Analytical Pattern in Dermatoglyphics

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Authors’ contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: The aim was to study the analytical pattern in dermatoglyphics.

Materials and Methods: The study was conducted in Skin Opd, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India. A total of 100 participants with different hand dermatitis pattern were included in the study. All patients were subjected to: 1. Complete history, 2. Dermatological examination, 3. Finger print pattern of all the patients, 4. Informed consent.

Results: This hospital-based study involved 100 patients with Psoriasis (47) Eczema (23) Dermatophytosis (12), Syphilis (3), Drug reaction (5) Palmar keratoderma (10), the most common being psoriasis and eczema. In psoriasis patients, whorl pattern was the commonest (48.29%), followed by 31.43% loop, 21.43% arch and 2.86% composite pattern. In eczema patients, loop and whorl pattern was found in (44.74%) followed by 34.23% loop, 22.43% arch and 1.86% composite pattern.

Conclusion: The palmar pattern intensities were increased in both sexes, while the digital pattern intensities were increased in males and decreased in females. TFRC was increased in males and decreased in female patients. In both cases and controls, TFRC was more in males than females. A-b count showed a significant reduction in both sexes.

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1. INTRODUCTION

Dermatoglyphics comes from two Greek words (Derm = skin, and glyph = carving.) Dermatoglyphics, as a scientific tool, came into use only towards the end of the 19th century. Dermatoglyphic traits are polygenitically regulated and are non – adaptive. It has distinct methodological advantages over anthropometry and serology. Dermal ridge differentiation takes place in the third and fourth month of fetal life. By the end of the fourth month, the ridges and their arrangements are in their complete and permanent form. From this time onwards until the death there is no morphological change either in the detailed structure of the ridges or in the patterns formed by them [1].

Dermatoglyphic traits do not vary with age or environment except in size. The differentiation occurs very early and the lines are permanent. Hence dermatoglyphics has become one of the important parameters in defining the characteristic features of the patients and is therefore of diagnostic value in screening mentally retarded children for large-scale. It has become a valuable tool in the medical field for delineating a number of clinical syndromes; such as chromosomal and genetic anomalies as well as congenital malformations of various organs.

Dermatoglyphic disturbances in chromosomal aberrations such as Downs syndrome, Trisomy 13 and Trisomy 18 are particularly striking and can be used to strengthen a diagnostic impression. Single gene mutations causing malformations of the hands and feet such as syndactyly, polydactyly, and brachydactyly are associated with dermatoglyphic features significantly varying from Normal [2].

2. METHODS

A total of 100 participants with different hand dermatitis pattern were included in the study. Initially complete medical history of each patient was recorded. The regular dermatological examination (Parameters like ulnar loop, radial loop, number of whorls and arches were assessed on the palmar and digital areas) was carried out along with the finger print pattern of all the patients [3].

3. RESULTS AND DISCUSSION

Dermatoglyphic traits do not vary with age or environment except in size. The age distribution among the cases was given in Table 1.

Table 1. Age distribution among cases (n=100)

| Age in years | No: of cases | Percentage (%) |
|--------------|--------------|----------------|
| 1 – 10       | 5            | 5%             |
| 11 – 20      | 16           | 16%            |
| 21 – 30      | 26           | 26%            |
| 31 – 40      | 23           | 23%            |
| 41 – 50      | 12           | 12%            |
| 51 – 60      | 11           | 11%            |
| 61 – 70      | 6            | 6%             |
| > 70         | 1            | 1%             |
| Total        | 100          | 100%           |
| Mean         | 34.62        |                |

Table 2. Sex wise incidence of various dermatitis

| Sex      | No of cases | Percentage% |
|----------|-------------|-------------|
| Male     | 52          | 52%         |
| Female   | 48          | 48%         |
| Total    | 100         | 100%        |

