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# Correlation of dermatoglyphics and different types of Skeletal growth pattern

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**ABSTRACT**
Dermatoglyphics is the study of the distinct pattern found on the palms, soles, fingers, and toes of the human body. In a number of disciplines, including genetics, anthropology, and forensic medicine, these dermatoglyphics have been very significant. According to Sir Francis Galton, a person's dermal pattern does not change over the course of their lifetime. Numerous investigations have raised the possibility of a connection between occlusion and dermatoglyphics. Research has indicated that dermatoglyphics may serve as a useful instrument for determining the underlying skeletal malocclusion. The genetic information in the dermal pattern may be utilized to evaluate the various forms of skeletal malocclusions since the dermal pattern and oral structures grow together. Therefore, the study aims to assess and compare the relationship between dermatoglyphics and skeletal growth pattern. Fifty samples in all were collected, with twenty-five samples each going into the horizontal and vertical growth patterns. The evaluation involved examining the dermatoglyphic pattern, which included loops, whorls, and arches, on the fingers of right and left hands. The Shapiro-Wilk and Kolmogorov-Smirnov tests were used to assess the data. The dermatoglyphic pattern and its relationship with horizontal and vertical growth pattern were statistically significantly correlated.

## *Introduction*

The study of the distinct pattern in the skin of the fingers, palms, soles, and toes is known as dermatoglyphics. These dermatoglyphics have been crucial in function in several disciplines, including anthropology, genetics, and forensic medicine.[1] The Greek name "dermatoglyphics" refers to the combination of the words "derma," which means "skin," and "glyphic," which means yearning.[2] Cummins and Mildo originally used the term "dermatoglyphics" in 1961. Sir Francis Galton divided fingerprints into three categories in 1892: whorls, loops, and arches. The ridges' curvature was used to evaluate these fingerprints. Whorls can be interpreted as spirals or double loops, loops as radial

or ulnar, and arches as simple or tented. According to Sir Francis Galton, a person's skin tone never changes during the course of their life. Numerous research works have proposed a potential correlation between occlusion and dermatologoglyphics. Also, AI applications in orthodontics and endodontics are improving treatment precision by simulating tooth movement and predicting the success of procedures like root canal therapy.[3] The most frequent issue in orthodontics is malocclusion. Malocclusion has an impact on facial aesthetics, and the underlying skeletal reason is typically the cause. According to studies, dermatoglyphics may be a useful method for determining the underlying skeletal malocclusion. Given that the dermal pattern and oral structures develop simultaneously, it may be possible to evaluate the various forms of skeletal malocclusions using the genetic information found in the dermal pattern.[4] Therefore, it's a non-invasive diagnostic for early detection of skeletal growth patterns. Determining the skeletal issues early, may assist in planning treatments more effectively and provide light on the genetic factors that contribute to malocclusion.

***Methodology***

This study was conducted in the Department of Orthodontics and Dentofacial Orthopaedics of DY Patil University School of Dentistry, Navi Mumbai. G Power software 3.1.9 was used to calculate the sample size. With a sample size of 50 in each group and a level of significance of alpha = 0.05, power beta = 80%, effect size d = 0.72, and allocation ratio N2/N1 = 1, the total sample size was determined to be 100. The subjects with complete permanent dentition between the age group of 18 years to 25 years and with no previous history of orthodontic treatments were included in the study.

Patients with a history of any myofacial pain dysfunction and with any congenitally missing abnormalities of the teeth were excluded. After selecting the study population, pre-treatment lateral cephalograms and fingerprints were recorded.

The lateral cephalograms were recorded with the jaws in habitual occlusion, lips stress-free, and the head oriented parallel to the Frankfort horizontal plane. These cephalograms were traced, and the Mandibular Plane angle, Y axis, and Jarabaks ratio were 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).

***Results***

The 100 samples were separated into growth patterns that were vertical and horizontal. Fifty samples were obtained for each group, and the dermatoglyphic pattern which includes loops, whorls, and arches—between the fingers of the right and left hands were assessed. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess the data distribution **(Tables 1, 2 and 3)**. Every measurement revealed a normal distribution of the data.

The distribution of the whorls, loops, and arches within the fingers of the left and right hand's vertical development pattern is displayed in **Table 2**. Among the group 1 patients, 16% had loops, 72% had a whorl pattern on the left index finger and 100% of the subjects had a whorl pattern on the left thumb. The loop pattern was 80% on the left middle finger, 60% on the left fourth finger, and 84% on the left fifth finger. The subject's right thumb had a whorl pattern preponderance (100%), while the subject's right index finger displayed a 44% whorl pattern and a 56% loop pattern. There was a 92% loop pattern on the subject's right middle finger.

