Original Research Article

Correlation of dermatoglyphics and Class II skeletal malocclusion – Original research

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A R T I C L E   I N F O

A B S T R A C T

Dermatoglyphics is a study of the unique pattern in the skin of fingers, palms, soles, and toes. These dermatoglyphics has played an important role in various fields like forensic medicine, genetics, and anthropology.

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Studies have suggested that dermatoglyphics could be used as a tool to identify the underlying skeletal malocclusion. As the dermal pattern and oral structures develop together, the genetic information in the dermal pattern could be used to assess the different types of skeletal malocclusions.

Hence, the study was aimed to compare and evaluate the correlation between dermatoglyphics and class II skeletal malocclusion in horizontal and vertical growth patterns. The total of 50 samples were taken and divided into horizontal and vertical growth pattern consisting of 25 samples each. The dermatoglyphic pattern between the right and left hand and the pattern such as arches, loops, and whorls were evaluated.

The data was analyzed by Kolmogorov – Smirnov and Shapiro Wilk test. There was a statistically significant association between class 2 malocclusion and the dermatoglyphic pattern.

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1. Introduction

The word 'Dermatoglyphics' is a Greek terminology that denotes the 'derma' meaning 'skin' and the 'glyphic' means craving.[1] The term dermatoglyphics was first coined by Cummins and Mildo in 1961. Dermatoglyphics is a study of the unique pattern in the skin of fingers, palms, soles, and toes. These dermatoglyphics had played an important role in various fields like forensic medicine, genetics, and anthropology.[2]

By the 12th week of the intrauterine life, the dermal configurations start arising and by the 24th week of the intrauterine life, it was established. The development of the dermal patterns and the dental structures mostly occurs at the same time.[3] An individual may have the same pattern on all ten fingers whereas, in some individuals, the various patterns can also be seen on different digits.[4]

In 1892, Sir Francis Galton classified the fingerprints into 3 loops namely the arches, loops, and whorls. These fingerprints were assessed according to the curvature of the

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ridges. These arches may be seen as simple or tented, loops may be seen as radial or ulnar and whorls may be seen as spirals or double loops

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In orthodontics, the most common problem dealt with is malocclusion. The malocclusion affects the facial esthetics which is most commonly due to the underlying skeletal cause. Studies have suggested that dermatoglyphics could be used as a tool to identify the underlying skeletal malocclusion. As the dermal pattern and oral structures develop together, the genetic information in the dermal pattern could be used to assess the different types of skeletal malocclusions.

Hence, it's a noninvasive marker to identify skeletal malocclusion at an early age. Identification of the skeletal problems could lead to better efficient treatment planning and also help in understanding the genetic causes of the malocclusion.[5]

2. Aim

The study was aimed to compare and evaluate the correlation between dermatoglyphics and class II skeletal malocclusion in horizontal and vertical growth patterns.

3. Objectives

The objectives of the study are to

1. To obtain the fingerprints using the ink method.
2. To determine the growth pattern (horizontal and vertical growth) in the lateral cephalogram of the Angle's Class II malocclusion.
3. To determine the dermal finger pattern – arches, loops, and whorls.
4. To determine the relationship between the fingerprints in Angle's class II malocclusion (horizontal and vertical growth pattern).
5. To compare the relationship between the frequency of the fingerprint pattern in the horizontal and the vertical growth pattern.

3.1. Null hypothesis

The null hypothesis is that there will not be any correlation between the fingerprint pattern in the two groups (horizontal and vertical growth pattern) of Angle's class 2 malocclusion.

4. Materials and Methods

This study was conducted in the department of orthodontics and dentofacial orthopedics, Tagore Dental College & Hospital, Chennai, Tamil Nadu. Approval was granted by the ethical committee of Tagore Dental College & Hospital. (IEC/TDC/083/2020)

4.1. Sample preparation

The sample size was calculated using G power software 3.1.9.

Based on the Level of significance alpha = 0.05, Power Beta = 80%, Effect size d= 0.72, Allocation ratio N2/N1 = 1; Based on this the sample in each group was 25, and the hence the total sample size was considered as 50.

4.2. Inclusion criteria

1. The subjects for the study were the south Indian population.
2. The subjects were taken were aged from 18 years to 25 years.
3. Complete permanent dentition.

4.3. Exclusion criteria

1. Patients with a history of any muscle abnormalities.
2. Patients with any congenitally missing abnormalities of the teeth.