Table 3. Distribution of various dermatitis among cases

| Clinical findings | No of cases | Percentage (%) |
|-------------------|-------------|----------------|
| Psoriasis         | 47          | 47%            |
| Eczema            | 23          | 23%            |
| Dermatophytosis   | 12          | 12%            |
| Syphilis          | 3           | 3%             |
| Drug reaction     | 5           | 5%             |
| Palmar keratoderma| 10          | 10%            |
| Total             | 100         | 100%           |

Table 4. Duration of disease

| Duration of disease | No of cases | Percentage % |
|---------------------|-------------|--------------|
| 0 - 6 months        | 38          | 38%          |
| 6 months - 1 year   | 30          | 30%          |
| More than 1 year    | 32          | 32%          |
| Total               | 100         | 100%         |
4. ANALYSIS OF QUALITATIVE PARAMETERS

4.1 Comparison of Finger Tip Pattern in Total Number of Cases

The percentage of arches in all fingers of the cases is 2.9%. The percentage of whorls in all the fingers of the cases is 36.1. It was found that the percentage of loops in all the fingers of the cases is 61. In the previous study they found similar differences between the cases and controls [4].

![Age distribution among cases (N=100)](image1)

Fig. 1. Age distribution among cases (N=100)

![Sex wise incidence of various dermatitis](image2)

Fig. 2. Sex wise incidence of various dermatitis
Fig. 3. Showing various dermatitis among cases

![Pie chart showing various dermatitis among cases]

Fig. 4. Duration of disease

![Pie chart showing duration of disease]

Table 5. Activity of disease

| Type           | No of patients | Total | Percentage % |
|----------------|----------------|-------|--------------|
|                | M  | F  |       |               |
| Progressive    | 25 | 32 | 57    | 57%           |
| Quiescent      | 20 | 13 | 33    | 33%           |
| Regressive     | 7  | 3  | 10    | 10%           |
| Total          | 52 | 48 | 100   | 100%          |
Fig. 5. Activity of disease

Fig. 6. Association - systemic and autoimmune

| Illness   | No of patients | Percentage |
|-----------|----------------|------------|
| Dyslipidemia | 1              | 8%         |
| Thyroid   | 2              | 17%        |
| Anemia    | 1              | 8%         |
| Diabetes  | 2              | 17%        |
| Hypertension | 6            | 50%        |
| Total     | 12             | 100%       |
Table 7. Comparison of finger tip pattern - percentage wise distribution

| Type | RT hand (n=100) | LT hand (n=100) | Both RT+LT (n=100) |
|------|----------------|----------------|-------------------|
|      | No | %   | No | %   | No | %   |
| A    | 17 | 3.4 | 12 | 2.4 | 29 | 2.9 |
| W    | 180| 36  | 181| 36.2| 361| 36.1|
| L    | 303| 60.6| 307| 61.4| 610| 61  |
| Total| 500| 100 | 500| 100 | 1000| 100 |

Fig. 7. Comparison of finger tip pattern - percentage wise distribution
A = Arch, W = Whorl, L = Loop, n = number of cases and controls

Table 8. Analysis of finger tip patterns – in digits separate, Right hand & left hand

| Digit | Finger tip pattern | RH | Lf | Chi square value | P value | Remark |
|-------|--------------------|----|----|------------------|---------|--------|
| Thumb | Arches             | 2  | 5  | 1.286            | 0.257   | NS     |
|       | Whorls             | 45 | 43 | 0.45             | 0.831   | NS     |
|       | Loops              | 53 | 52 | 0.010            | 0.922   | NS     |
| Index | Arches             | 7  | 14 | 0.846            | 0.106   | NS     |
|       | Whorls             | 23 | 31 | 0.674            | 0.203   | NS     |
|       | Loops              | 70 | 55 | 3.987            | 0.028*  | S      |
| Middle| Arches             | 7  | 13 | 1.800            | 0.180   | NS     |
|       | Whorls             | 42 | 27 | 3.261            | 0.071   | NS     |
|       | Loops              | 51 | 60 | 0.730            | 0.393   | NS     |
| Ring  | Arches             | 1  | 3  | 0.817            | 0.179   | NS     |
|       | Whorls             | 58 | 43 | 3.760            | 0.048*  | S      |
|       | Loops              | 41 | 54 | 1.385            | 0.239   | NS     |
| Little| Arches             | 0  | 1  | -                | >0.05   | NS     |
|       | Whorls             | 12 | 8  | 0.800            | 0.371   | NS     |
|       | Loops              | 88 | 91 | 0.089            | 0.766   | NS     |
In this study, a statistical significance in the comparison of the loops of right index finger between cases and controls and also between the whorls of right ring finger between cases and controls were found with the p values being 0.028 and 0.048 respectively.

