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Dermatoglyphics and Malocclusion

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***Abstract*:**

Background: Dermatoglyphics, coined by Cummins and Midlo in 1926, is a branch of genetics dealing with the skin ridge system. From cradle to grave, until the body decomposes fingerprints remain unchanged. Dermatoglyphics is the study on epidermal ridges on the palmar and plantar surfaces of the feet and hand. Dermatoglyphic patterns, share their development time during the intrauterine period, with the development and completion of dental hard tissues. Malocclusion, a dental disorder, with its genetic etiology being proven, thus gains attention in this field.

Materials and Methods: A total of 60, 9-12 years old, healthy children, with mixed dentition, were included in the study. Their left and right handprints were recorded on a paper, and the fingerprints were studied to find the frequency of occurrence of different types of patterns. Based on the dental aesthetic index, malocclusion was graded into four groups and then was correlated with the patterns' frequency.

Results: Loops were found to increase and while the whorls decreased, with increasing severity of malocclusion. In this study, loop pattern is a more common in the thumb and middle finger. Whorl pattern is a more common in the ring finger and index finger.

Conclusion: Dermatoglyphic analysis can be used as an indicator of malocclusion at an early age, thereby aiding the development of treatments aiming to establish favorable occlusion. Inheritance and twin studies, as well as those conducted in different ethnic groups, are required to examine these relationships further.

***Key Words*:** Dental aesthetic index, dermatoglyphics, malocclusion, mixed dentition

Introduction

Dermatoglyphics (derma refers to skin and glyphic refers to carving), as the name suggests, is the study of epidermal ridges and the patterns seen on the palm. The term dermatoglyphics was coined by Sir Harold Cummins, in the year 1926.[1]

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

Dermal ridges start to appear during the 12th week of intrauterine life and are completed by the 24th week of intrauterine life. Thereafter, they remain constant.[3]

Abnormal dermatoglyphic patterns have seen in several non-chromosomal genetic disorders and other diseases whose etiology may be influenced directly or indirectly by genetic inheritance. Dermatoglyphics are assumed to be genetically controlled, and the exact mechanism of inheritance is still unknown.[4]

Malocclusion is one of the genetically controlled forms of the most common dental diseases. The purpose of this study was therefore to find any relationship between malocclusion and dermatoglyphic.

Materials and Methods

A cross-sectional study design was conducted and a sample of 60, 9-12 years 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, lipstick,[5] magnifying glass and white sheets of paper were used.

Methodology

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

Recording of malocclusion

Modified dental esthetic index (DAI)[6] (Table 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 four groups with increasing severity. Group 1 (final value ≤25), Group 2 (final value 26-30), Group 3 (final value 30-35), and Group 4 (final value ≥36).

DAI components grading criteria

For no 2 is as follows: 0 = No segment crowded, 1 = One segment crowded, 2 = Two segments crowded, for no 3 is as follows: 0 = No segment spaced, 1 = One segment spaced, 2 = Two segments spaced, and for no 10 is as follows: The 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. The "lipstick" method[5] requires a dark shade of "lipstick," a foam rubber pad and a white sheet of paper. The lipstick was applied on the entire palm of the children including the wrist creases and digits (Figure 1). Then, we placed the sheet of paper on top of the foam rubber pad on a flat, stable surface. The subject's palm was placed on this and gently pressed. The foam pad was used to fill the concavity of the palm when the pressure was applied to the back of the hand. Otherwise, blank areas or white spaces would appear in the center of the palm. Then, we gently pressed each digit to make sure it also appeared on the palm print. Then, we placed our hand on the upper edge of the paper to assist the person in removing his/her hand. The subject did not need to wash his hands as the lipstick's color came off easily by wiping with a soft, damp cloth, and left a perfume too.

Table 1: Modified DAI.

DAI components	Recorded value	Rounded weights	Final value
Number of missing visible teeth		5.76 (6)	
Crowding in the incisal segment		1.15 (1)	
Spacing in the incisal segment		1.31 (1)	
Midline diastema (mm)		3.13 (3)	
Largest anterior irregularity in maxilla (mm)		1.34 (1)	
Largest anterior irregularity in mandible (mm)		0.75 (1)	
Anterior maxillary overjet (mm)		1.62 (2)	
Anterior mandibular overjet (mm)		3.68 (4)	
Vertical anterior openbite (mm)		3.69 (4)	
Anteroposterior molar relation		2.69 (3)	
Constant		13.36 (13)	13

DAI: Dental aesthetic index

Figure 1: Palmar impression of ridges of hand with Lipstick.

Interpretation of the prints

The interpretation of the final recorded prints was done by observing the distal phalanges of the 10 digits under a 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.

