ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Dermatoglyphics And Malocclusion – Are they related ?

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Manuscript Info

Manuscript History:

Received: 12 April 2014
Final Accepted: 22 May 2014
Published Online: June 2014

Key words:

Corresponding Author

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Abstract

Background: Dermatoglyphic patterns, share their development time during the intrauterine period, with the development and completion of dental hard tissues. Being related by origin, the association has also been thought to be present in factors affecting and influencing dental structures, to have an effect on the dermal ridges. Malocclusion, a dental disorder, with its genetic etiology being proven, thus gains attention in this field. Thus the aim of the study was to determine the relation between dermatoglyphics and malocclusion.

Materials and Methods: One hundred and twenty, 9-12 year old, healthy children, with mixed dentition, were included in the study. Their left and right handprints were recorded on a paper, and the finger prints were studied to find the frequency of occurrence of different types of patterns. Based on Dental Aesthetic Index (DAI), malocclusion was graded into four groups and was then correlated with the patterns' frequency. Ridge density count as calculated on the proximal hypothenar area, was also correlated with malocclusion.

Results and Conclusion: Loops were found to increase and while the whorls decreased, with increasing severity of malocclusion. The relation between ridge density count and malocclusion was not statistically significant.

INTRODUCTION

Dermatoglyphics (derma – skin & glyphic – carving), as the name suggests, is the study of epidermal ridges and the patterns seen on the palm. This scientific term was coined by sir Harold Cummins, in the year 1926. [1]

Dermatoglyphic patterns are basically classified into 4 types, that is, arches, loops, whorls and composite. The arches can be further subdivided into simple and tented, the loops can be radial or ulnar and the whorls are further classified into spiral, symmetrical and double loop. These patterns are genetically determined and once formed, remain constant for lifetime, except in overall size. [2]

In humans, the time of process of development and completion of primary lip and palate and that of dermal ridges are approximately the same, coinciding at 6-13th week of intrauterine life. Thus, any environmental or genetic

factors affecting the process of development of dental hard tissues might affect and also get recorded in the dermal ridges. This forms the basis of comparison of dental diseases with that of dermatoglyphics. [3]
Extensive researches are available to relate dermatoglyphics and dental diseases, but most of them seem to be missing on malocclusion. Malocclusion is genetically controlled and forms one of the most common dental diseases. The purpose of this study was therefore to find any relationship between malocclusion and dermatoglyphics.

MATERIALS AND METHOD

A cross-sectional study design was conducted and a sample of one hundred and twenty, 9-12 year old, healthy children, in their mixed dentition, were included for the study. The children with syndromes, any history of oral habit or orthodontic treatment were excluded.
The materials used in the study were the basic diagnostic instruments for examination and detection of malocclusion. For recording the palm print, ink pad, magnifying glass and white sheets of paper were used.

Methodology

The study initiated after obtaining approval from Institutional Ethics Committee. Parent's consent was obtained before enrolling the children in the study.

Recording of malocclusion
Modified Dental Aesthetic Index (DAI) [4](Table No.1) was used for grading the severity of malocclusion. The final value was obtained by multiplying the recorded clinical value with the respective rounded weight and then adding constant 13 to it. Depending on the final value obtained, the malocclusion was graded into 4 groups with increasing severity. Group 1 (final value ≤ 25), group 2 (final value 26-30), group 3 (final value 30-35) and group (final value ≥ 36).

DAI components grading criteria:
For 2* is as follows: 0= no segment crowded, 1= one segment crowded, 2= Two segments crowded
For 3** is as follows: 0= no segment spaced, 1= one segment spaced, 2= Two segments spaced
For 10*** is as follows: Largest deviation from normal either left or right, 0= normal, 1= ½ cusp either mesial or distal, 2= one full cusp or more either mesial or distal

Recording the handprints
The methodology was explained to the children. Children's hands were cleaned, scrubbed and dried. Both the hands were then placed, one by one, on a large sized ink pad and pressed firmly against it. The hands were then placed on a white sheet of paper, with fingers spread apart, and light pressure being applied uniformly over the back side of the palm, by the examiner. The children were cautioned, not to smear the ink, on their body or clothing before washing with soap and water
The palm prints were checked using a magnifying glass, for the clarity and were repeated in case they were not recorded satisfactory.

Interpretation of the prints
The interpretation of the recorded prints was done by observing the distal phalanges of the 10 digits under magnifying glass and the type of pattern present was noted. The data obtained, was supervised by an expert. Only the basic classification of patterns, that is, arches, loops, whorls and composite were considered.
Ridge Density: In order to measure the ridge density count, proximal hypothenar area of both the hands were chosen. A square of 25 mm^2 (5mm X 5mm) area (Fig. No 1) was drawn on a transparent film, and the number of lines crossing it diagonally were counted. Thus, the ridge density count obtained was ridge density per 25 square mm area.

