Assessment and Correlation between Dermatoglyphic pattern and Sagittal Skeletal Discrepancies: Short Study

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KEYWORDS

ABSTRACT

Dermatoglyphics, the intricate ridges and patterns on fingertips, serve as unique identifiers and have been linked to skeletal malocclusion. The development of dentition and palate coincides with dermal patterning around the sixth or seventh week of uterine development. Environmental and hereditary factors influencing the palate, alveolus, and lip may also affect fingerprint patterns. This study aims to assess and correlate dermatoglyphic parameters with skeletal Class I and Class II malocclusion. A total of 62 patients from the Orthodontics and Dentofacial Orthopaedics department were selected and divided into two groups of 31 each based on skeletal parameters (ANB angle and Witts) from cephalometric tracings. Fingerprints were recorded using the ink and stamp method and analyzed in forensic studies.Results indicated significant differences in dermatoglyphic patterns between groups. Specifically, the left index finger (F1) and left and right ring fingers (F4) exhibited dominant pattern variations, with p-values of 0.026, 0.026, and 0.035, respectively. Whorl patterns were predominant in Skeletal Class II, while loop patterns were prevalent in Class I, particularly in the left index and both ring fingers.In conclusion, dermatoglyphic parameters demonstrate a significant correlation with sagittal skeletal discrepancies and dental malocclusion, suggesting their potential as non-invasive diagnostic tools in orthodontics.

INTRODUCTION :

Malocclusion a condition defined by Gardiner, White and Leighton is a condition in which there is a deflection from the normal relation of the teeth to other teeth in the same arch and/or teeth in opposite arch[1.] Malocclusion adversely affects facial aesthetics, functional efficacy and structural balance that makes it primary reason for seeking orthodontic treatment[1]. Among malocclusion, skeletal malocclusion is the most cumbersome to treat as it is timebound, so to predict the malocclusion early and to take required preventive measures, one can take the aid of dermatoglyphics. Dermatoglyphics is defined as the scientific study of the skin ridge patterns on the fingers, toes, palms of hands and soles of feet. Just as malocclusion distinguish individuals, dermatoglyphics (the unique patterns on our fingertips)also creates distinctive imprints(Figure 1). Beyond mere appearance, emerging research suggests a potential link between these fingerprint patterns and skeletal malocclusion[1]. This intriguing connection underscores the intricate relationship between genetics, facial development, and dental

alignment. Understanding this interplay could revolutionize orthodontic diagnosis and treatment, improving both oral health and facial aesthetics.[1,2]

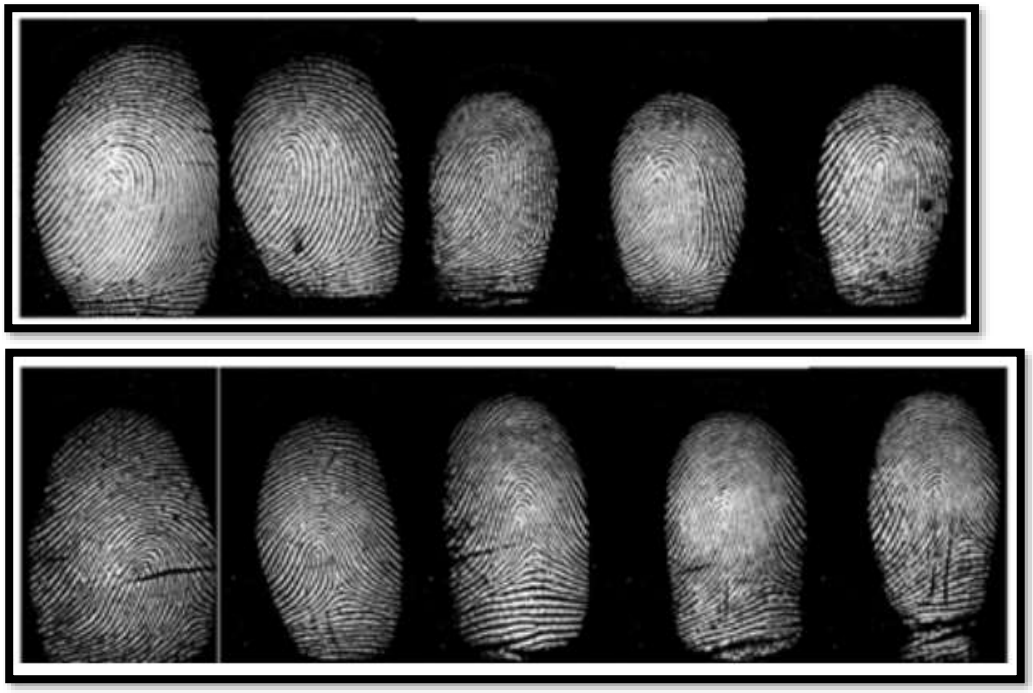


FIGURE1 : Dermatoglyphic Pattern Recorded By Scanner Method

Dentition and palatal morphogenesis commence simultaneously around the sixth or seventh week post-conception, concurrent with the initiation of dermal patterning within the uterine environment. Environmental and genetic factors influencing the development of the palate, alveolus, and lip may potentially correlate with irregularities in palm and fingerprint formation. Recent findings suggest a connection between sagittal plane discrepancies, and variations in dermatoglyphics.[2]

FIGURE 2: Magnified View Of A Finger Print

Both genetic and environmental influences contribute to the formation of the face and skull, leading to various facial structures. The genetic code established during early development might be reflected in the patterns on our fingertips, as both are shaped by a combination of inherited traits and external factors.[3] The most common fingerprint pattern encountered are loops and whorls of all the intricate ridges and patterns adorning our fingerprints.[4,5] (Figure 2) Intriguingly, studies by Sengupta A.B et al[6] and Shair T[7] et al suggest that disruptions occurring during the crucial period of craniofacial development may simultaneously leave

their mark on fingerprint patterns. This raises the possibility that unusual fingerprint formations could serve as an early indicator of underlying skeletal discrepancies.[6,7]
Many dental predictions can be done for instance, those missing lateral incisors had more specific loop patterns and tri-radii on the palms and soles of their feet. Similarly, those missing second premolars exhibited variations in loop patterns, tri-radii distribution, and plantar characteristics. Overall, patients with congenital hyperplasia collectively showed increased frequencies of particular fingerprint features[8]. This is an example showing the prevelance and corelation of the two things with each other that further suggests detailed research is needed on this topic.

