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# Dermatoglyphics in Diabetic Cataract Patients: A Case Control Study

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***Abstract:***

***Objective:*** To study finger and palmar dermatoglyphic patterns in diabetic cataract patients, to find out whether a specific dermatoglyphic trait exists & its significance, To compare dermatoglyphic configuration of diabetic cataract patients with normal population in central India region. ***Material & methods:*** The sample constituted 200 (100 men and 100 women) patients suffering from cataract associated with diabetes mellitus, all above 40 years of age group obtained from Ophthalmology wards, of a government medical college, in central India. The age matched control group of 200 (100 men and 100 women) were obtained from general population which were normal healthy individuals with no other obvious genetic disorders, all above 40 years of age group. Dermatoglyphic prints were taken by 'INK METHOD' described by Cummins (1936) and Cummins and Midlo (1961) & were subjected for specific dermatoglyphic analysis with the help of magnifying hand lens. The prints obtained by ink method were studied in right and left hand separately. For statistical analysis of qualitative data 2 x 2 chi-square test and for quantitative data student's t-test were applied. ***Observation & results:*** Increase in the frequency of pattern in 3rd interdigital area in diabetic cataract males. Also there is decrease frequency of patterns in 4th interdigital area in diabetic cataracts of both the sexes. Further hypothenar area in diabetic cataract females shows slight increase in pattern frequency. Main line index shows no significant variations in diabetic cataracts of both sexes when compared to controls. The main line formulae 11 9 7 pattern is most common pattern in both the groups. No significant variations are observed in atd angle. Total number of triradii found is significantly higher in diabetic cataract males and females as compared to controls. ***Conclusion:*** Significant variations are observed in the various dermatoglyphic parameters among normal population and persons having cataract associated with diabetes mellitus. On the basis of results obtained, the study can be used for early detection of the predisposed persons from the normal population so that they can be subjected to preventive measures, to avoid the future burden of the disease on the community.

***Keywords:*** ***Dermatoglyphics, Cataract, Diabetes, Main line index, Main Line Formulae, Triradii, atd Angle***

## 1. Introduction

Dermatoglyphics is one of the branches of medical science where the dermal ridge patterns are studied and used in prediction of genetic disorders. Whenever there is abnormality in the genetic makeup of parents, it is inherited in children and is reflected in dermatoglyphic pattern. Hence, the study of dermatoglyphics proves to be very useful in predicting the hereditary diseases in patients. Abnormal dermatoglyphic patterns are known to occur with chromosomal abnormalities like Mongolism, Turner's syndrome, Klinefelter's syndrome, etc. (Harold Cummins, 1936; Penrose, 1963; Holf J Lindsten, 1964).[1],[2],[3]

Characteristic dermatoglyphic associations are also seen in many diseases with genetic predisposition e.g. cancers, mental retardation, schizophrenia as well as in cataract and diabetes.

In cataract as well as diabetes there are qualitative i.e. fingertip pattern, position of axial triradius etc. and quantitative like changes in total and absolute finger ridge counts in dermatoglyphic pattern are observed.

With the advancement in the field of dermatoglyphics it will be possible, to a large extent to predict whether an individual is suffering or will suffer in future from a particular disease.

Taking into consideration the genetic predisposition of cataract and diabetes, as there have been hardly any studies on the dermatoglyphic pattern in diabetic cataract patients in central India region. It was decided to study the dermatoglyphic patterns in diabetic cataract patients. The study was undertaken to find out correlation between them, so that it may prove helpful in early prediction and prevention of disease.

## .2. Objective

The present study was carried out with the following aims and objectives:-

- To study finger and palmar dermatoglyphic patterns in diabetic cataract patients.
- To find out whether a specific dermatoglyphic trait exists in cataract associated with diabetes mellitus and if exists whether it is significant.
- To compare dermatoglyphic configuration of diabetic cataract patients with normal population in central India region.
- To apply results of the study in early diagnosis of the disease.

## 3. Material & methods

The present work was carried out in Department of Anatomy during the period from March 2010 to November 2011.

The sample constituted 200 (100 men and 100 women) patients suffering from cataract associated with diabetes mellitus, all above 40 years of age group. The patients were obtained from Ophthalmology wards, of a government medical college, in central India. The age matched control group of 200 (100 men and 100 women) were obtained from general population which were normal healthy individuals with no other obvious genetic disorders, all above 40 years of age group.

**Material used**

1) Kores quick drying duplicating ink
2) A Rubber roller
3) An inking slab - Thick glass sheet fixed over wooden support
4) Century board
5) White 'Map Litho' paper
6) Pressure pad made up of rubber foam
7) Cotton puffs
8) Scale
9) Pencil
10) Protractor - to measure 'atd' angle
11) Magnifying lens
12) Needle with a sharp point, for ridge counting
13) Soap for washing hands
14) Napkin to dry the hands

**Figure 1: Photograph showing material used for the study of palmar dermatoglyphics**

**3.1 METHODS OF DERMATOGLYPHIC PRINTING:**
A number of techniques have been recorded for the printing of dermal ridge configurations. Dermatoglyphics prints can be directly inspected by means of simple magnifying lens. For permanent record and for the detailed study such as quantitative analysis permanent prints are needed.

Various methods used as of today are

1) Ink Method
2) Chemical Method
3) Adhesive type Method
4) Photographic Method
5) Special Methods
   Hygrophotography
   Radiodermatography
   Plastic Moulds

In the present study dermatoglyphic prints were taken by 'INK METHOD' described by **Cummins (1936)**[4] and **Cummins and Midlo (1961)**.[5] This method was selected from the various methods described in literature because of following advantages:

1) It possesses simple technique
2) It has low cost
3) It gives clarity of prints
4) It is less time consuming

The prints were taken on one side of paper separately for each hand.

