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Dermatoglyphics and Malocclusion: An Assessment of Fingerprints with Malocclusion in School Children.

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Abstract: *Aim: The aim of this study is to compare, analyse and correlate the different classes of malocclusion and the patterns of finger tips. Materials and Methods: 100 students aged 13-16 years were clinically examined to determine the class of malocclusion based on Angle's classification. The fingerprint patterns of both right and left hand of each student were recorded and studied using the magnifying glass. Statistical analysis was done to analyse and correlate the findings. Results: An increased frequency of whorls was seen in students with Normal occlusion and Class 1 malocclusion whereas increased frequency of loops was found in students with Class 2 malocclusion. Class 3 malocclusion students had predominance of arches and whorls as compared to other classes of malocclusion Conclusion: A possible relation between dermatoglyphics and different types of malocclusion exists as seen in various studies. Further research with bigger sample size will produce a convincing result to link fingerprint patterns with malocclusion.*

Keywords: *Dermatoglyphics, Fingerprints, Angle's Classification, Malocclusion.*

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I. Introduction:

The term 'Dermatoglyphics' as defined by Cummins and Midlo refers to the detailed study of dermal ridges, its count and the study of prints of palms and soles.[1]

Volar pads form around 6th week of gestational stage and the ridges develop in relation to these volar pads. Appearing prominently around 12th week of intrauterine life and developing completely by 24th week of intrauterine life, these patterns of fingertips, palms and soles are genetically determined and multiple factors are affecting these patterns.[2]

There are three basic types of fingerprints: Whorls, Arches and Loops. Whorls: Homocentric design with most ridges making orbit around the core.Loops: Ridges curve around only on outermost end and flow to the brink of the finger. Depending upon the side brink on which the loop opens, it is called ulnar loop or radial loop.Arches: Ridges pass from one side to another with distally inclined wave.[3] (**Fig. 1**).

Whorl Loop Arch

Figure 1: Basic patterns found in the distal phalanges of the digits.

Unique fingerprint patterns can be considered as hereditary marker for dental diseases as both the enamel of tooth and epithelium of finger buds are derived from ectoderm and, both are created simultaneously in intrauterine life.[4]

Malocclusion is one of the widely reported dental/skeletal condition and its prevalence is high owing to the change in diet patterns, environmental factors and genetics of an individual.

Since the embryological development of both fingerprints and teeth occur during the same time (beginning around 6th week of intrauterine life), genetic factors affecting development exert similar effects on both these parameters of our study. Geographical and racial variations also affect the development of an individual but the genetic influence is more dominant during embryological development and hence a study comparing, correlating the dermatoglyphic patterns with different classes of malocclusion can be a useful predictor tool for children in early ages.

II. Materials and Methods:

The study was carried out in the schools which were located in cities like Gandhinagar, Jamnagar, and Amran town of Morbi district of Gujarat state.

Students were explained in detail about the study process and informed consent was obtained from the parents after explaining them the study procedure. Ethical clearance was obtained from institutional ethical committee of Karnavati School of Dentistry - Uvarsad, Gandhinagar.

Inclusion Criteria:

- Age 13 to 16 years
- All permanent teeth erupted in oral cavity
- No history of any orthodontic therapy

Exclusion Criteria:

- Students with mixed dentition or permanent teeth not fully erupted to occlusal plane level were excluded from study
- Students who had undergone any kind of prophylactic treatment in last 6 months were not included in this study.
- Students who had one class of malocclusion on one side and other class of malocclusion on opposite side were not included in this study.

100 students satisfying the sample selection criteria were examined for classes of malocclusion based on Angle's classification. (**Fig. 2**).