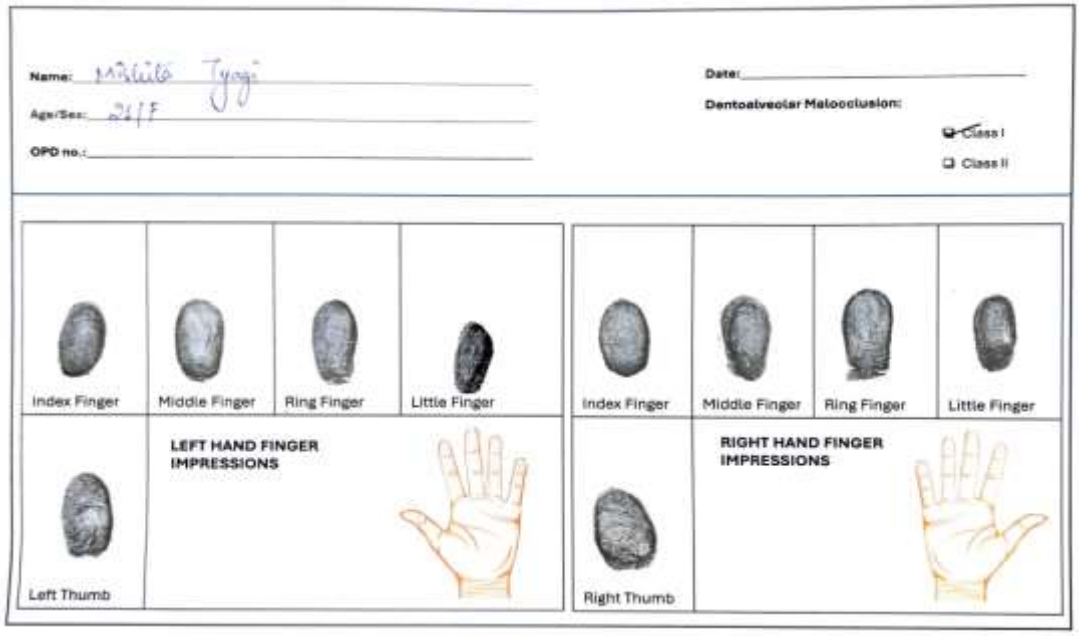


FIGURE 3: Finger Print Recording In A Official Format Design

The potential correlation between dermatoglyphics and skeletal malocclusion offers an exciting opportunity for orthodontists. Analyzing fingerprint patterns could become a non-invasive supplementary screening tool but for that a proper format to record finger prints is required (Figure 3). Early identification of patients at increased risk of jaw misalignment would facilitate timely intervention, potentially leading to preventive orthodontic treatment or measures to guide optimal jaw growth.[9,10] This has the potential to streamline orthodontic care and contribute to superior long-term outcomes.[11,12]

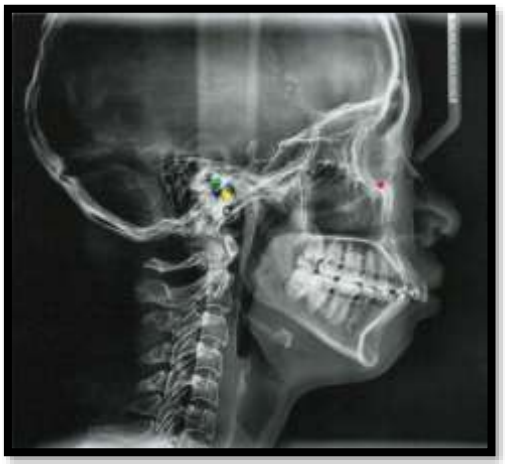


FIGURE 4 : Lateral Cephalometric View Of Face

FIGURE : 5 Finger Print Showing Loops And Whorls.

The emerging connection between dermatoglyphics and malocclusion (Figures 4 & 5) sparks intriguing inquiries into the complex interplay of genetics, development, and their observable expressions in medicine and forensics. [13]
Using dermatoglyphic analysis parameters to provide early warning signs of possible orthodontic development would enable early intervention, avoiding or reducing the severity of treatment when the time is ready for orthodontic intervention. This establishment of a dependable relationship between dermatoglyphics and orthodontic conditions can lead to a paradigm shift in the manner in which patients are assessed and treated.

AIM:

Assessing and correlating various dermatoglyphic parameters of individuals with Skeletal Class I and Class II malocclusion.

***OBJECTIVES*:**

- To assess dermatoglyphic parameters associated with Skeletal Class I relationship.
- To assess dermatoglyphic parameters associated with Skeletal Class II relationship.
- To evaluate the difference in dermatoglyphic parameters of Skeletal Class I and Class II relationship.
- To correlate dermatoglyphics parameter with Dental Class I and Class II malocclusion.

***NULL HYPOTHESIS*:**

There is no significant correlation between dermatoglyphic parameters of skeletal Class I and Class II relationship with Angle's Class I, and Class II malocclusion.

***MATERIALS AND METHODS*:**

A total of 62 patients reporting to the department of Orthodontics and Dentofacial Orthopaedics in Inderprastha Dental College and Hospital, Ghaziabad, India were selected as study sample. The patients were selected based on following inclusion and exclusion criteria.

- *INCLUSION CRITERIA:*
  - Age of the individual was 15 years or greater.

- Individual had never received any orthodontic treatment previously.
- Individual must have permanent dentition.
- No missing teeth in the dentition except for the third molars.
- No supernumerary teeth was present.

- *EXCLUSION CRITERIA:*
  - Individuals having Mixed dentition
  - Retained teeth in the dentition.
  - Supernumerary teeth present.
  - Any missing teeth in the dentition except for third molars.
  - Orthodontically treated prior to this study.
  - Syndromic patients.
  - CL/CP Patients.
  - Skeletal Class III patients.

Armamentarium:

The following materials were used for the study:

- Pre-treatment lateral cephalometric radiographs.
- Intra-oral photography mouth mirrors.
- Cheek retractors.
- DSLR Camera(Canon 1500 D).
- Ethyl alcohol.
- Ink Pad(Sirchie printmatic Flawless Ink pad).
- Adhesive Tape.
- Template

Methodology:

A sample of 62 patients was selected as per the inclusion and exclusion criteria, patients were briefed about the study procedure, and a consent explaining the rules and regulations of the hospital was signed by the patient. Selected individuals were grouped under two groups i.e. Group A – Skeletal Class I relationship and Group B – Skeletal Class II relationship of 31 patients each based on ANB angle and Witts.