**STEPS IN THE PRINTING METHOD:-**

1) The subjects were asked to clean their hands with soap and water and to dry them but leave some moisture.
2) The requisite amount of ink was placed on the glass slab. It was uniformly spread by the rubber roller to get a thin even ink film on the glass slab.

3) The thin film of ink was applied on the palm by passing the inked rubber roller uniformly over the palm and digits taking care that the hollow of the palm and the flexor creases of the wrist were uniformly inked.
4) The palm was examined for the uniformity of the ink. The un–inked area or hollows of palm were inked with the help of cotton puffs.
5) Right hand of subject was then placed on the sheet of paper (kept over the pressure pad) from proximal to distal end. The palm was gently pressed between inter–metacarpal grooves at the root of fingers and on the dorsal side corresponding to thenar and hypothenar regions. The palm was then lifted from the paper in the reverse order from distal to proximal end. The fingers were rolled from the paper in reverse order from distal to proximal end. The fingers were rolled from radial to ulnar side to include all the patterns.
6) The same procedure was repeated for left hand. Separate paper was used for left hand.
7) The printed sheets were coded with the name, age, and whether it was of cataract or of control group.

The prints were subjected for detail dermatoglyphic analysis with the help of magnifying hand lens. The ridge counting was done with the help of sharp needle and the details were noted on the same paper with the pencil.

### 3.2 MORPHOLOGY:-

### DERMATOGLYPHIC CONFIGURATIONS:

### RIDGE DETAIL (MINUTIAE) (FIG.1):-

Minutiae are the characteristics of individual ridges **(Galton, 1892)**.[6] Intricate details of structure of epidermal ridges are termed as minutiae. They occur universally and are useful for personal identification.

**Penrose (1968)**[7] proposed a classification based on the six common types of minutiae described by **Cummins and Midlo (1961)**[5] and added comb as seventh type.

**Penrose's Classification:**

i. **Island or point:** - It is very short ridge lying independent of other ridges, circular in shape and bears only one sweat pore.
ii. **Short Ridges:** - It contains two to five sweat gland pores.
iii. **Fork:** - It is the bifurcation of a ridge or a Y – formation.
iv. **Enclosures:** - It is formed by two forks being in opposition.
v. **End:** - ¬ It is an abrupt termination of the ridge.
vi. **Interstitial line:** - It is narrow subsidiary ridge in the furrows between individual ridges. It is inconstant and does not have sweat pores. It is omitted in ridge counting.
vii. **Comb:** - Is a ridge formation in which three or more parallel ridges join another ridge almost at right angles to their direction of flow.

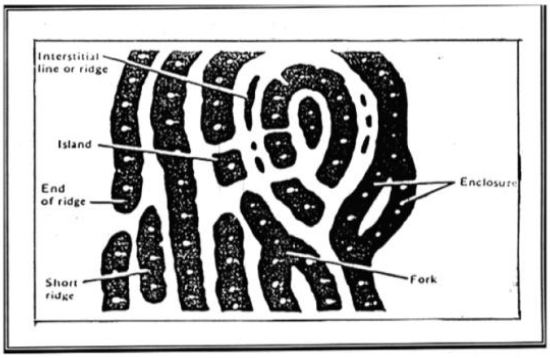



FIG. - I
SHOWING NOMENCLATURE OF MINUTIAE.

➢ PATTERN CONFIGURATIONS

**A. FINGERS**

- Fingertip Pattern Configurations.
- Dermatoglyphic Landmarks.

**B. PALM**

Palmar Pattern Configuration:-

Thenar and first interdigital area (The. / I)
Second, third and fourth interdigital areas (II, III, IV)
Hypothenar Area (Hyp.)

- Palmar Landmarks

Axial triradii
Digital triradii

➢ FINGERTIP PATTERN CONFIGURATIONS

**Galton (1892)**[6] divided fingertip patterns into three groups,

I. Arches
II. Loops
III. Whorls

According to **Henry (1900)**[8] there are four main types of fingertip patterns – arches, loops, whorls and composites. Thus **Henry (1900)** added fourth group 'composite' to determine more complex patterns.

In this study prints were analyzed under following headings:

1. Qualitative analysis of palmar patterns.
2. Main line index.
3. Main line formula.
4. 'atd' angle.
5. Total number of palmar triradii.
6. Position of axial triradius. (t0, t1, t2, t0t1, t0t2, t1t2, t0t1t2).

- **DERMATOGLYPHIC LANDMARKS ON THE FINGERTIP PATTERNS**
  1) Triradii
  2) Cores
  3) Radiants

**1. Triradii: - (Fig.2)**

A triradius is formed by confluence of three ridge systems.

**Triradial point: -**

The center of triradius is designated as triradial point. Ideally, it is the meeting point of three opposing epidermal ridges that form angle of approximately 1200 with one another. However, if these three ridges fail to meet, the triradial point can be represented by very short dot like ridge called as island or by a ridge ending or it may lie on a ridge at point near the center of divergence of three innermost ridges. Triradius in such cases is described as extra limited and commonly observed in the hypothenar area of the palm.

**2. Cores: -**

It is the approximate centre of the pattern. Usually it is represented by a rod like ridge in the center of the pattern, or it may appear as a dot. It may be of different shapes. In counting the ridges, point of core is used.