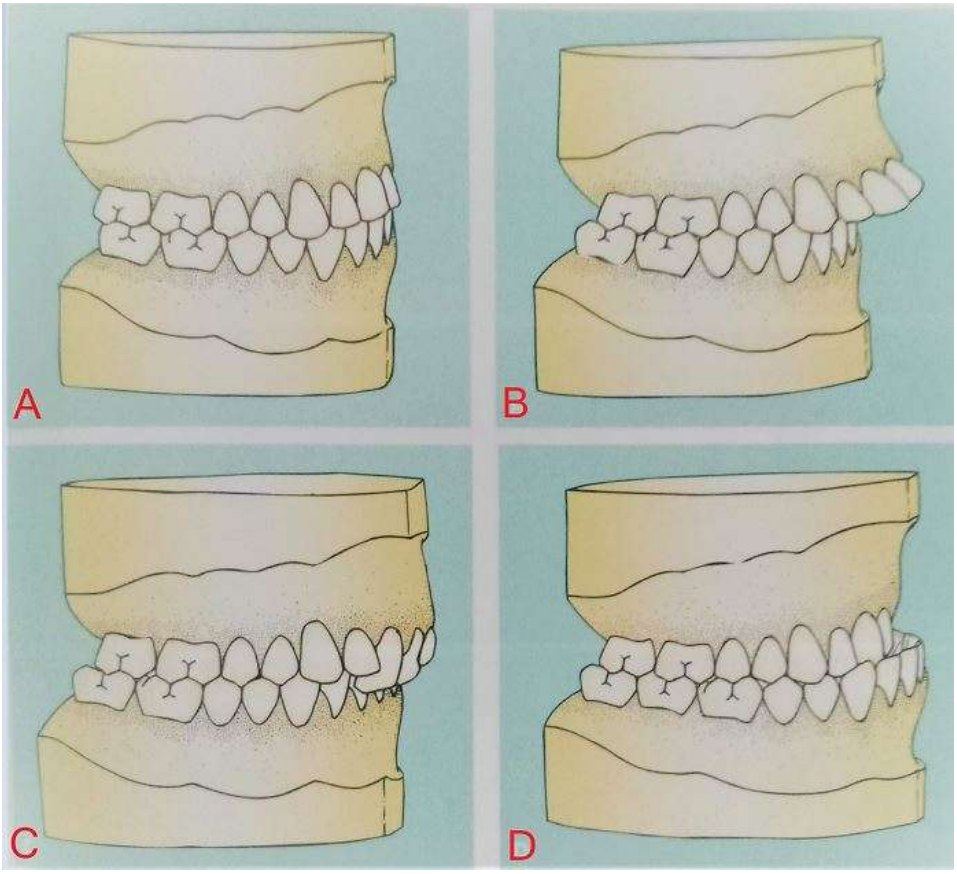

Figure 2: Angle's Classification. (A) Class I, (B) Class II, division 1, (C) Class II, division 2, (D) Class III (Image Courtesy: Dr. S. I. Bhalajhi. Orthodontics – The Art and Science. 4th Edition.)

Ink-stamp method by Harold Cummins and his associate Midlo (1926) was followed for recording fingerprint patterns. Right hand fingers and left hand fingers were pressed firmly on white paper which was placed on flat surface. (**Fig. 3**)

Figure 3: Recording of fingerprints using ink-stamp pad method

III. Observations and Results:

SPSS software version 24 and Microsoft Excel were used to tabulate and analyse the data statistically. The frequencies of all pattern types on fingertips of students with Normal occlusion, Class I, II, and III were assessed. (**TABLE 1**)

Table 1: Frequencies of pattern types seen on fingertips of students with Normal occlusion, Class I, II, and III malocclusion.

		Whorls	Loops	Arches
ANGLE'S CLASSIFICATION	NORMAL OCCLUSION	192	95	63
	CLASS I	110	88	32
	CLASS II	66	97	47
	CLASS III	49	86	75
	P VALUE	<0.005		

IV. Discussion:

Law of inheritance is well recognised in world literature and dermal ridges patterns are no exception in following this rule. Many genetic and environmental factors affect the final patterns that develop on fingertips, palms and soles.

The term Dermatoglyphics comes from combination of two Greek words – Derma meaning skin and Glyphics meaning carvings. These patterns are unique for each and every individual and are often used by law enforcement agencies around the world for identification of criminals or an individual victim.