Group A	Skeletal Class I Jaw relationship.
Group B	Skeletal Class II Jaw relationship.

Criteria for Skeletal Class I and Skeletal Class II:

Skeletal Classification	ANB angle	Witts
Skeletal Class I	2 +/- 2	Witts = -1 to +1
Skeletal Class II	> 4	Witts >/= 2

For calculation of these cephalometric parameters, patients were sent for a lateral cephalogram which were later traced manually. For the collection of dermatoglyphic samples, participants were instructed to wash their hands with soap and water, followed by wiping them with ethyl alcohol to eliminate sweat, oil, and dirt from the skin's surface.
Fingerprints were recorded using the ink stamp method (illustrated in Figures 6, 7, and 8). Black duplicating ink was applied to the fingertips of all ten fingers before capturing the impressions. The

prints were then transferred onto a specially designed template sheet secured with adhesive tape. To prevent duplication, fingerprints were systematically recorded for each finger, from the thumb to the little finger, on both hands. Pattern interpretation was carried out following the Cummins and Midlo method. Using the ink pad technique, blue duplicating ink was applied to the fingertips, and impressions were taken on a blank white sheet. [3,7]

FIGURE 6: Instructions to patient regarding sample collection

FIGURE 7 : Stamp pad (Sirchie printmatic Flawless Ink pad)

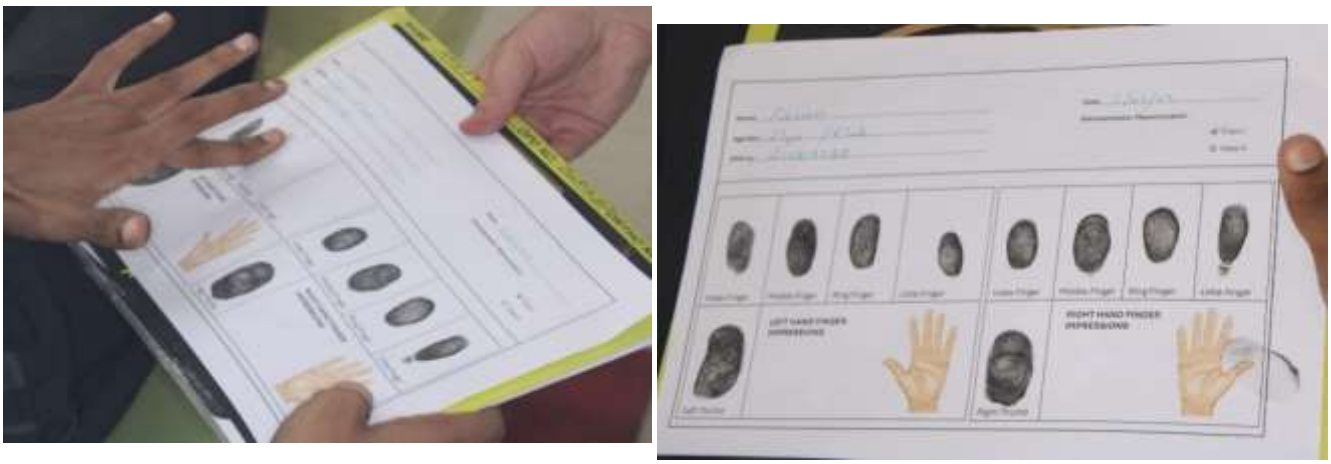


FIGURE 8: Sample Collection

LATERAL CEPHALOGRAM:

The lateral cephalogram of the respective patient were imported to NEMOCEPH software where cephalometric landmarks were traced after the manual tracing was done(as shown in figure 9) and the below-mentioned angular parameters of analysis were analyzed that were selectively taken for the study to reduce magnification error:

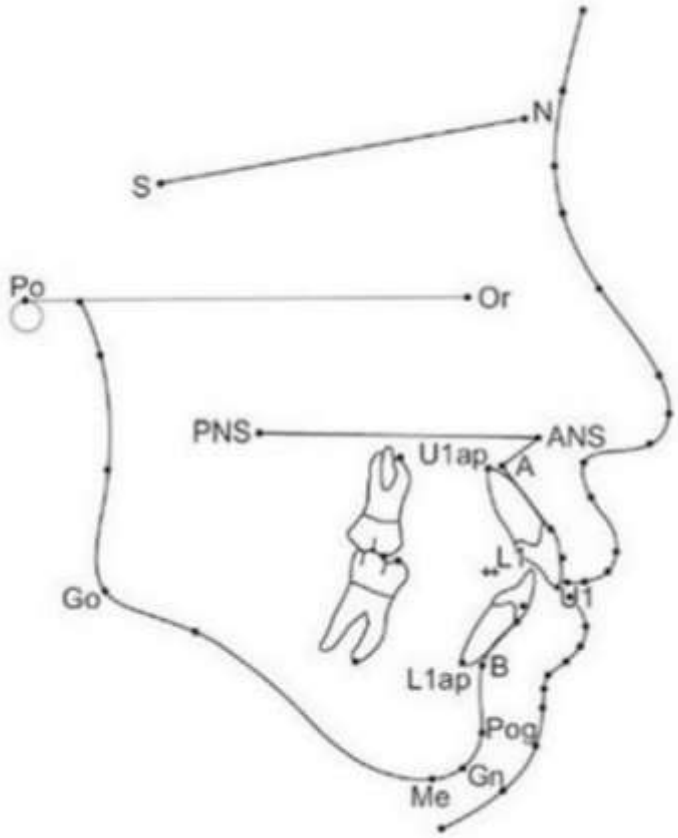


FIGURE 9: Lateral Cephalometric Landmarks

- ***Skeletal Parameter***

1. *SNA (^{0})*
2. *SNB(^{0})*
3. *WITTS Appraisal*
4. *Angle of Convexity*
5. *Facial Angle*
6. *ANB angle(^{0})*
7. *SN-GoGn angle (^{0})*
8. *FMA (^{0})*

Only a single examiner (i.e., the principal investigator) was marking the landmarks and assessing the measurements. Also, 10 random radiographs (5 from each) were selected from the already evaluated 62 lateral cephalograms of the sample patients and assessed by the same investigator after 3-4 weeks for checking the reliability of the cephalometric reading.[4]

DERMATOGLYPHIC ANALYSIS

1. Each fingerprint was taken and checked for precision. That was achieved through use of design template with space of designated finger.