4.4. Methodology

After selecting the subjects, the following records are to be taken:

1. Pretreatment lateral cephalogram.
2. Fingerprints of the subjects.

4.4.1. Handprints

1. While taking the handprints the investigator and the patient, alone were present in a closed room.
2. The subjects are asked to clean their hands with soap and water and wipe with ethyl alcohol to remove sweat, dirt, oil from the skin.
3. The dried distal phalanges of both the hands are pressed onto the ink pad and stamped onto an A4 sheet where the sheet is fixed to a place by adhesive tape.
4. Handprints are to be repeated until the perfect record is obtained.
5. To avoid duplication fingers are numbered from 1 to 5 in the left fingers and 6 to 10 in the right fingers.
6. The obtained prints are to be assessed for the frequency of arches, whorls, and loops.
7. The sheet which has the best print will be retained confidentially for the study and other sheets will be destroyed in front of the patient.
8. The print sheets will be allocated dummy numbers for identification purposes and all the print sheets with the dummy numbers are maintained in a black colored box file.

9. Another file will be maintained confidentially with the dummy numbers and information for correlation in a separate black-colored box file.
10. The box files will be maintained confidentially in a metal locker in the same closed room. The keys to the metal locker and the room are maintained only by the investigator.
11. Study is performed alone, only in a closed room. No one was allowed inside the room while performing the study.
12. Once the study is completed and published all the handprint sheets will be destroyed in front of the subject.

4.5. *Lateral cephalogram*

1. The lateral cephalograms to be recorded with the jaws in habitual occlusion, lips stress-free, and the head-oriented parallel to the Frankfort horizontal plane.
2. The radiographs are to be obtained.
3. All the cephalograms were recorded with the same exposure parameters.
4. These cephalograms are to be traced, mandibular plane angle to be measured according to Steiner's analysis to determine the type of growth pattern and thus separated into two groups (group); group I being horizontal growth pattern (HGP) and group II being vertical growth pattern (VGP).

5. Results

The 50 samples were divided into a horizontal and vertical growth pattern. Under each group, 25 Samples were taken and the dermatoglyphic pattern between the right and left hand and the pattern such as arches, loops, and whorls were evaluated.

The data distribution was analyzed by Kolmogorov – Smirnov and Shapiro Wilk test (Tables 1, 2 and 3). All the measurements showed normal distribution of data.

Table 1: Distribution of study participants

Groups	Number	Percentage
Group 1 (vertical growth)	25	50%
Group 2 (horizontal growth)	25	50%
Total	50	100%

Table 2 Shows the distribution of the arches, loops, and whorls among the vertical growth pattern in the left hand. The left thumb had a predominantly whorl pattern of 100%, the left index finger had a 64% of whorl pattern and 16% of the subjects had loops. The left middle finger had 80% of the loop pattern, the left fourth finger had 60% of the loop pattern, and the left fifth finger had 84% had the whorl pattern (p<0.05 statistically significant).

Table 2: Distribution of the study participants based on the dermatoglyphic patterns among a left hand of group 1

Group 1 (vertical growth)	Dermatoglyphic patterns		
	Arch	Loop	Whorl
Left Thumb	0(0%)	0(0%)	25(100%)
Left Index finger	3(12%)	4(16%)	16(64%)
Left middle finger	1(4%)	20(80%)	4(16%)
Left fourth finger	0(0%)	15(60%)	9(36%)
Left fifth finger	0(0%)	4(16%)	21(84%)

X^2= 24.98, p= 0.02, p<0.05 statistically significant

Table 3: Distribution of the study participants based on the dermatoglyphic patterns on the right arch of group 1

Group 1 (vertical growth)	Dermatoglyphic patterns		
	Arch	Loop	Whorl
Right Thumb	0(0%)	0(0%)	25(100%)
Right Index finger	0(0%)	13(52%)	10(40%)
Right middle finger	2(8%)	23(92%)	1(4%)
Right fourth finger	0(0%)	8(32%)	17(68%)
Right fifth finger	2(8%)	16(64%)	7(28%)

X^2= 31.12, p= 0.01, p<0.05 statistically significant

Table 3 Shows the distribution of the arches, loops, and whorls among the vertical growth pattern in the right hand. The Subject's right thumb had a Whorl pattern predominance for the subject's right index finger had a 52% loop pattern was seen and a 40% of whorl pattern was observed. The subject's right middle finger had a 92% of loop pattern (p<0.05 statistically significant).