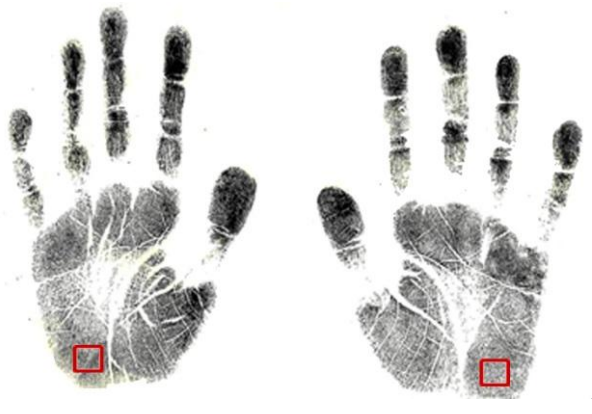

Fig. No. 1: Red Square demarcating the proximal hypothenar area

STATISTICAL ANALYSIS

The data recorded was subjected to SPSS ver. 16 software for statistical analysis. Chi square test was applied for comparison between frequency of occurrence of the finger print patterns and their association with the four groups of malocclusion. Ridge density count of right and left hand was compared with malocclusion groups by using ANOVA test.

RESULT

Table No. 1: The modified Dental Aesthetic Index

S No.	DAI Components	Recorded Value	Rounded weights	Final Value
1.	Number of missing visible teeth		5.76 (6)	
2*.	Crowding in the incisal segment		1.15 (1)	
3**.	Spacing in the incisal segment		1.31 (1)	
4.	Midline diastema (mm)		3.13 (3)	
5.	Largest anterior irregularity in maxilla (mm)		1.34 (1)	
6.	Largest anterior irregularity in mandible (mm)		0.75 (1)	
7.	Anterior maxillary overjet (mm)		1.62 (2)	
8.	Anterior mandibular overjet (mm)		3.68 (4)	
9.	Vertical anterior openbite (mm)		3.69 (4)	
10***.	Anteroposterior molar relation		2.69 (3)	
11.	Constant	-	13.36 (13)	13
				=

The frequency distribution of the four types of finger print patterns as recorded in the four groups of malocclusion, is presented in table No. 2.

The results show that the distribution of dermatoglyphic patterns were 52.6% loops type, 36.2% whorls type, 5.4% arch type and 5.8% composite type. Since loops and whorls were noted more frequently as compared to arches and composites, Chi square test was applied to their frequency of occurrence (table) and the results obtained, showed a statistically significant increase ($p < 0.001$) for loops and decrease ($p < 0.001$) for whorls, with increasing severity of malocclusion(Table 3 and 4).

The ridge density count of the right and left hand, showed no statistically significant association with different malocclusion groups (for right hand, F value = 1.486 & p value .222 and for left hand, F value = .306 & p value .821)

In the present study frequency of loops increased with severity of malocclusion but whorls reduced with increased severity of malocclusion. The patterns on the right ring finger were more significant and related to the malocclusion variations than other fingers.

Table No. 2: Distribution of different types of ridge pattern in comparison to the type of malocclusion with respect to each finger.