2. The obtained prints were analyzed for the prevalence of arches, loops, and whorls, and the total ridge count was also evaluated (as depicted in Figure 10). Pattern interpretation followed the method described by Cummins and Midlo, which involved thoroughly cleaning the hands with Savlon and

allowing them to dry. Subsequently, the digits of the right hand were guided onto the ink stamp pad by the researchers and firmly pressed against bond paper placed on a smooth, flat surface three to four times. The collected data was then forwarded to fingerprint experts for forensic analysis.

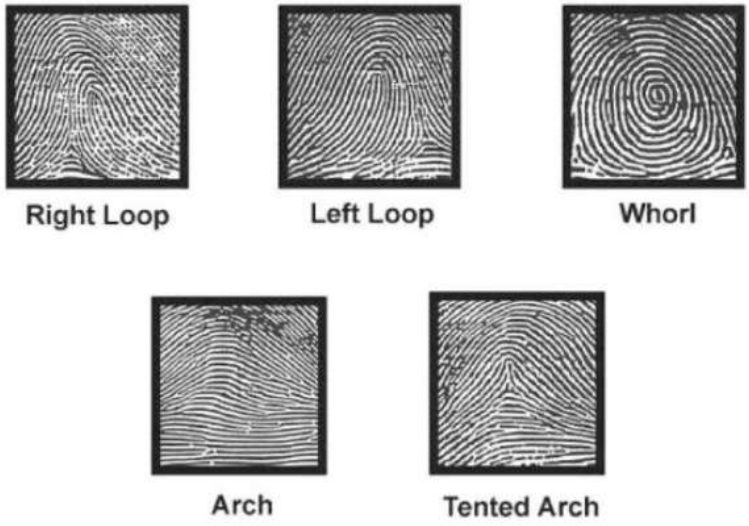


FIGURE 10: Loops, Arch And Whorls Pattern

After the evaluation of finger prints, data was obtained from the forensics team providing a detail about the total number of loops ,whorls and ridges in a particular patient. After obtaining a detailed description of patients, results were evaluated of both the groups and comparison between the two groups was done on the basis of number of loops ,whorls and ridge count.

***Statistical Analysis*:**

Descriptive data was analyzed as number, frequency, mean and Standard Deviation. the statistical analysis was carried out by using SPSS version 27 software. To analyze the intergroup comparison for quantitative data One way ANOVA was used and for qualitative data Chi-square test was used. The level of significance less than and equal to 0.05 was considered significant.

RESULT:

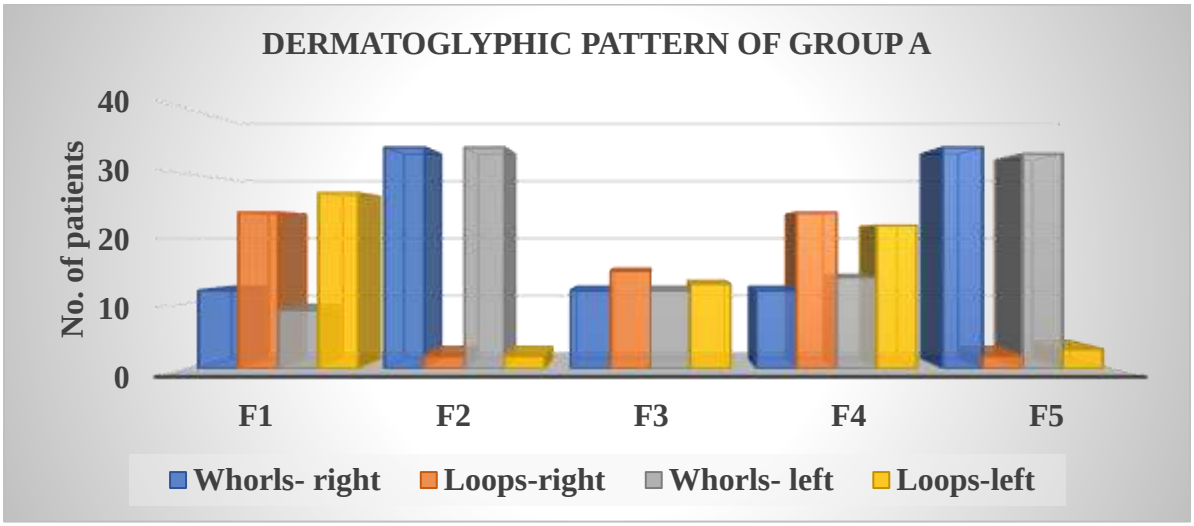
This study was undertaken for the assessment of dermatoglyphic pattern in the routine diagnostic records for orthodontic patients. For this purpose, 62 patients were selected and were divided into two groups based on their Skeletal relationship i.e., patients having Skeletal Class I relation (Group A) and having Skeletal Class II (Group B) relationship on the basis of lateral cephalometric parameters that were ANB angle and Witts.

Dermatoglyphic parameters of all the fingers of left and right hand were assessed of Group A in Table1 and Graph1 using chi-square test and it was found that there is a significant differences of loop or whorl pattern in all the fingers of patients of skeletal Class I relationship, with p value of 0.001, stating that loop pattern was dominant on F1, F3 and F4, whereas whorl pattern was dominant in F2and F5 in both hand.