**3. Radiants (Type lines):-**

They are also called as type lines. Radiants are the ridges that emanates from the triradius and enclose the pattern area. These ridges constitute skeletal framework of pattern area. In schematic drawing the type lines alone are used to represent the pattern.

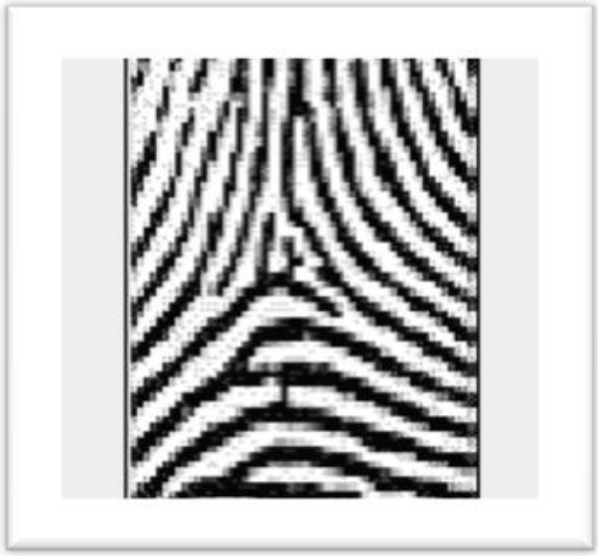


**Fig. 2: Triradius**

**PALMAR PATTERN CONFIGURATIONS (Fig. 3)**

To carry out dermatoglyphic analysis, palm has been divided into several anatomically defined areas. These areas approximate the site of embryonic volar pads. They include the thenar area, four interdigital areas and hypothenar area.

**a. Thenar and First Interdigital area (The. / I):-**

These two areas are closely related anatomically and therefore considered together as one area. In most cases there is no pattern in Th. /I area and ridges follow a mild curve around the base of thumb. Sometimes this flow is interrupted by an area of abruptly disarranged ridges which are oriented at an angle to general direction of other ridges in area. They do not have a true pattern hence this configuration is called as vestige. Pattern when present are most often loops. Whorls are rarely encountered.

**b. Second, Third and Fourth Interdigital Areas (II, III and IV):-**

These areas are found in the distal palm in region of heads of metacarpal bones. Each interdigital area is bordered laterally by a digital triradius. The digital triradii are located proximal to the base of digits 2 - 5. These digital triradii are labeled as a, b, c and d starting from digits 2 - 5. The interdigital area II lie between the digital triradii a and b, III lies between digital triradii b and c and IV between digital triradii c and d.

When a digital triradius is absent, the midpoint of base of corresponding digits can be used to separate the interdigital areas. Configurations encountered in the interdigital regions are loops, whorls, vestiges and open fields.

**c. Hypothenar area (Hyp.):-**

It is an area of palm situated on ulnar side of midline of palm which covers the hypothenar prominences. True patterns are commonly present in the hypothenar area. The true patterns are whorls, loops and tented arches.

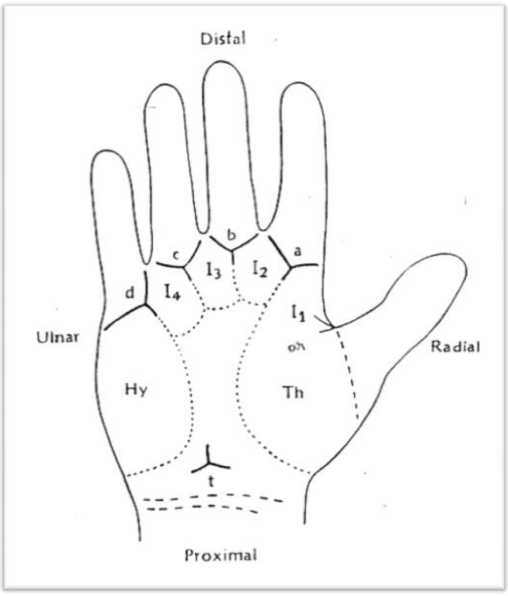



**Fig.3: Palmar Dermatoglyphic Pattern Areas**

- **PALMAR LANDMARKS (fig.4)**

Digital and axial triradii constitute important landmarks for dermatoglyphic analysis.

**Digital triradii: -** The digital triradii are located proximal to the base of digits 2 – 5. These digital triradii are labeled as a, b, c and d starting from digits 2 – 5.

**Axial Triradius (t):-** The triradius or triradii close to palmar axis are termed as axial triradius .It is usually present near the proximal margin of palm, near the axis of 4th metacarpal bone. The position of 't' is subject to considerable variation. It may be shifted to ulnar or radial side, or it may be shifted distally in the palm. Sometimes there are more than one axial triradii in the palm.

The following criteria as detailed by Cummins and Midlo, and Penrose, Kumar et al have been used to indicate the position of axial triradius.

The axial triradius is indicated as 't' when it is near the wrist crease.

It is indicated as 't" ', when it is near the centre of the palm.

It is indicated as 't' ', when it lies intermediate near a line transecting the base of the thumb.

***In the present study position of axial triradius t, t' and t" are denoted as t0, t1 and t2 respectively.***

While, Penrose suggested the position of axial triradius depending upon 'atd' angle as follows:

The axial triradius is indicated as 't' when 'atd' angle is less than $45^0$.

It is indicated as t', when 'atd' angle is in between $45^0$ and $56^0$.

While it is indicated as t", when 'atd' angle is more than $56^0$.

If more than one axial triradius is present, the most distal axial triradius is used for analysis.