5. ANALYSIS OF QUANTITATIVE PARAMETERS

Based on the ridge counts, the parameters taken are:

5.1 Total Finger Ridge Count (TFRC)—a Statistical Evaluation (Table 9)

The difference in the mean value of TFRC values between right and left were, RT side- 11.52 and left side -10.60 and with respect to both hands, the difference in mean value was 22.12. All the values of TFRC, right side and left side and both together were compared statistically using the 2-tailed independent sample t-test had a significant difference, p < 0.001.

5.2 Absolute Finger Ridge Count (AFRC)-Statistical Evaluation (Table 10)

The difference in the mean value of AFRC values between RT side- 12.02 and left side- 12 and with respect to both hands, the difference in mean value was 24.02. All the values of AFRC, right side and left side and both together were compared statistically using the 2-tailed independent sample t-test, and it was found that the values against cases and controls had a significant difference, p< 0.001.

A – b ridge count – statistical evaluation: The a-b ridge count in all the cases and control were assessed separately on both sides. The difference in the mean value of ABRC values between cases and controls were, Right side - 5.48 and left side - 7.99 and with respect to both hands, the difference in mean value was 13.48. All the values of ABRC, right side and left side and both together were compared statistically using the 2-tailed independent sample t-test, and it was found that the values against cases and controls had a significant difference, p< 0.001.

Angles of the palm: The ATD, DAT and ADT angles were compared for the right hand between cases and controls. The data were statistically evaluated using the t-test and was found that the act angles between cases and controls showed a statistical significance (p-value = 0.026).

Fig. 8. Analysis of finger tip patterns – in digits separate, right hand & left hand
Table 9. Total finger ridge count (TFRC)

| TFRC   | Mean±SD      | P value | Remark |
|--------|--------------|---------|--------|
| Cases (n=100) |             |         |        |
| Right  | 63.13±13.546 | <0.001  | S      |
| Left   | 62.88±13.586 | <0.001  | S      |
| Total  | 126.01±18.763| <0.001  | S      |

**– Significant at 1%, S – Significant.

Fig. 9. Total finger ridge count (TFRC)
Total finger ridge count (TFRC)– statistical evaluation (Fig. 9)

Fig. 10. Comparison of absolute finger ridge count in right and left hand
### Table 10. Absolute finger ridge count (AFRC)

| AFRC         | Mean±SD     | p     | Remarks |
|--------------|-------------|-------|---------|
| Right hand   | 77.04±9.672 | <0.001| S       |
| Left hand    | 76.72±9.951 | <0.001| S       |
| Both hands   | 153.76±14.714 | <0.001 | S       |

**- Significant at 1%, S –Significant.

### Table 11. A-b ridge count - statistical evaluation

| ABRC | Mean±SD     | p Value | Remark |
|------|-------------|---------|--------|
| Right | 32.26±6.045 | <0.001  | S      |
| Left  | 33.10±4.939 | <0.001  | S      |
| Total | 65.36±8.613 | <0.001  | S      |

**- Significant at 1%, S –Significant.

![Image of a graph showing the comparison of A-b ridge count in right and left hands](image)

**Fig. 11. Comparison of a-b ridge count in right and left hands**

### Table 12. ATD, DAT, ADT angles right and left hands were assessed separately

| Angle | Right Mean±SD | Left Mean±SD | p value |
|-------|---------------|--------------|---------|
| ATD   | 42.77±4.707   | 42.69±4.809  | 0.905   |
| DAT   | 58.95±5.059   | 57.24±5.159  | 0.195   |
| ADT   | 78.28±5.591   | 80.07±5.732  | 0.026   |

