were males. The mean age of the participants was 21.88±4.11 years. Most of the individuals (92, 43.8%) had Angle's Class I malocclusion, followed by Class II (83, 39.5%) and Class III (35, 16.7%) malocclusion. Most common dermatoglyphic pattern seen in the study participants was loop (1079), followed by whorl (785) and arch (236). Frequency distribution of dermatoglyphic patterns according to malocclusion are shown in Table 1 and 2. Loop pattern was most commonly seen in the right middle finger of participants having Angle's Class II malocclusion. Whorl pattern was seen more in the right ring finger of individuals with Angle's Class I and arch pattern was seen commonly in left index finger in participants with Angle's Class I malocclusion. Most of the individuals with Angle's Class I and II malocclusion had at least one loop pattern than those with Angle's Class III and the proportional difference was statistically significant (P=0.020, Table 3).

Table 1: Frequency distribution of dermatoglyphic patterns according to malocclusion.

Type of pattern	Malocclusion (Angle's classification)	Digit I (Thumb)		Digit II (Index)		Digit III (Middle)		Digit IV (Ring)		Digit V (Little)	
		Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Loop	Class I	45	44	47	31	56	49	31	36	52	53
	Class II	50	41	37	36	69	58	45	44	64	60
	Class III	13	12	12	10	19	15	8	6	19	17
Whorl	Class I	37	36	28	38	25	30	53	50	36	37
	Class II	27	29	30	29	8	15	35	38	15	19
	Class III	17	16	15	15	11	17	25	26	14	14
Arch	Class I	10	12	17	23	11	13	8	6	4	2
	Class II	6	13	16	18	6	10	3	1	4	4
	Class III	5	7	8	10	5	3	2	3	2	4

Table 2: Distribution of dermatoglyphic patterns in study participants with different malocclusion types.

Dermatoglyphic pattern	Type of malocclusion (Angle's classification)			Total
	Class I n (%)	Class II n (%)	Class III n (%)	
Number of loop present	444 (41.1)	504 (46.7)	131 (12.2)	1079
Number of whorl present	370 (47.1)	245 (31.2)	170 (21.7)	785
Number of arch present	106 (44.9)	81 (34.3)	49 (20.8)	236

Table 3: Distribution of individuals according to their dermatoglyphic patterns and type of malocclusion.

Dermatoglyphic pattern	Status	Type of malocclusion (Angle's classification)			P value*
		Class I	Class II	Class III	
Loop	Present (at least one)	84 (43.3%)	81 (41.8%)	29 (14.9%)	**0.020**
	Absent	8 (50.0%)	2 (12.5%)	6 (37.5%)	
Whorl	Present (at least one)	74 (46.5%)	57 (35.8%)	28 (17.6%)	0.162
	Absent	18 (35.3%)	26 (51.0%)	7 (13.7%)	
Arch	Present (at least one)	36 (45.6%)	26 (32.9%)	17 (21.5%)	0.196
	Absent	56(42.7%)	57 (43.5%)	18 (13.7%)	

**Chi square test*

DISCUSSION

It is well established fact that the orofacial structures are under genetic control. Most of the craniofacial abnormalities are multifactorial produced by a combination of many genes interacting with the environment.[13] There may be variability in expression of malocclusion as a result of the interactions of genetic and environmental factors.[18] Both orofacial structures and the epidermal ridges are derived from ectoderm of the embryonic tissue.[19] The genetic message in the genome that may be either normal or abnormal, is interpreted during this critical time period and could be reflected through fingerprint pattern. Hence, the association between dermatoglyphics and orofacial anomalies and malocclusion can be shown.[20] Understanding this biology will aid progress toward effective treatment, prevention, thereby decreasing the burden of the condition of orofacial region.[19] This study was done to assess the types of malocclusion, dermatoglyphic patterns and establish their association in individuals visiting Kathmandu Medical College, Dental Hospital, Duwakot, Nepal.

In the present study, most of the individuals (92, 43.8%) had Angle's Class I malocclusion, followed by Class II (83, 39.5%) and Class III (35, 16.7%) malocclusion which is similar to the finding of another study done in Nepal[21] and in other countries like Saudi Arabia and Nigeria.[22,23] The dermatoglyphic pattern mostly seen in the study sample was loop (1079) followed by whorl (785) and arch type (236). This finding is comparable with other studies among individuals residing in different places of Kathmandu valley.[24,25] Similarly, studies done in Sri Lanka and Malaysia have reported the higher occurrence of loop and least of arch pattern.[26,27] According to a review done by Bhasin, the distribution of the frequencies of different finger patterns (in percentage) may be generalised among major population groups according to descending order as follows: Whorls: Mongoloids > American Indians > Europeans > Africans; Loops: Africans > Europeans > American Indians > Mongoloids; Arches: Africans > American Indians > Europeans > Mongoloids.[28]

In the current study, loop pattern was most commonly seen in the right middle finger of participants having Angle's Class II malocclusion. Whorl pattern was seen more in the right ring finger of individuals with Angle's Class I and arch pattern was seen commonly in left index finger in participants with Class I malocclusion. However, a study done in India by Shetty et al, Angle's Class III malocclusion (n = 23) was most frequently seen in individuals with loop ridge pattern in their left thumb, whereas Class I malocclusion (n = 20) was seen in individuals with whorl ridge pattern in their left thumb.[14] Two studies done in India by Reddy et al and Deepti et al observed more loop patterns in right little finger in participants with Angle's Class II malocclusion.[11,29]

In the present study, loop pattern was seen significantly associated with malocclusion (P=0.020). Most of the patients with Angle's Class I had loop pattern (84, 43.3%), followed by Class II (81, 41.8%) malocclusion. Very few individuals with Class III malocclusion (29, 14.9%) had at least one loop pattern in their phalanges. This finding was in contrast to a study done in India by Tikare et al, where whorl pattern was found to be significantly associated with Angle's Class I and III malocclusion.[30]

In this study, whorl and arch pattern were not significantly associated with type of malocclusion. However, in a study done in India by Deepti et al, loop and whorl pattern of finger print were equally distributed in all individuals with malocclusion.[29]

The limitations of the study are: comparable number of participants with Angle's Class I, II and III malocclusion were not included while selecting sample due to which the association established may be chance occurrence; prospective studies should be done for the establishment of dermatoglyphic markers of malocclusion. If the genetic component and individual susceptibility for malocclusion is known early in life, this could be helpful in planning the preventive and interceptive procedures.

CONCLUSION

The findings of this study concluded that the Angle's Class I was the most common type of malocclusion among the study participants. The most predominant fingerprint was loop pattern and was associated with Class I and II malocclusion. The results of present study provide insight into specific fingerprint patterns for malocclusion.

Conflict of Interest: None

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