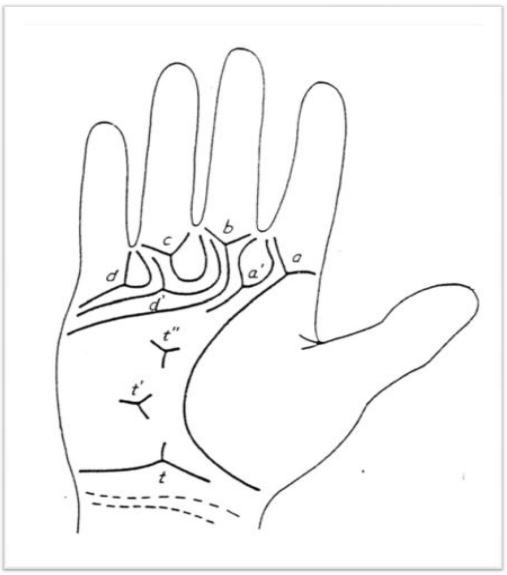



**Fig.4: Palmar Triradii a, b, c, d, and t**

**Palmar Main Lines: - (fig.5)**

When the proximal radiant is traced along its course within the palmar area forms a palmar main line. There are four main lines each originating from one of the digital triradii. They are labeled as A, B, C, and D corresponding to the triradius having the same lower case letter.

A triradius may be missing, two triradii may be fused into a single triradius or there may be additional triradius or triradii.

**Main Line Formula (MLF):-**

The termination of the main lines is determined by the numbers distributed along the periphery of the palm. This gives the information about their course.

The Penrose system (1968) is more detailed than the system used by Cummins and Midlo (1961).

**The Penrose system is as follows-**

Altogether 15 numbers are used. The numbering starts in proximal part of the thenar area and continues along the ulnar, distal and radial borders of the palm. The termination of the main lines D, C, B, A are used to express the main line formula.

The main line formula constitutes the first part of palmar formula. It is followed by the position of axial triradius and then by the symbols used for the palmar configuration in the following order-

Hyp, Th/Dl, lD2, lD3, lD4.

**In the present study data has been tabulated in the following manner:-**

1) For individual main line termination.
2) For combined D, C, and B main line termination.
3) For the position of axial triradii.
4) For atd angle, angle atd is the angle between the lines joining a-t and d-t triradii.
5) For frequency distribution of patterns in thenar/I interdigital area, II interdigital area, III interdigital area, IV interdigital area and hypothenar area.

Tables were prepared separately for right hand, left hand of men and women, belonging to control and cases groups. Calculation of main line index requires special mention, for this modified values **(Fig.6)** of the palm for termination of D line are adopted modifying 5`` of the ulnar border of the palm as 6 and instead of 6, 7, 8,9,10,11,12,13 positions, they are numbered as 1,2,3,4,5,6,7,8 respectively. The main line index is obtained by addition of both A and D line termination values.[95]

## ➢ QUANTITATIVE ANALYSIS

Many dermatoglyphic characteristics can be described quantitatively.

**Pattern Intensity:-**

It means the complexity of the ridge configurations. It can be expressed by counting the number of triradii. A fingertip may have the pattern intensity 0-3 according to the number of triradii. The simple arch that lacks triradius is denoted by number 0, whereas the tented arch and the loop have intensity 1.

Similarly, pattern intensity of the palm can be expressed as the sum of all the triradii present.

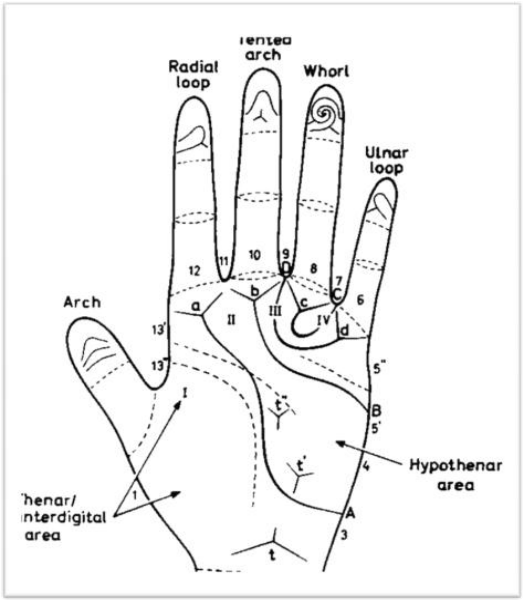



**Fig.5: Palmar Main Lines**

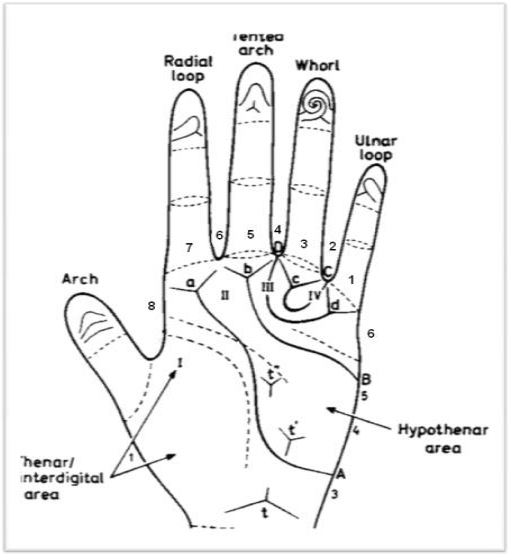



**Fig.6: Modified values for palmar line**

**'atd' angle:- (Fig.7 atd angle calculation)**

This angle is formed by lines drawn from the digital triradius 'a' to axial triradius 't' and from this triradius to digital triradius 'd'. In case of more than one axial triradius, most distal of them is used for measuring 'atd' angle. The most distal the position of axial triradius (t), larger is the 'atd' angle. It is used in interpreting the position of axial triradius 't'.