Type of finger	Malocclusion groups	Loop	Whorl	Arch	Composite	P value
Left little	Group 1	17 (56.7%)	11 (36.7%)	1 (3.3%)	1 (3.3%)	Chi sq. 9.397 df 9 p value 0.401
	Group 2	21 (70.0%)	7 (23.3%)	0 (.0%)	2 (6.7%)	
	Group 3	24 (80.0%)	5 (16.7%)	0 (.0%)	1 (3.3%)	
	Group 4	24 (80.0%)	6 (20.0%)	0 (.0%)	0 (.0%)	
Left ring	Group 1	7 (23.3%)	21 (70.0%)	0(.0%)	2 (6.7%)	Chi sq. 5.448 df 9 p value 0.794
	Group 2	13 (43.3%)	16 (53.3%)	0 (.0%)	1 (3.3%)	
	Group 3	11 (36.7%)	16 (53.3)	1 (3.3%)	2 (6.7%)	
	Group 4	11 (36.7%)	17 (56.7%)	1 (3.3%)	1 (3.3%)	
Left middle	Group 1	16 (53.3%)	12 (40.0%)	1 (3.3%)	1 (3.3%)	Chi sq. 5.738 df 9 p value 0.766
	Group 2	17 (56.7%)	8 (26.7%)	3 (10.0%)	2 (6.7%)	
	Group 3	15 (50.0%)	9 (30.0%)	3 (10.0%)	3 (10.0%)	
	Group 4	20 (66.7%)	6 (20.0%)	3 (10.0%)	1 (3.3%)	
Left index	Group 1	9 (30.0%)	16(53.3%)	2(6.7%)	3 (10.0%)	Chi sq. 6.467 df 9 p value 0.692
	Group 2	14(46.7%)	11(36.7%)	3 (10.0%)	2(6.7%)	
	Group 3	10 (33.3%)	12(40.0%)	2(6.7%)	6 (20.0%)	
	Group 4	11(36.7%)	10 (33.3%)	4(13.3%)	5(16.7%)	
Left thumb	Group 1	15 (50.0%)	12 (40.0%)	2 (6.7%)	1(3.3%)	Chi sq.14.249 df 9 p value 0.114
	Group 2	24(80.0%)	2 (6.7%)	2 (6.7%)	2 (6.7%)	
	Group 3	18(60.0%)	6 (20.0%)	5(16.7%)	1 (3.3%)	
	Group 4	16(53.3%)	9 (30.0%)	2(6.7%)	3 (10.0%)	
Right little	Group 1	14(46.7%)	15(50.0%)	0(.0%)	1 (3.3%)	Chi sq.14.262 df 9 p value 0.113
	Group 2	21(70.0%)	7(23.3%)	1 (3.3%)	1 (3.3%)	
	Group 3	25(83.3%)	4(13.3%)	0 (.0%)	1(3.3%)	
	Group 4	22(73.3%)	7(23.3%)	1 (3.3%)	0 (.0%)	
Right ring	Group 1	3 (10.0%)	27(90.0%)	0(.0%)	0(.0%)	Chi sq.22.793 df 9 p value 0.007
	Group 2	12(40.0%)	16(53.3%)	2 (6.7%)	0 (.0%)	
	Group 3	9(30.0%)	17(56.7%)	0 (.0%)	4(13.3%)	
	Group 4	12(40.0%)	16(53.3%)	1 (3.3%)	1 (3.3%)	
Right middle	Group 1	17(56.7%)	10(33.3%)	0(.0%)	3 (3.3%)	Chi sq. 9.929 df 9 p value 0.356
	Group 2	23(76.7%)	7(23.3%)	0 (.0%)	0 (.0%)	
	Group 3	19(63.3%)	8(26.7%)	2(6.7%)	1(3.3%)	

	Group 4	21(70.0%)	6(20.0%)	2(6.7%)	1(3.3%)	
Right index	Group 1	8(26.7%)	16(53.3%)	3(10.0%)	3(10.0%)	Chi sq. 5.466 df 9 p value 0.792
	Group 2	13(43.3%)	9(30.0%)	6(20.0%)	2(6.7%)	
	Group 3	12(40.0%)	12(40.0%)	3(10.0%)	3(10.0%)	
	Group 4	12(40.0%)	11(36.7%)	5(16.7%)	2(6.7%)	
Right thumb	Group 1	15(50.0%)	13(43.3%)	1(3.3%)	1(3.3%)	Chi sq. 8.355 df 9 p value 0.499
	Group 2	23(76.7%)	5(16.7%)	1(3.3%)	1(3.3%)	
	Group 3	20(66.7%)	6(20.0%)	1(3.3%)	3(10.0%)	
	Group 4	17(56.7%)	10(33.3%)	1(3.3%)	2(6.7%)	

Table No. 3: Varying frequency of the loops, with varying malocclusion severity groups.
Chi square 9.213, df- 57, p value .000

Malocclusion Groups	Left little	Left ring	Left middle	Left index	Left thumb	Right little	Right ring	Right middle	Right index	Right thumb
Group 1	17 (56.7%)	7 (23.3%)	16 (53.3%)	9 (30.0%)	15 (50.0%)	14 (46.7%)	3 (10.0%)	17 (56.7%)	8 (26.7%)	15 (50.0%)
Group 2	21 (70.0%)	13 (43.3%)	17 (56.7%)	14 (46.7%)	24 (80.0%)	21 (70.0%)	12(40.0%)	23 (76.7%)	13 (43.3%)	23 (76.7%)
Group 3	24 (80.0%)	11 (36.7%)	15 (50.0%)	10 (33.3%)	18 (60.0%)	25 (83.3%)	9 (30.0%)	19 (63.3%)	12 (40.0%)	20 (66.7%)
Group 4	24 (80.0%)	11 (36.7%)	20 (66.7%)	11 (36.7%)	16 (53.3%)	22 (73.3%)	12 (40.0%)	21 (70.0%)	12 (40.0%)	17 (56.7%)
Total count	86 (71.7%)	42 (35.0%)	68 (56.7%)	44 (36.7%)	73 (60.8%)	82 (68.3%)	36 (30.0%)	80 (66.7%)	45 (37.5%)	75 (62.5%)