The distribution of the loops, whorls, and arches in the left and right hand of the horizontal growth pattern is displayed in **Table 3**. The right thumb finger of the subject exhibited a whorl pattern of 100%, the right index fingers a whorl pattern of 70%, and the loop pattern of 28%, The patterns on the right middle finger were primarily loop (80%) and arch (8%). The loop pattern was 52% and the whorl pattern was 48% on the right fourth finger. 84% of the right fifth finger had a whorl pattern, while 16% had a loop pattern. The left thumb finger of the patient displayed a whorl pattern 100% of the time, followed by a whorl pattern on the left index finger (68%), 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 (80%).

| Groups | Number of patients | Percentage (%) |
|---|---|---|
| Group 1 (vertical growth) | 50 | 50 |
| Group 2 (horizontal growth) | 50 | 50 |
| Total | 100 | 100 |

**Table 1: Distribution of study patients**

| Group 1 (vertical growth) | Dermatoglyphic patterns | | |
|---|---|---|---|
| | Arch | Loop | Whorl |
| Left Thumb | 0 | 0 | 50 |
| Left Index finger | 6 | 8 | 36 |
| Left middle finger | 2 | 40 | 8 |
| Left fourth finger | 0 | 30 | 20 |
| Left fifth finger | 0 | 8 | 42 |
| Right Thumb | 0 | 0 | 50 |
| Right Index finger | 0 | 28 | 22 |
| Right middle finger | 4 | 46 | 2 |
| Right fourth finger | 0 | 16 | 34 |
| Right fifth finger | 4 | 32 | 14 |

**Table 2: Distribution of the study participants based on the dermatoglyphic patterns on the right and left hand of group 1**

| Group 2 (horizontal growth) | Dermatoglyphic patterns | | |
|---|---|---|---|
| | Arch | Loop | Whorl |
| Left Thumb | 0 | 0 | 50 |
| Left Index finger | 8 | 8 | 34 |
| Left middle finger | 0 | 42 | 8 |
| Left fourth finger | 0 | 30 | 20 |
| Left fifth finger | 2 | 8 | 40 |
| Right Thumb | 0 | 0 | 50 |
| Right Index finger | 0 | 14 | 35 |
| Right middle finger | 4 | 40 | 6 |
| Right fourth finger | 0 | 26 | 24 |
| Right fifth finger | 0 | 8 | 42 |

**Table 3: Distribution of the study participants based on the dermatoglyphic patterns among the right and left hand of group 2**

## *Discussion*

Dermatoglyphics is a fairly simple and affordable technique that possesses a strong genetic foundation and can be employed as a diagnostic tool. Epigenetic factors are known to entail modifications in the pattern of the dermis.[2] The study of fingerprints has always captivated people due to its extraordinary complexity and intricacy. Every person has distinguishing features that run along their palm side and soles, which are thought to be unique and unrepeatable.

It has been observed for a single person. Every one of the ten fingers has a design. However, research has shown that of the three different kinds of finger patterns, such

as loops, arches, and whorls, the whorls are mostly located in the finger's thumb.[5]

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 finger, left middle finger and fourth finger predominantly the loop pattern ($p<0.05$ statistically significant). [6-12] Also, among the vertical growth pattern in the right hand; the thumb, index finger and fifth finger had a whorl pattern predominance ($p<0.05$ statistically significant).

The purpose of the current study is to evaluate the connection between the fingerprint and skeletal growth pattern. Many literary works have assessed the connection between malocclusion and fingerprints using Angle's Classification of Malocclusion, which is predicated on the relationship between the first and second molars. The association between the dermatoglyphic pattern and the skeletal malocclusion in classes 1, 2, and 3 was evaluated in light of prior research. It was discovered that class I skeletal malocclusion had a higher arches pattern, and class 2 skeletal malocclusion mostly had a whorl pattern.[4] However, other research has also discovered that class II malocclusion patients had a lower prevalence of whorl pattern. [13] The whorl pattern predominated in the left thumb, left index finger, and left fifth finger of the left hand among the horizontal growth patterns. In the left middle and left fourth fingers, the loop pattern was more prominent. Out of the two horizontal development patterns, the right thumb, right index finger, right fourth digit, and right fifth finger showed a predominant whorl pattern. The right middle finger was where the loop was most noticeable.

The thumb and index fingers in the right and left hands showed a higher percentage of whorl patterns in the vertical growth pattern group than in the horizontal pattern group in the current study. In both horizontal and vertical growth pattern group hands, a higher frequency of loop patterns in the middle finger is been noted in the literature, as a result, these dermatoglyphics can be used to diagnose and plan treatments. A sizable sample size could be beneficial in the process of creating a diagnostic tool

for treatment planning. Furthermore, because a person's dermatoglyphic pattern doesn't change throughout the course of their lives, it may be possible to use this pattern to identify skeletal issues early in life.[14,15]

***Limitations of the study***

*The study results as such cannot be clinically applied to predict the skeletal growth pattern based on dermatoglyphysics. However, to assess* whether dermatoglyphic analysis can be employed reliably in the early diagnosis of patients at risk for developing horizontal or vertical growth patterns, more study is required, especially large-scale and longitudinal investigations.

## *Conclusion*

The dermatoglyphic and skeletal growth patterns are statistically significantly correlated. This work could serve as the foundation for a more in-depth investigation into pediatric patient populations for preventive and interventional orthodontics. The inconsistent results across various populations and research suggest that, although a relationship might exist, it is probably impacted by a complicated interaction between hereditary and environmental factors. Gaining knowledge of this correlation may help to improve early orthodontic interventions and preventative measures. Furthermore, it may be simple to investigate the genetic manifestation of malocclusion with a bigger sample size and ethnicity relevant to the study.

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