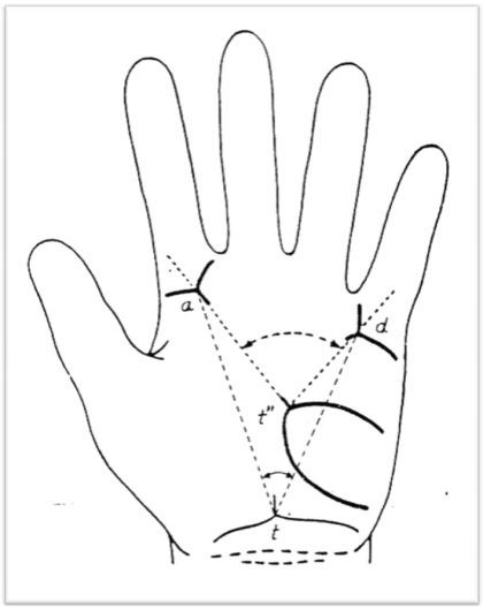



**Fig.7 atd angle calculation**

**STATISTICAL ANALYSIS**

The prints obtained by ink method were studied in right and left hand separately. For statistical analysis of qualitative data 2 x 2 chi-square test and for quantitative data student's t-test were applied.

## 4. Observations & results

The prints were analyzed under following headings –

1. Qualitative analysis of palmar patterns.
2. Main line index.
3. Main line formula.
4. 'atd' angle.
5. Total number of palmar triradii.
6. Position of axial triradius. (t0, t1, t2, t0t1, t0t2, t1t2, t0t1t2).

**List of Symbols Used in Tables**

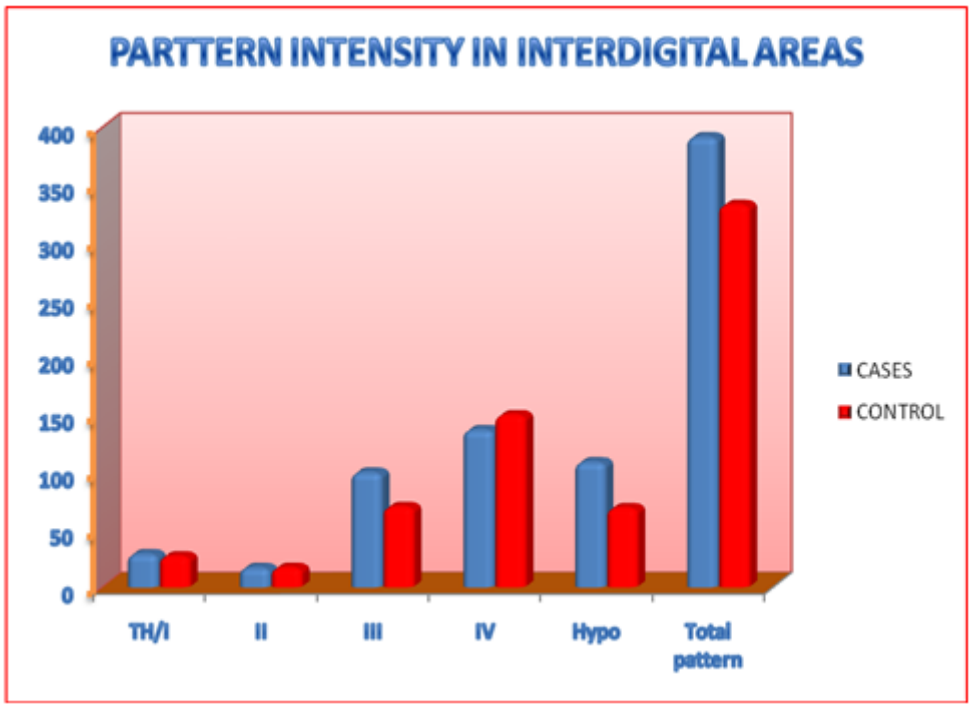
| | | |
|---|---|---|
| M | - | Male |
| F | - | Female |
| M+F | - | Male + Female |
| NM | - | Normal male |
| NF | - | Normal female |
| CM | - | Cataract male |
| CF | - | Cataract female |
| R | - | Right |
| L | - | Left |
| R + L | - | Right + Left |
| % | - | Percentage |
| The. /I | - | Palmar thenar and first interdigital area |
| II | - | Palmar second interdigital area |
| III | - | Palmar third interdigital area |
| IV | - | Palmar fourth interdigital area |
| Hyp. | - | Palmar hypothenar area |
| $X^2$ | - | Chi-square |
| df | - | Degree of freedom |

| | | | | | |
|---|---|---|---|---|---|
| S.D. | - | Standard deviation | Wc | - | whorl concentric |
| S.E. | - | Standard error of Mean | Wd | - | whorl composite |
| CV | - | Coefficient of variation | Ap | - | arch plain |
| S | - | Significant | At | - | arch tented |
| NS | - | Non significant | MLF | - | main line formula |
| Lu | - | loop ulnar | MLI | - | main line index |
| Lr | - | loop radial | NOT | - | number of triradii |
| Ws | - | whorl spiral | POT | - | position of triradii |