TABLE 1: DERMATOGLYPHIC PATTERN OF GROUP A

Pattern	F1	F2	F3	F4	F5	Chi-square value	p-value
Whorls-right	12 (6.7%)	34 (18.9%)	12 (6.7%)	12 (6.7%)	34 (18.9%)	100.281	**0.001**
Loops-right	24 (13.3%)	2 (1.1%)	15 (8.3%)	24 (13.3%)	2 (1.1%)		
Whorls- left	9 (5%)	34 (18.9%)	12 (6.7%)	14 (7.8%)	33 (18.3%)	109.791	**0.001**
Loops-left	27 (15%)	2 (1.1%)	13 (7.2%)	22 (12.2%)	3 (1.7%)		

$p \leq 0.05$ – Significant, CI = 95 %



GRAPH 1 : DERMATOGLYPHIC PATTERN OF GROUP A

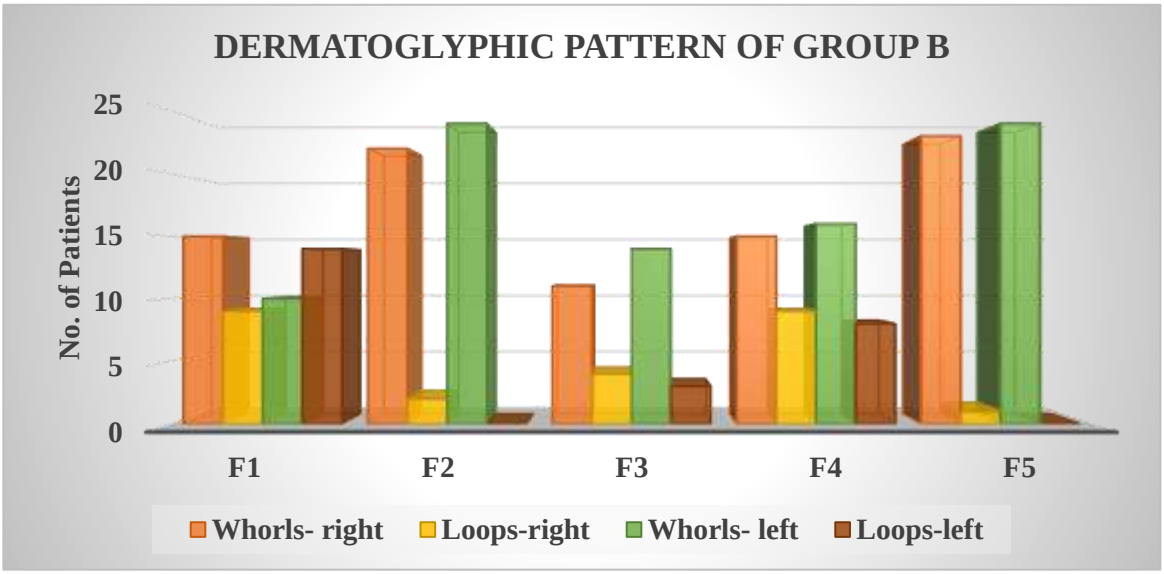
Dermatoglyphic parameters of all the fingers of left and right hand were assessed of Group B in Table 2 and Graph 2 using chi-square test and it was found that significant differences of loop or whorl pattern in all the fingers of patients of skeletal Class II relationship, with p value of 0.001, stating that whorl pattern was dominant in all the fingers except F1 left.

TABLE 2: DERMATOGLYPHIC PATTERN OF GROUP B

Pattern	F1	F2	F3	F4	F5	Chi-square value	p-value
Whorls-right	15 (12.5%)	22 (18.3%)	11 (9.2%)	15 (12.5%)	23 (19.2%)	53.692	**0.001**
Loops-right	9 (7.5%)	2 (1.7%)	4 (3.3%)	9 (7.5%)	1 (0.8%)		
Whorls- left	10 (8.3%)	24 (20%)	14 (11.7%)	16 (13.3%)	24 (20%)	65.618	**0.001**
Loops-left	14 (11.7%)	0 (0%)	3 (2.5%)	8 (6.7%)	0 (0%)		

$p \leq 0.05$ – Significant, CI = 95 %

GRAPH 2 : DERMATOGLYPHIC PATTERN OF GROUP B.



The dermatoglyphic parameters of all the fingers on the left hand were analyzed separately for whorls and loops in Group A and Group B (as shown in Table 3). It was observed that whorls were more prevalent in Group B patients, although the difference was not statistically significant. In contrast, loops were more common in Group A, and this difference was highly significant.

TABLE 3: (LEFT HAND) RELATION BETWEEN DOMINANT PATTERN(LOOPS OR WHORLS) WITH SKELETAL CLASS I AND II.

LEFT HAND

Variable	Fingers	Group A	Group B	Chi-square value	p-value, S/NS
WHORLS	**F1**	12 (6.3%)	15 (7.9%)	0.155	0.997,NS
	F2	26 (13.7%)	30 (15.8%)		
	F3	10 (5.3%)	13 (6.8%)		
	F4	12 (6.3%)	15 (7.9%)		
	F5	27 (14.2%)	30 (15.8%)		
	Total	87 (45.8%)	103 (54.2%)		
LOOPS	**F1**	18 (19.6%)	15 (16.3%)	11.657	**0.020,S**
	F2	4 (4.3%)	0 (0%)		
	F3	5 (5.4%)	14 (15.2%)		
	F4	18 (19.6%)	15 (16.3%)		
	F5	3 (3.3%)	0 (0%)		
	Total	48 (52.2%)	44 (47.8%)		

Dermatoglyphic parameters of all the fingers of right hand were compared in Group A and Group B separately for whorls and loops(as shown in table 4), it was found that whorls was found more in Group B patients but the difference was not significant whereas loops were more in Group A and the difference was highly significant.

TABLE 4: (RIGHT HAND) RELATION BETWEEN FINGERS DOMINANT PATTERN(LOOPS OR WHORLS) WITH SKELETAL CLASS I AND II.