Table 4: Distribution of the study participants based on the dermatoglyphic patterns among the left arch of group 2

Group 2 (horizontal growth)	Dermatoglyphic patterns		
	Arch	Loop	Whorl
Left Thumb	0(0%)	0(0%)	25(100%)
Left Index finger	4(16%)	4(16%)	17(68%)
Left middle finger	0(0%)	21(84%)	4(16%)
Left fourth finger	0(0%)	15(60%)	9(36%)
Left fifth finger	1(4%)	4(16%)	21(84%)

X^2= 14.65, p= 0.01, p<0.05 statistically significant

Table 4 shows the distribution of the arches, loops, and whorls in the left hand of the horizontal growth pattern. The subject's left thumb finger had a predominantly whorl pattern (100%), the left index finger had a whorl pattern (64%), the left middle finger had a loop pattern (84%), the left fourth finger had a loop pattern (60%) and the left fifth finger had whorl pattern (84%).

Table 5 shows the distribustion of the arches, loops, and the whorl pattern in the right hand of the subjects - with a horizontal growth pattern. The subject's right thumb finger had a predominantly whorl pattern (100%), the right index finger had a predominantly whorl pattern (60%), and the loop pattern (28%). The right middle finger had a predominantly loop pattern (80%) and arch pattern (8%).

Table 5: Distribution of the study participants based on the dermatoglyphic patterns among theright arch of group 2

Group 2 (horizontal growth)	Dermatoglyphic patterns		
	Arch	Loop	Whorl
Right Thumb	0(0%)	0(0%)	25(100%)
Right Index finger	0(0%)	7(28%)	15(60%)
Right middle finger	2(8%)	20(80%)	1(4%)
Right fourth finger	0(0%)	13(52%)	14(56%)
Right fifth finger	0(0%)	4(16%)	20(80%)

X2= 36.11, p= 0.01, p<0.05 statistically significant

The right fourth finger had a predominantly whorl pattern (56%) and the loop pattern was (52%). The right fifth finer had a whorl pattern (80%) and a loop pattern was (16%). The p-value (p= 0.01) was p<0.05 statistically significant.

6. Discussion

Dermatoglyphics is a very easy and economical method that can be used as a diagnostic tool that has a strong hereditary basis. It's known that epigenetic factors involve changes in the dermal pattern.[1] It has been seen for an individual same pattern could be found in all ten fingers. But studies have revealed that among the three types of finger patterns such as arches, loops, and whorls; the whorls were predominantly found in the thumb finger. The ring finger usually had radial loops and arches most commonly whereas the ring finger had ulnar loops mostly.[4]

The current study was to assess the relationship between skeletal malocclusion and the fingerprint. Many works of literature have evaluated the relationship between fingerprints and malocclusion based on Angle's Classification of malocclusion which is based on the first molar relationship.[6] Previous studies were assessed to correlate the relationship between the dermatoglyphic pattern and the skeletal malocclusion among class 1, class 2, and class 3. It was found that the arches pattern was increased in class 1 and whorl pattern predominantly in class 2 skeletal malocclusion.[5] But other studies have also found that there was a decreased frequency of whorl pattern in class 2 malocclusion.[7] This variation in the frequency of finger patterns may be due to the regional and ethnic differences in sample selection among those studies.

In the present study; the vertical growth pattern was seen in the left hand; the whorl pattern was seen in the thumb finger, left index, the fifth finger. The left middle finger and fourth finger had predominantly had the loop pattern (p<0.05 statistically significant).[8–14]

Also, among the vertical growth pattern in the right hand; the thumb, index finger, and fifth finger had a whorl pattern predominance. Loop pattern was predominantly seen in the left middle and fourth finger (p<0.05 statistically significant).

Among the horizontal growth pattern in the left hand; the whorl pattern was predominant in the left thumb finger, left index finger, and the left fifth finger. The loop pattern was predominant in the left middle finger and the left fourth finger.

Among the horizontal growth pattern in the right and; the whorl pattern was predominant in the right thumb finger, the right index finger, the right fourth finger, and the right fifth finger. Loop was predominantly seen in the right middle finger.

In the present study, there was an increased percentage of whorl patterns in the thumb finger, index finger, and fifth finger in the horizontal as well as the vertical growth pattern group in the right and left hand. There was also an increased frequency of loop patterns in the middle finger in both of the growth pattern groups in both hands, thus these dermatoglyphics can be used in the diagnosis and treatment planning. A large sample population might help in developing a diagnostic tool in the process of treatment planning. Also, as the dermatoglyphic pattern remains constant during a person's lifetime; this pattern could be used to find out the skeletal problems at an early age itself. Hence it would be much easier to formulate treatment at an early age itself.[15,16]

7. Conclusion

There was a statistically significant association between class 2 malocclusion and the dermatoglyphic pattern. This study may be the basis for further extensive research in preventive and intervention orthodontics in the pediatric group of patients. Also, a larger sample size and the ethnicity related to the investigation can be easy for exploring the genetic expression of malocclusion.

8. Conflicts of Interests

The authors have no financial interests or conflicts of interests.

9. Source of Funding

None.

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