**Table 1: Frequency Distribution For Different Palmar Patterns Among Cataract And Control Group**

| Group | Sex | Side | TH/I | II | III | IV | Hypo | Total pattern | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No. | % |
| Cases | | Right | 11 | 2 | 47 | 26 | 24 | 110 | 12.67 |
| | | Left | 8 | 2 | 20 | 29 | 19 | 78 | 8.99 |
| | Male | Right + Left | 19 | 4 | 67 | 55 | 43 | 188 | 21.66 |
| | | Right | 6 | 11 | 26 | 40 | 30 | 113 | 13.02 |
| | | Left | 4 | 2 | 7 | 42 | 36 | 91 | 10.48 |
| | Female | Right + Left | 10 | 13 | 33 | 82 | 66 | 204 | 23.50 |
| | | Right | 17 | 13 | 73 | 66 | 54 | 223 | 25.69 |
| | | Left | 12 | 4 | 27 | 71 | 55 | 169 | 19.47 |
| | Male+ Female | Right + Left | 29 | 17 | 100 | 137 | 109 | 392 | 45.16 |
| Control | | Right | 9 | 5 | 23 | 44 | 22 | 103 | 11.87 |
| | | Left | 14 | 6 | 21 | 40 | 20 | 101 | 11.64 |
| | Male | Right + Left | 23 | 11 | 44 | 84 | 42 | 204 | 23.50 |
| | | Right | 1 | 2 | 17 | 30 | 13 | 63 | 7.26 |
| | | Left | 3 | 4 | 9 | 36 | 14 | 66 | 7.60 |
| | Female | Right + Left | 4 | 6 | 26 | 66 | 27 | 129 | 14.86 |
| | | Right | 10 | 7 | 40 | 74 | 35 | 166 | 19.12 |
| | | Left | 17 | 10 | 30 | 76 | 34 | 167 | 19.24 |
| | Male+ Female | Right + Left | 27 | 17 | 70 | 150 | 69 | 333 | 38.36 |

Table no.1 shows frequency distribution for different palmar patterns among cataract and control group. The pattern intensity in cataract males and control females show no significant variations. In case of females cataracts shows increase intensity of patterns. On comparing both the sexes cataracts shows increase intensity of pattern than controls.





*Indexcopernicus value* - 64.48

**Table 2: Significance test for Patterns in Different Palmar Areas Among Cataract And Control Group**

| AREA | COMPARISION | X2 VALUE | p value | REMARK |
|---|---|---|---|---|
| | CM(R+L) XNM(R+L) | 0.1396 | 0.7087 | NS |
| | CF(R+L) XNF(R+L) | 0.4964 | 0.4811 | NS |
| THENAR/1ST ID | C(M+F)(R+L)XN(M+F)(R+L) | 0.1274 | 0.7211 | NS |
| | CM(R+L) XNM(R+L) | 2.833 | 0.0923 | NS |
| | CF(R+L) XNF(R+L) | 0.3008 | 0.5834 | NS |
| 2ND ID | C(M+F)(R+L)XN(M+F)(R+L) | 0.2378 | 0.6258 | NS |
| | CM(R+L) XNM(R+L) | 9.541 | 0.002 | S INCREASE IN CASE |
| | CF(R+L) XNF(R+L) | 1.311 | 0.2523 | NS |
| 3RD ID | C(M+F)(R+L)XN(M+F)(R+L) | 2.021 | 0.1551 | NS |
| | CM(R+L) XNM(R+L) | 6.075 | 0.0137 | S |
| | CF(R+L) XNF(R+L) | 3.849 | 0.0498 | S |
| 4TH ID | C(M+F)(R+L)XN(M+F)(R+L) | 7.674 | 0.0056 | S |
| | CM(R+L) XNM(R+L) | 0.3006 | 0.5835 | NS |
| | CF(R+L) XNF(R+L) | 5.123 | 0.0236 | S |
| HYPOTHENAR | C(M+F)(R+L)XN(M+F)(R+L) | 4.880 | 0.0272 | S INCREASE IN CASE |

Table no.2 shows significance test for patterns in different palmar areas. The pattern intensity in thenar, 1st and 2nd interdigital areas shows no significant variations. The 3rd interdigital area show increase pattern intensity in cataract males than controls. The 4th interdigital area shows decrease pattern intensity in cataract cases. The hypothenar area show increase frequency in cataract cases.