RIGHT HAND

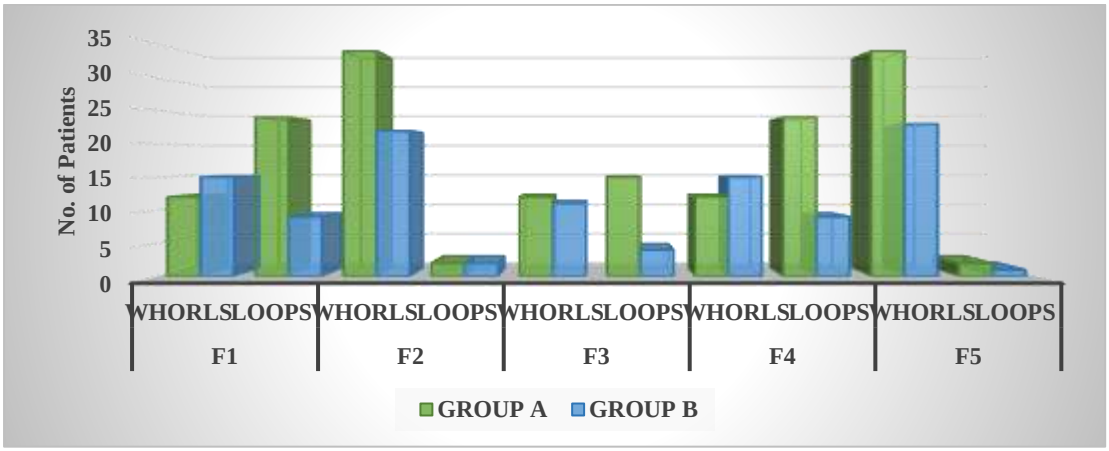
Variable	Fingers	Group A	Group B	Chi-square value	p-value, S/NS
WHORLS	**F1**	7 (3.7%)	12 (6.3%)	1.050	0.902,NS
	F2	28 (14.7%)	30 (15.8%)		
	F3	13 (6.8%)	13 (6.8%)		
	F4	13 (6.8%)	17 (8.9%)		
	F5	27 (14.2%)	30 (15.8%)		
	Total	88 (46.3%)	102 (53.7%)		
LOOPS	**F1**	23 (25%)	18 (19.6%)	15.107	**0.004,S**
	F2	2 (2.2%)	0 (0%)		
	F3	2 (2.2%)	14 (15.2%)		
	F4	17 (18.5%)	13 (14.1%)		
	F5	3 (3.3%)	0 (0%)		
	Total	47 (51.1%)	45 (48.9%)		

Dermatoglyphic parameters of all the left hand fingers of Group A and Group B were compared in Table 5 and Graph 3, it was found that, index finger (F1) , little finger (F4) showed significant differences on the basis of presence of dominant dermatoglyphic pattern with a p value of 0.026, stating that in F1and F4 loop pattern was dominant in GROUP A whereas whorl pattern was dominant in GROUP B.

TABLE 5: (LEFT HAND) RELATION BETWEEN FINGERS AND THEIR DOMINANT PATTERN(LOOPS OR WHORLS) OF BOTH GROUP A AND B.

Finger	Pattern	(GROUP A)	(GROUP B)	Chi-square value	p-value
F1	**Whorls**	12 (20%)	15 (25%)	**4.949**	**0.026**
	Loops	24 (40%)	9 (15%)		
F2	**Whorls**	34 (56.7%)	22 (36.7%)	0.179	0.673
	Loops	2 (3.3%)	2 (3.3%)		
F3	**Whorls**	12 (20%)	11 (18.3%)	4.179	0.124
	Loops	15 (25%)	4 (6.7%)		
F4	**Whorls**	12 (20%)	15 (25%)	**4.949**	**0.026**
	Loops	24 (40%)	9 (15%)		
F5	**Whorls**	34 (56.7%)	23 (38.3%)	0.058	0.809
	Loops	2 (3.3%)	1 (1.7%)		

$p \leq 0.05$ – Significant, CI = 95 %



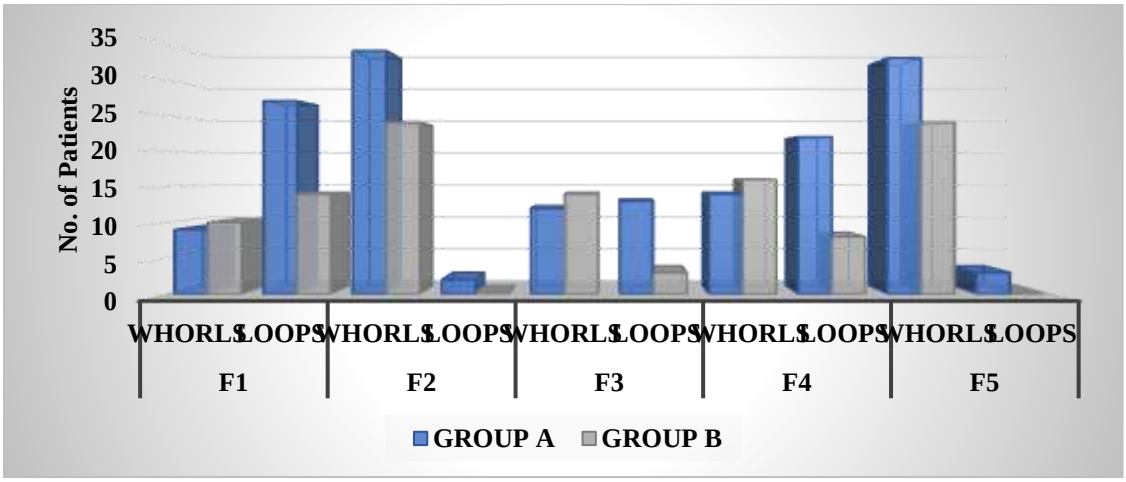
GRAPH 3 : (LEFT HAND) RELATION BETWEEN FINGERS AND THEIR DOMINANT PATTERN (LOOP OR WHORLS) OF BOTH GROUP A AND B.

Dermatoglyphic parameters of all the right hand fingers of Group A and Group B were compared in Table 6 and Graph 4, it was found that, little finger (F4) showed significant difference on the basis of dominant dermatoglyphic pattern presence(loop) with a p value of 0.035, stating that in F4 loop pattern was dominant in F4 GROUP A whereas whorl pattern was dominant in F4 GROUP B.

TABLE 6: (RIGHT HAND) RELATION BETWEEN FINGERS AND THEIR DOMINANT PATTERN(LOOPS OR WHORLS) OF BOTH GROUP A AND B.

Finger	Pattern	(GROUP A)	(GROUP B)	Chi-square value	p-value
F1	**Whorls**	9 (15%)	10 (16.7%)	1.849	0.174
	Loops	27 (45%)	14 (23.3%)		
F2	**Whorls**	34 (56.7%)	24 (40%)	1.379	0.240
	Loops	2 (3.3%)	0 (0%)		
F3	**Whorls**	12 (20%)	14 (23.3%)	5.097	0.078
	Loops	13 (21.7%)	3 (5%)		
F4	**Whorls**	14 (23.3%)	16 (26.7%)	**4.444**	**0.035**
	Loops	22 (36.7%)	8 (13.3%)		
F5	**Whorls**	33 (55%)	24 (40%)	2.015	0.147
	Loops	3 (5%)	0 (0%)		

$p \leq 0.05$ – Significant, CI = 95 %



GRAPH 4 : (RIGHT HAND) RELATION BETWEEN FINGERS AND THEIR DOMINANT PATTERN (LOOP OR WHORLS) OF BOTH GROUP A AND B.