Table no. 4: **Varying frequency of the whorls, with varying malocclusion severity groups.**
Chi square 6.604, df – 57, p value .000

Malocclusion Groups	Left little	Left ring	Left middle	Left index	Left thumb	Right little	Right ring	Right middle	Right index	Right thumb
Group 1	11 (36.7%)	21 (70%)	12 (40.0%)	16 (53.3%)	12 (40.0%)	15 (50.0%)	27 (90.0%)	10 (33.3%)	16 (53.3%)	13 (43.3%)
Group 2	7 (23.3%)	16 (53.3%)	8 (26.7%)	11 (36.7%)	2 (6.7%)	7 (23.3%)	16 (53.3%)	7 (23.3%)	9 (30.0%)	5 (16.7%)
Group 3	5 (16.7%)	16 (53.3%)	9 (30.0%)	12 (40.0%)	6 (20.0%)	4 (13.3%)	17 (56.7%)	8 (26.7%)	12 (40.0%)	6 (20.0%)
Group 4	6 (20.0%)	17 (56.7%)	6 (20.0%)	10 (33.3%)	9 (30.0%)	7 (23.3%)	16 (53.3%)	6 (20.0%)	11 (36.7%)	10 (33.3%)
Total count	29 (24.2%)	70 (58.3%)	35 (29.2%)	49 (40.8%)	29 (24.2%)	33 (27.5%)	76 (63.3%)	31 (25.8%)	48 (40.0%)	34 (28.3%)

DISCUSSION

In humans, intrauterine period of development of dermal ridges and teeth enamel is the same, that is, between 6-7th week to 12-13th week. Thus, any genetic deviation reflected in the formation and alignment of teeth, may also be shown in the dermatoglyphic patterns. [3]In the year 1969, Carter [5]stated that abnormalities occurring during the intrauterine period, are influenced by hereditary and environmental factors, but these reflect upon an individual only when these combined factors exceed the threshold level.

In the present study the age group of 9-12 years was chosen, as this is the mixed dentition period when permanent maxillary incisors are present in the oral cavity, for recording the overjet.

The Dental Aesthetic Index was used to study malocclusion as it includes much more variables, and thus the severity can be graded in a much more defined way. The DAI has been proved to be a reliable and valid index, in various studies. Its simplicity accounts from the fact that it is used intra orally and no radiographs are required. WHO has nominated it to be a cross cultural index.[6] This index also has certain limitations. It does not take into account buccal cross bite, open bite, deep bite and center line discrepancy. Most of the studies have used Angle's classification of malocclusion, which considers only the permanent first molar relationship. Thus, to find a more elaborate and specified malocclusion severity, dental aesthetic index was chosen for this study.

Dermatoglyphic distribution study by Bhasi[7], revealed that whorls were very common followed by loops and arches among overall Indian population. There was a deviation in the observation in our study where we found more loops compared to whorls. In a cross-sectional study among Indian Sunni muslims,Ghosh et al[8] found that the overall frequency of whorl was higher followed by loop and arch. Since religion was not considered in our study, this aspect cannot be explored.

Many studies have been carried out to find the relation between palm prints and various dental disorders like caries [9], cleft lip & palate [10]. In the study done by Trehan et al[11], correlating the dermatoglyphic patterns and malocclusion, in 60 subjects, it was found that the frequency of whorls was more in number in class 1 and class 3 and the frequency of radial loop and arches were more in number in class 1 and class 2 division 1 cases.

In another study done by Reddy[12] et al on 96 subjects, divided equally (24 each) into four groups, it was found that class 2 division 2 pattern of malocclusion was related with increased frequency of arches and ulnar loops and decreased frequency of whorls. Also, in class 3 malocclusion, the frequency of arches and radial loop was high and ulnar loops were low.

TikareS et al[13] in a study on 696 children aged between 12-16 years found significant association between occurrence of whorl pattern and class 1 and 3 malocclusion.

We found no significant relation between ridge count and malocclusion. Similar results were also found by Reddy et al[14] where their parameters of malocclusion did not coincide with the palm print.

The authors could not find any articles that have compared the dermatoglyphics and malocclusion severity according to DAI. This study is unique in this way and hence the results cannot be compared with other studies.

The data obtained herein is a preliminary one since the sample size was small, but is suggestive of a significant association between dermatoglyphics and malocclusion. Dermatoglyphics as a diagnostic tool in the dental field may turn out to be a boon in early diagnosis for early intervention and also in epidemiologic studies as a cost-efficient method.

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