**Table 3: Statistical calculations for Main Line Index**

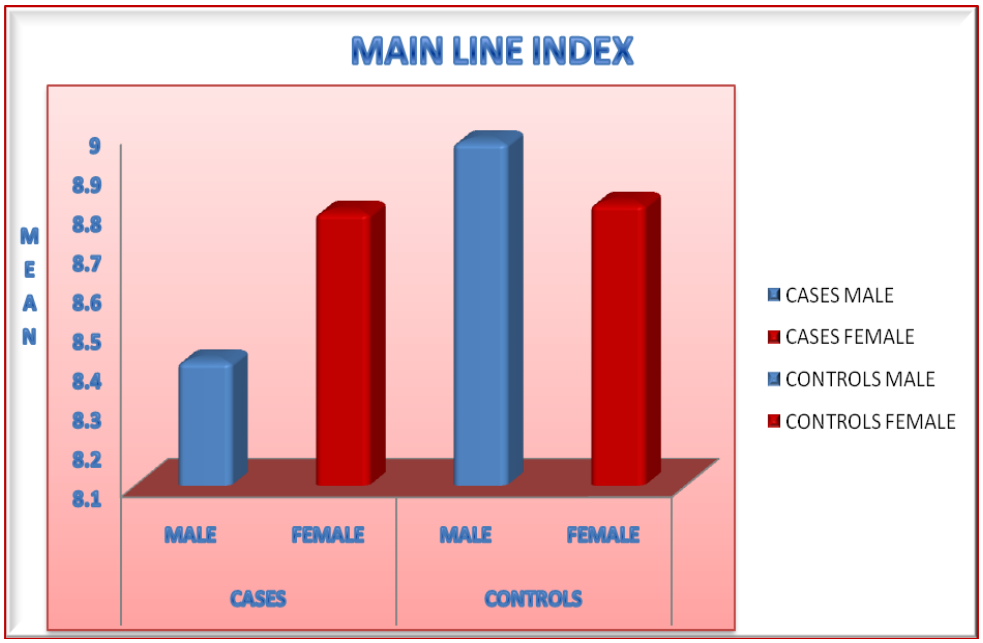
| Group | Sex | Side | Mean | S.D. | SEM | CV% | Range |
|---|---|---|---|---|---|---|---|
| Cases | | Right | 8.9 | 1.59 | 0.159 | 17.9 | 5 -13 |
| | | Left | 7.95 | 1.52 | 0.152 | 19.1 | 5 -11 |
| | Male | Right + Left | 8.42 | 1.62 | 0.115 | 19.31 | 5-13 |
| | | Right | 9.28 | 1.58 | 0.158 | 17 | 5-12 |
| | | Left | 8.32 | 1.84 | 0.184 | 22.1 | 5-12 |
| | Female | Right + Left | 8.8 | 1.77 | 0.125 | 20.21 | 5-12 |
| | | Right | 9.09 | 1.598 | 0.113 | 17.58 | 5-13 |
| | | Left | 8.135 | 1.694 | 0.1198 | 20.83 | 5-12 |
| | Male+ Female | Right + Left | 8.613 | 1.713 | 0.0857 | 19.89 | 5-13 |
| Control | | Right | 9.18 | 1.66 | 0.166 | 18.1 | 6-12 |
| | | Left | 8.87 | 1.76 | 0.176 | 20.1 | 5-12 |
| | Male | Right + Left | 8.98 | 1.72 | 0.121 | 19.2 | 5-12 |
| | | Right | 9.27 | 1.48 | 0.148 | 16.1 | 6-11 |
| | | Left | 8.06 | 1.74 | 0.174 | 21.6 | 4-10 |
| | Female | Right + Left | 8.66 | 1.72 | 0.122 | 19.94 | 4-11 |
| | | Right | 9.225 | 1.577 | 0.1115 | 17.09% | 6-12 |
| | | Left | 8.42 | 1.789 | 0.1265 | 21.24% | 4-12 |
| | Male+ Female | Right + Left | 8.823 | 1.732 | 0.0866 | 19.63% | 4-12 |

Table no. 3 shows statistical calculations for main line index. Only slight variations are observed among the means of the main line index in both sexes of two groups.

**Table 4: Test of Significance for Main Line Index**

| COMPARISION | p VALUE | REMARK |
|---|---|---|
| CMR X NMR | 0.2267 | NS |
| CML X NML | 0.0005 | S |
| CFR X NFR | 0.9634 | NS |
| CFL X NFL | 0.3068 | NS |
| C (M+F)R X N(M+F)R | 0.3957 | NS |
| C (M+F)L X N(M+F)L | 0.1027 | NS |
| C (M+F)(R+L) X N(M+F)(R+L) | 0.085 | NS |

Table no. 4 shows test of significance for main line index. The main line index shows no significant variations in two groups except in left hand of male cataract and control in which statistically significant difference is observed.