Dermatoglyphic parameters of all the fingers were compared with patients having Angle's Class I and II molar relationship in Table 7 and Graph 5, it was found that, middle finger (F2) left , ring finger (F3) left and right, hand showed significant difference between the Dental Class I and Dental Class II on the basis of dominant dermatoglyphic pattern presence(loops or whorls) with a p value of 0.038, 0.002 and 0.001 respectively, stating that in Angle's Class I molar relation whorl pattern was dominant in F2 Left and F3 Left and Right and in Angle's Class II molar relation loop pattern was found dominant in F3 Left and Right whereas whorl pattern was dominant in F2 Left.

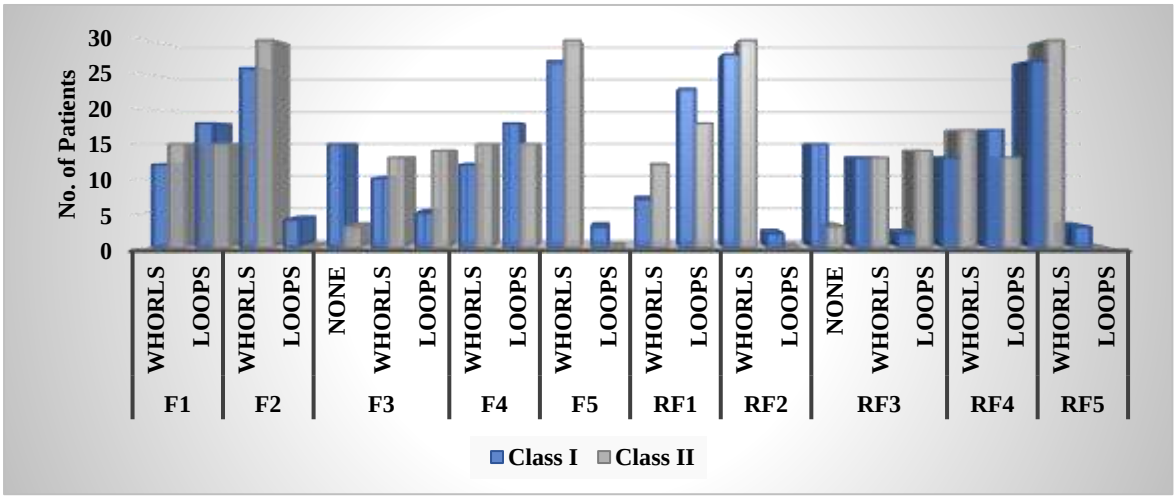
TABLE 7: <u>OVERALL RELATION OF PATTERN WITH MALOCCLUSION.</u>

Finger	Pattern	DENTAL CLASS		Chi-square value	p-value
		Class I	Class II		
F1	**Whorls**	12 (20%)	15(25%)	0.606	0.436
	Loops	18 (30%)	15(25%)		
F2	**Whorls**	26 (43.3%)	30 (50%)	4.286	**0.038**
	Loops	4 (6.7%)	0 (0%)		
F3	**None**	15 (25%)	3 (5%)	12.654	**0.002**
	Whorls	10 (16.7%)	13 (21.7%)		
	Loops	5 (8.3%)	14 (23.3%)		
F4	**Whorls**	12 (20%)	15(25%)	0.606	0.436
	Loops	18 (30%)	15(25%)		
F5	**Whorls**	27 (45%)	30 (50%)	3.158	0.076
	Loops	3 (5%)	0 (0%)		
RF1	**Whorls**	7 (11.7%)	12 (20%)	1.926	0.165
	Loops	23 (38.3%)	18 (20%)		
RF2	**Whorls**	28 (46.7%)	30 (50%)	2.069	0.150
	Loops	2 (3.3%)	0 (0%)		
RF3	**None**	15 (25%)	3 (5%)	17.000	**0.001**
	Whorls	13 (21.7%)	13 (21.7%)		

	Loops	2 (3.3%)	14 (23.3%)		
RF4	**Whorls**	13 (21.7%)	17 (28.3%)	1.067	0.302
	Loops	17 (28.3%)	13 (21.7%)		
RF5	**Whorls**	27 (45%)	30 (50%)	3.158	0.076
	Loops	3 (5%)	0 (0%)		

p ≤ 0.05 – Significant, CI = 95 %

GRAPH 5: RELATION BETWEEN ALL 10 FINGERS AND THEIR DOMINANT PATTERN(LOOPS OR WHORLS) WITH DENTAL CLASS I AND II MALOCCLUSION.



DISCUSSION:

The present study was conducted to assess and correlate various dermatoglyphic parameters of individuals with Skeletal Class I and Class II relationship. On conducting the study there were significant differences observed in both of the groups with regards to all dermatoglyphic variables. This indicates that the skeletal relationship observed in both Skeletal Class I and Class II groups correspond to a great degree of differences in various loop or whorl patterns. This observation differs from the one analysed by study of Jindal G et al[5]. where they found no significant difference among Skeletal class I, class II and class III when dermatoglyphic parameters were analysed. But was some how similar with the study done by Shair T et al [7] which stated that there are significance differences is the loop and whorl pattern between Class I and Class II patients.

During the meticulous scrutiny of dermatoglyphic patterns, a notable proportion of loop-whorl pattern variables exhibited noteworthy dissimilarities within both the left and right hands, establishing meaningful distinctions between the two focal groups. Which can direct the indication that Dermatoglyphic pattern were affected by different cephalometric variables. Although when seen individually there is a significant difference in pattern but on comparing the two groups only a few fingers showed a significant distinguishable pattern like index finger(F1) of left hand and little finger(F4) of both left and right hands.

On the basis of presence of dominant dermatoglyphic pattern this present study show similaties with study done by Shair T et al [7] in which significant difference in pattern was found on comparing Class I and Class II Groups which stated only a few fingers showed a significant distinguishable pattern like index finger(F1) of left hand and little finger(F4) of both left and

right hands while study done by Jindal G et al[5] and Perose LS et al[16] showed no significant differences in dermatoglyphic pattern of Class I and Class II groups .