Statistical analysis

The data recorded was subjected to SPSS version 22 software for statistical analysis. Chi-square test was applied for comparison between the frequency of occurrence of the fingerprint patterns and their association with the four groups of malocclusion.

Results

The results showed that the distribution of dermatoglyphic patterns - loops, whorls arches, and composites in both the right and the left hand. Since loops and whorls were noted more frequently as compared to arches and composites, Chi-square test was applied.

Graph 1 shows that there is statistically significant correlation between the dermatoglyphics pattern in the left ring finger with the malocclusions with the whorl pattern.

Graph 2 shows that there is no statistically significant correlation present between various dermatoglyphics patterns and the type of malocclusions in right hand.

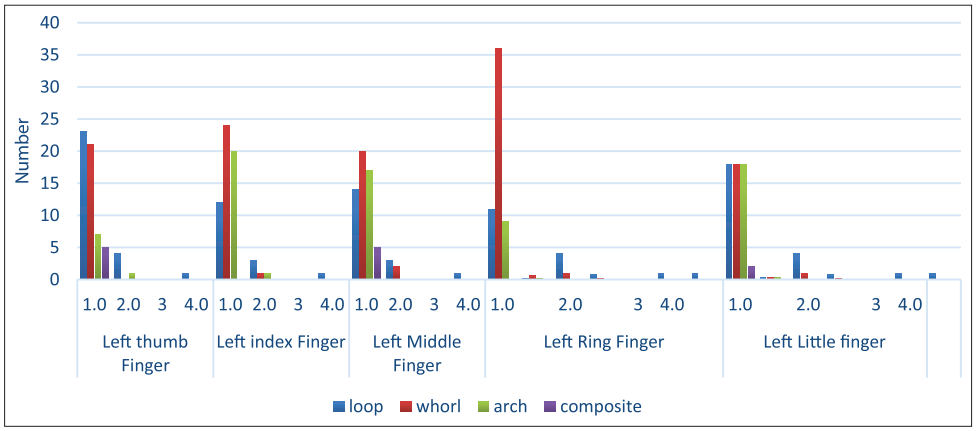
Graph 3 shows that there is statistically highly significant correlation present between the fingerprint pattern and the malocclusion with the loop pattern is more common in the thumb and middle finger.

Graph 4 shows that there is statistically highly significant correlation present between the fingerprint pattern and the malocclusion with the whorl pattern is more common in the ring finger and index finger.

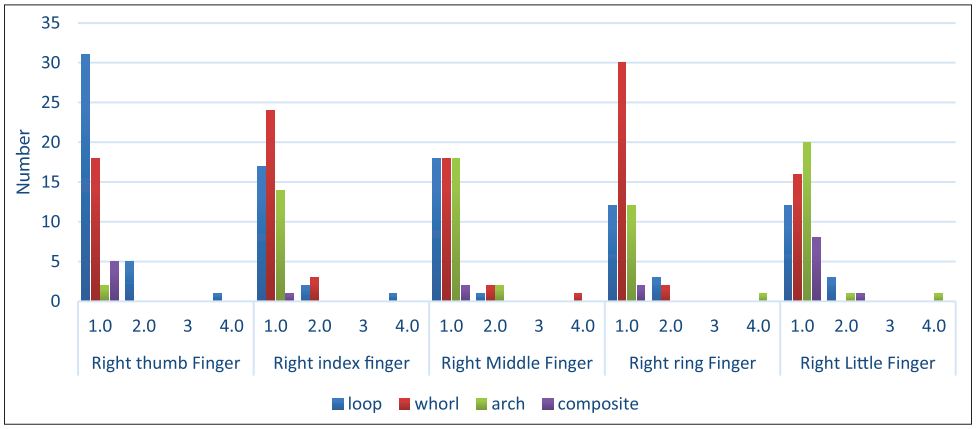
Discussion

In the year 1969, Carter stated that abnormalities occurring during the intrauterine period are influenced by hereditary and environmental factors, which reflect on an individual only when these combined factors exceed the threshold level.[7]