* - Significant at 5% level
ATD, DAT, ADT angles right and left hands were assessed separately

Table 13. Comparison of pattern intensity in males and females

| Pattern Intensity | Males (n=52) | Females (n=48) | P value |
|-------------------|--------------|----------------|---------|
| **Finger**        |              |                |         |
| • Left            | 6.90±1.83    | 5.75±1.38      | <0.001**|
| • Right           | 6.54±1.61    | 5.77±1.26      | 0.008*  |
| • Total           | 13.44±3.17   | 11.52±2.27     | 0.001** |
| **Palmar**        |              |                |         |
| • Left            | 0.98±0.85    | 0.54±0.61      | 0.003** |
| • Right           | 1.17±0.87    | 0.60±0.66      | <0.001**|
| • Total           | 2.15±1.19    | 1.13±0.84      | <0.001**|
Fig. 13. Comparison of pattern intensity in males and females
(A) In finger; (B) In palm

Table 14. Comparison of ridge count in males and females

| Ridge count | Males (n=52)   | Females (n=48) | P value |
|-------------|----------------|----------------|---------|
| Finger      |                |                |         |
| Left        | 72.69±8.63     | 63.06±12.98    | <0.001**|
| Right       | 74.27±7.82     | 62.69±12.33    | <0.001**|
| Total       | 146.96±12.36   | 125.75±23.18   | <0.001**|
| Palmar (a-b)|                |                |         |
| Left        | 22.15±4.39     | 35.04±4.66     | <0.001**|
| Right       | 18.38±6.07     | 35.06±4.54     | <0.001**|
| Total       | 40.54±8.42     | 70.10±6.89     | <0.001**|

Fig. 14. Comparison of ridge count in males and females
Table 15. Comparison of angle ‘ATD’ in males

| Angle ATD | Males (n=52) | Females (n=48) | P value |
|-----------|--------------|----------------|---------|
| • Left    | 39.37±2.19   | 39.13±2.59     | 0.625   |
| • Right   | 39.29±2.23   | 39.42±2.16     | 0.755   |
| • Total   | 78.65±3.93   | 78.56±4.15     | 0.904   |

Fig. 15. Comparison of Angle ‘ATD’ in Males

On quantitative analysis of the finger prints, the TFRC between cases and controls were evaluated using the t test and it was found to be 75 statistically significant in comparison of cases to controls. In the previous reports, they also found significant differences in TFRC values between cases and controls. The mean values of AFRC values between cases and controls were also analyzed using the t test and a statistical difference was found. The earlier study found that the mean ridge count in the right hand between cases and controls to be statistically significant, p< 0.05 [5].

The mean ridge count of left hand also showed significance in that mean ridge count in cases was lower than in controls. The a-b ridge count of the cases and controls were tabulated in Table 7, and a statistical difference was found between cases and controls on both right and left sides. In previous study, they found statistical differences between cases and controls [6].

6. CONCLUSION

In the analysis of qualitative patterns, the percentage of arches in all the fingers of the cases is 2.9%, and in that of controls, the percentage is 6%. The percentage of whorls in all the fingers of the cases is 36.1%, the percentage in controls being 32.1%. It was found that the percentage of loops in all the fingers of the cases is 61%, while that in controls it is 61.9%. From this I conclude that the percentage of arches is more in controls than in cases. And also, the percentage of whorls is more in cases than in controls accompanied with a negligible difference in the percentage of loops. The mean value of TFRC in both hands of cases is 126.01 with a standard deviation of 18.763 and the total
mean of TFRC in controls is 103.89 with a standard deviation of 17.754. This difference in mean value is found to be statistical increase in the mean value of cases with p value < 0.001.

CONSENT

Informed and written consent was obtained from each patient and was preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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