Changes in the embryological development has a profound effect on the overall development of face, dental development as well as other body parts like fingertips, skin, nails and hair.[5] The development of fingerprints and face, including teeth, occur concomitantly from the common origin (ectoderm) and have the same genetic signals contained in genome for them which are decrypted during this period of development.[6]

On considering the amount of research done in last few decades, it is learnt that dermatoglyphics have a significant role in diagnosis of health conditions, human identification and solving crime mysteries.[7]

In the present study, whorl pattern was found to be higher in students with Normal occlusion as well as Class I malocclusion. This result was in harmony with the study done by Trehan M. et al.[8] (2001) who reported that class I malocclusion was associated with increased number of whorls and in disparity to findings of Reddy BRM et al.[9] (2013), and Jindal G et al.[6] (2015) who reported that class 1 malocclusion was associated with loop patterns.

Students with Class II Malocclusion had more number of loops along with more arches as compared to other classes of malocclusion. This was in consistency with the findings of Reddy S[10] (1997) and Reddy BRM et al.[9] (2013). Those students with Class III malocclusion were found to have more arch patterns followed by whorl pattern and it was consistent with the findings of Jindal G[6] (2015) and Reddy S[10] (1997) and in fractional uniformity to findings of Tikare S[3] (2010) who reported that Class III had significant association with whorl patterns.

The intergroup data was analysed using Pearson Chi square test at 5% level of significance and p value was calculated. On analysis of intergroup data of right and left hand for each finger separately, with Angle's Malocclusion, it was found that the patterns of both right and left ring finger had statistically significant correlation with the different classes of malocclusion with p=0.001 and p=0.006 respectively.

Left thumb also showed statistically significant correlation with the different classes of malocclusion with p=0.007. The little finger of left hand showed statistically significant correlation with classes of malocclusion having p=0.043. (**TABLE 2**)

Table 2: The intergroup data analysed using Pearson Chi square test at 5% level of significance. ($p<0.05$ = significant)

	RIGHT					LEFT			
ANGLE'S CLASSIFICATION	NORMAL	CLASS I	CLASS II	CLASS III		NORMAL	CLASS I	CLASS II	CLASS III
THUMB					THUMB				
Whorls	24	12	7	8	Whorls	25	13	5	6
Loops	8	8	9	6	Loops	7	7	9	8
Arches	3	3	5	7	Arches	3	3	7	7
P value	0.085				P value	**0.007**			
INDEX FINGER	NORMAL	CLASS I	CLASS II	CLASS III	INDEX FINGER	NORMAL	CLASS I	CLASS II	CLASS III
Whorls	15	13	6	5	Whorls	10	10	7	4
Loops	11	7	12	8	Loops	14	8	9	11

Arches	9	3	3	8	Arches	11	5	5	6
P value	0.108				P value	0.720			
MIDDLE FINGER	NORMAL	CLASS I	CLASS II	CLASS III	MIDDLE FINGER	NORMAL	CLASS I	CLASS II	CLASS III
Whorls	16	12	6	5	Whorls	19	11	8	4
Loops	10	8	9	8	Loops	10	9	10	10
Arches	9	3	6	8	Arches	6	3	3	7
P value	0.338				P value	0.177			
RING FINGER	NORMAL	CLASS I	CLASS II	CLASS III	RING FINGER	NORMAL	CLASS I	CLASS II	CLASS III
Whorls	26	9	7	4	Whorls	24	7	9	4
Loops	5	10	10	8	Loops	7	13	8	10
Arches	4	4	4	9	Arches	4	3	4	7
P value	**0.001**				P value	**0.006**			
LITTLE FINGER	NORMAL	CLASS I	CLASS II	CLASS III	LITTLE FINGER	NORMAL	CLASS I	CLASS II	CLASS III
Whorls	16	12	5	5	Whorls	17	11	6	4
Loops	11	7	12	9	Loops	12	11	9	8
Arches	8	4	4	7	Arches	6	1	6	9
P value	0.222				P value	**0.043**			

V. Conclusion

Several factors are responsible for occurrence and survival of periodontal pathogens in oral cavity. The reasons for occurrence and survival are still not understood completely even after so many years of research. Anything, that is mysterious, is ultimately leading researchers to look for genetic causes of that particular disease and that is where dermatoglyphics plays an important role. Patient's compliance and expertise of researcher in recording dermatoglyphic patterns are the two main adverse scenarios that may come as hindrance in promoting dermatoglyphic analysis as a predictor of oral as well as systemic diseases. Public awareness and further research on a larger scale in this area of fingerprint analysis will yield better and significant results in days to come.

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Conflict of Interest: None

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