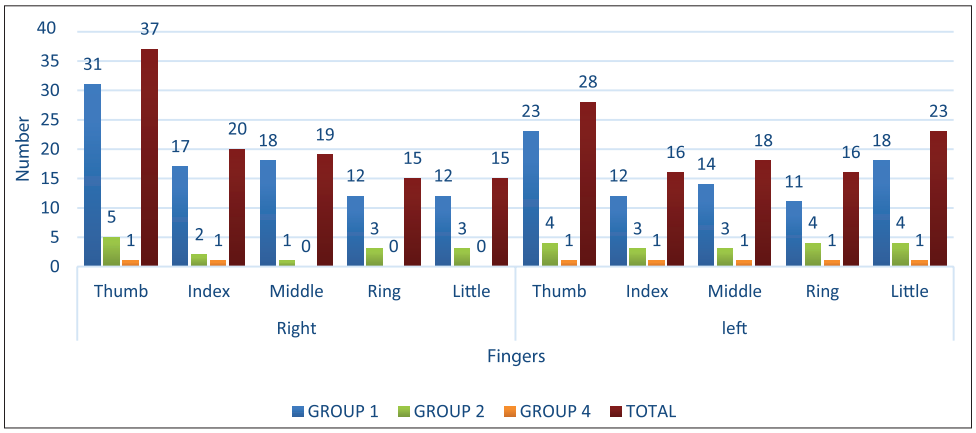
It has been accepted by the WHO as a cross-cultural index.[8] It identifies occlusal traits and mathematically derives a single score. The DAI appears to be easy to use, although the lack of assessment of traits such as buccal crossbite, open bite, centerline discrepancy, and deep overbite is a limitation of this index.[9]



Graph 1: Comparison of dermatoglyphic pattern with malocclusion (left hand).



Graph 2: Comparison of dermatoglyphic pattern with malocclusion (right hand).



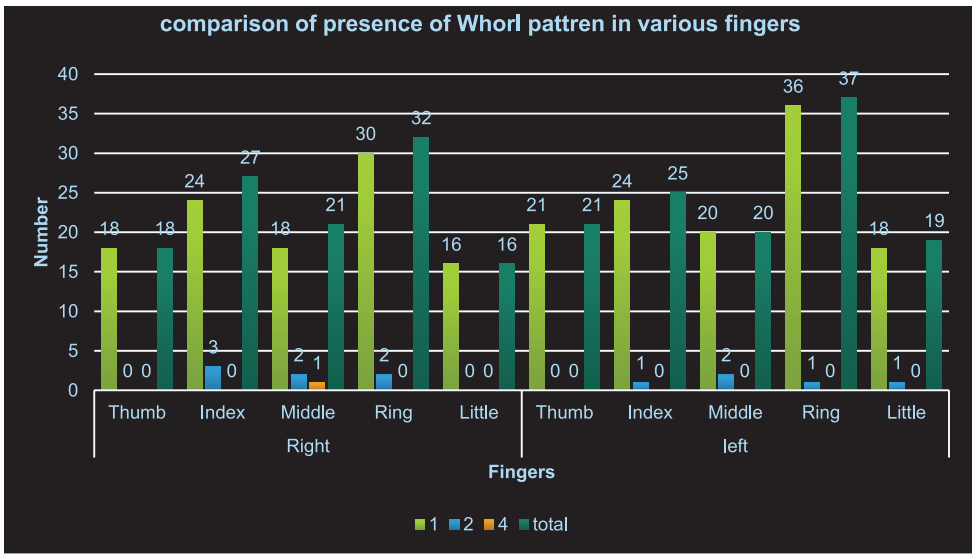
Graph 3: Comparison of presence of loop pattern in various fingers.

In addition, DAI measurements are carried out using a millimeter gauge, and small errors in accuracy can have an exaggerated effect due to the index weightings.[10]

In this 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 DAI 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 intraorally and no radiographs are required. The WHO has nominated it to be a cross-cultural index.[8]

Dermatoglyphic distribution study by Bhasin[11] revealed that whorls were very common followed by loops and arches among the 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 conducted among Indian Sunni Muslims, Ghosh *et al.*[12] found that the overall frequency of whorl was higher followed by loop and arch. Since religion was



Graph 4: Comparison of presence of whorl pattern in various fingers.

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,[4] cleft lip and palate.[13]

In the study done by Trehan *et al.*,[14] correlating the dermatoglyphic patterns and malocclusion, in 60 subjects, it was found that the frequency of the whorl pattern was more in number in Class 1 and 3 and the frequency of radial loop and arches were more in number in Class 1 and 2 division 1 cases.

In another study done by Reddy *et al.*[15] on 96 subjects, divided equally (24 each) into four groups, it was found that Class 2 division 2 pattern of malocclusion was correlated with increased frequency of arches and ulnar loops whereas decreased frequency of whorls. Furthermore, in Class 3 malocclusion, the frequency of arches and radial loop was high and ulnar loops were low.

The advantages of dermatoglyphics are that scanning or recording is cost-effective, rapid and can be done in the clinics without hospitalization and without causing any trauma. It also requires minimum equipment and data collected can be preserved for lifelong.[16]

Conclusion

Fingerprints are unique and unalterable and hence an excellent tool for population studies, personal identification, morphological, and genetic research. Any deviation in dermatoglyphics patterns indicates a genetic difference between control group and abnormal population. Although dermatoglyphics is considered an inexact, science has moved from obscurity to acceptability as a diagnostic tool. Extensive research in this field is required in order to determine the validity.

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