Dermatoglyphic parameters of all the fingers of left and right hand were assessed of Group B in Graph 4 using chi-square test and it was found that significant differences of loop or whorl pattern in all the fingers of patients of skeletal Class II relationship, with p value of 0.001, stating that whorl pattern was dominant in all the fingers except F1 left unlike the study done by Eslami N et al[3] that showed Loop was the most frequent pattern in all the fingers of the three groups devided as skeletal Class I ,II and III, whereas the arch pattern occurred with the lowest frequency and also SN-Go Gn and FMA showed a positive correlation with all the fingers in three groups.
The study conducted by Perose LS et al (1973)[16] The analysis of dermatoglyphic data, including various finger ridge patterns, total finger ridge count, and angle measurements, revealed an increase in loop count and a reduction in whorls and arches in individuals with skeletal Class III malocclusion compared to those with Class I malocclusion ($p = 0.037$). However, no statistically significant differences were observed among the groups concerning total finger ridge count and angle measurements. These findings differ notably from our study, where a significant association between dermatoglyphic patterns was identified.
In a study done by Reddy RS et al (1997)[18] potential link between fingerprint and palm patterns and different types of bite alignment was investigated. By comparing individuals with normal and abnormal bites, researchers found some preliminary correlations between specific fingerprint patterns and certain malocclusions, such as increased twinned loops in Class II malocclusions and absence of radial loops in Class III malocclusions. However, palm print patterns showed no significant differences this study showed some similarities with our study depicting the increased number of loop patterning in Skeletal Class II relationship.
In a study done by Reddy BR et al(2013)[2] The participants were categorized into four distinct groups: Group 1 comprised individuals with Class I ideal occlusion, Group 2 included those with Class I malocclusion, Group 3 encompassed individuals with Class II Division 1 and Division 2 malocclusions, and Group 4 consisted of those with Class III malocclusion. Finger and palmar print patterns were collected and analyzed for each group. Specific parameters, such as the Total Finger Ridge Count (TFRC), the a-b ridge count, and the “atd” angle (formed by lines connecting the digital triradius ‘a’ to the axial triradius and from the axial triradius to the digital triradius ‘d’), were examined in relation to each group. Certain finger patterns demonstrated statistical significance, including an increase in twinned loops in Class II malocclusions and the absence of radial loops in Class III malocclusions. However, no statistically significant associations were found for parameters related to palmar prints. This result is in conjunction with our study stating loop presence and twinned loop in Class II patients while there was no conclusive evidence of radial loop presence.

On comparison of Dermatoglyphic parameters of all the fingers with patients having Angle’s Class I and II molar relationship, it was found that, middle finger (F2) left , ring finger (F3) left and right, hand showed significant difference between the Dental Class I and Dental Class II on the basis of dominant dermatoglyphic pattern presence(loops or whorls) with a p value of 0.038, 0.002 and 0.001 respectively, stating that in Angle’s Class I molar relation whorl pattern was dominant in F2 Left and F3 Left and Right and in Angle’s Class II molar relation loop pattern was found dominant in F3 Left and Right whereas whorl pattern was dominant in F2 Left. There are limited studies found on dental abnormalities and dermatoglyphic pattern.
For example a study done by Sen Gupta AB et al[6] suggests strong correlation between molar relationship and dermatoglyphic pattern and a study done by Atau M et al[8] suggests variation in dermatoglyphic parameters in patients with and without missing premolars.

These studies show a strong correlation between dental findings and dermatoglyphic pattern but still there has been no studies done to compare dental malocclusion with dermatoglyphic pattern earlier, on which we have emphasized to find a correlation between the two and also revaluate the skeletal parameters as well ,due to limited amount of studies and with no conclusive results comparing the skeletal parameters with dermatoglyphic parameters.

Previous studies have demonstrated associations between dermatoglyphic variations and dental defects such as cleft lip and palate, dental caries, and tooth dimensional variations. These findings have provided valuable diagnostic tools for early detection of dental abnormalities. However, the specific relationship between dermatoglyphic patterns and dental malocclusion - a common orthodontic concern affecting both function and aesthetics - remains largely unexplored.

This study aims to address this research gap by investigating potential correlations between dermatoglyphic patterns and various types of dental malocclusion. Additionally, we seek to examine skeletal parameters in relation to dermatoglyphic patterns, an area where existing research is both limited and inconclusive. The inclusion of skeletal measurements adds a crucial dimension to our understanding, as malocclusion often involves both dental and skeletal components.

The integration of skeletal parameter analysis represents a novel approach in dermatoglyphic research. While some studies like Shair T et al [7] , Jindal G et al[5] , Perose LS et al[16] , Eslami N et al[3] and Reddy RS et al (1997)[18] have attempted to correlate dermatoglyphic patterns with basic skeletal measurements, their results have been inconsistent and limited in scope. Our comprehensive examination of both dental malocclusion and skeletal parameters in relation to dermatoglyphic patterns may reveal previously unidentified associations that could enhance early diagnosis and treatment planning in orthodontics.

These studies are of great use as early identification of patients at increased risk of jaw misalignment that would facilitate timely intervention, potentially leading to preventative orthodontic treatment or measures to guide optimal jaw growth. This has the potential to streamline orthodontic care and contribute to superior long-term outcomes, therefore broadening our perspective of craniofacial and dental development in relation to these fingerprint patterns can revolutionize patient evaluation and treatment planning.

Conclusion:

- Following conclusion was drawn from this study that there was significant differences in dermatoglyphic patterns between Skeletal Class I with loop patterns being dominant in Skeletal Class I (F1, F3, F4).
- Whorl patterns was found more prevalent in Skeletal Class II (especially across all fingers except F1 left).
- On comparing the dermatoglyphic parameters of all the fingers of Group A and Group B, it was found that, index finger (F1)(left) , little finger (F4)(of both hands) showed significant differences as whorls was found more in Group B patients but the difference was not significant whereas loops were more in Group A and the difference was highly significant.
- Additionally, when comparing dermatoglyphic patterns in patients with Angle's Class I and II molar relationships, significant differences were found in the middle (F2 left) and ring (F3 left and right) fingers. In Class I molar relationships, whorl patterns were more dominant, while in Class II molar relationships, loop patterns were more dominant.

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