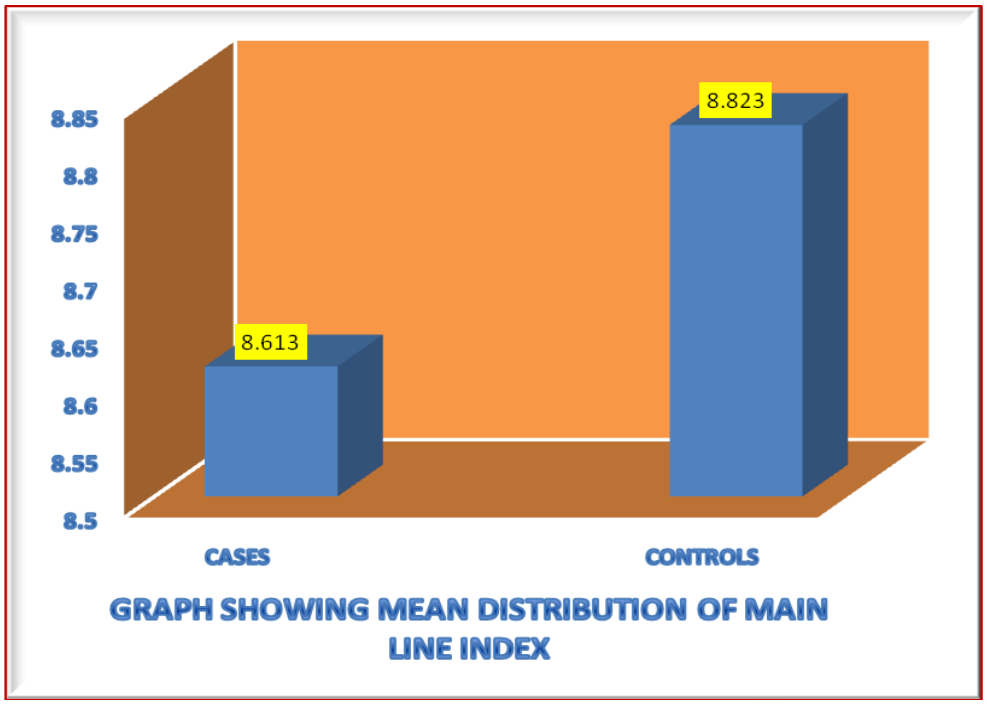




**Table 5: Frequency Distribution of Main Line Formula in Cataracts**

| | CASES | | | | | |
|---|---|---|---|---|---|---|
| | MALE | | | | | |
| | R | | L | | R+L | |
| MLF | NO. | % | NO. | % | NO. | % |
| 11 9 7 | 36 | 36 | 8 | 8 | 44 | 22 |
| 7 5" 5' | 9 | 9 | 18 | 18 | 27 | 13.5 |
| 11 0 7 | 8 | 8 | 11 | 11 | 19 | 9.5 |
| 9 7 5' | 6 | 6 | 10 | 10 | 16 | 8 |
| 9 0 5' | 2 | 2 | 12 | 12 | 14 | 7 |
| 9 7 5" | 7 | 7 | 4 | 4 | 11 | 5.5 |
| Rest | 32 | 32 | 37 | 37 | 69 | 41.5 |

| | CASES | | | | | |
|---|---|---|---|---|---|---|
| | FEMALE | | | | | |
| | R | | L | | R+L | |
| MLF | NO. | % | NO. | % | NO. | % |
| 11 9 7 | 29 | 29 | 21 | 21 | 50 | 25 |
| 9 7 5" | 10 | 10 | 16 | 16 | 26 | 13 |
| 9 7 5' | 5 | 5 | 10 | 10 | 15 | 7.5 |
| 7 5" 5' | 5 | 5 | 6 | 6 | 11 | 5.5 |
| 11 7 5' | 4 | 4 | 7 | 7 | 11 | 5.5 |
| 11 0 7 | 4 | 4 | 4 | 4 | 8 | 4 |
| Rest | 43 | 43 | 36 | 36 | 79 | 39.5 |

Table no.5 show main line formulae in diabetic cataract. The main line formulae 11 9 7 most common pattern in men 22% and women 25%, other patterns in men 7 5"5' in 13.5%, 11 0 7 in 9.5%, 9 7 5' in 8%, 9 0 5' in 7%, 9 7 5" in 5.5%. Other patterns in women are 9 7 5" in 13%, 9 7 5' in 7.5%, 7 5"5' in 5.5%, 11 7 5' in 5.5% and 11 0 7 pattern in 4%.

**Table 6: Frequency Distribution of Main Line Formula in Controls**

| | CONTROLS | | | | | |
|---|---|---|---|---|---|---|
| | MALE | | | | | |
| | R | | L | | R+L | |
| MLF | NO. | % | NO. | % | NO. | % |
| 11 9 7 | 27 | 27 | 19 | 19 | 46 | 23 |
| 7 5" 5' | 8 | 8 | 6 | 6 | 14 | 7 |
| 9 7 5" | 5 | 5 | 7 | 7 | 12 | 6 |
| 9 7 5' | 5 | 5 | 6 | 6 | 11 | 5.5 |
| 11 0 7 | 6 | 6 | 4 | 4 | 10 | 5 |
| 11 11 7 | 8 | 8 | 1 | 1 | 9 | 4.5 |
| Rest | 41 | 41 | 57 | 57 | 98 | 49 |

| | CONTROLS | | | | | |
|---|---|---|---|---|---|---|
| | FEMALE | | | | | |
| | R | | L | | R+L | |
| MLF | NO. | % | NO. | % | NO. | % |
| 11 9 7 | 42 | 42 | 12 | 12 | 54 | 27 |
| 9 0 5' | 4 | 4 | 12 | 12 | 16 | 8 |
| 11 0 7 | 13 | 13 | 1 | 1 | 14 | 7 |
| 7 5" 5' | 4 | 4 | 8 | 8 | 12 | 6 |
| 11 9 5' | 6 | 6 | 5 | 5 | 11 | 5.5 |
| 11 0 5' | | 0 | 10 | 10 | 10 | 5 |
| Rest | 31 | 31 | 52 | 52 | 83 | 41.5 |

Table no.6 show main line formulae in controls. The main line formulae 11 9 7 most common pattern in men 23% and women 27%, other patterns in men 7 5"5' in 7%, 9 7 5" in 6%, 9 7 5' in 5.5%, 11 0 7 in 5%, 11 11 7 in 4.5%. Other patterns in women are 9 0 5' in 8%, 11 0 7 in 7%, 7 5"5' in 6%, 11 9 5' in 5.5% and 11 0 5' pattern in 5%.

**Table 7: Statistical Calculations for 'atd' Angle**

| Group | Sex | Side | Mean | S.D. | SEM | CV% | Range |
|---|---|---|---|---|---|---|---|
| Cases | | Right | 40.33 | 5.44 | 0.54 | 13.49 | 30-72 |
| | | Left | 41.67 | 5.6 | 0.56 | 13.46 | 31-65 |
| | Male | Right + Left | 41 | 5.55 | 0.3926 | 13.54 | 30-72 |
| | | Right | 41.36 | 5.74 | 0.57 | 13.9 | 30-70 |
| | | Left | 41.77 | 6.51 | 0.65 | 15.6 | 14-58 |
| | Female | Right + Left | 41.56 | 6.03 | 0.43 | 14.7 | 14-70 |
| | | Right | 40.85 | 5.608 | 0.3965 | 13.73 | 30-72 |
| | | Left | 41.72 | 6.061 | 0.4286 | 14.53 | 14-65 |
| | Male+ Female | Right + Left | 41.28 | 5.848 | 0.2924 | 14.17 | 14-72 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Control | | Right | 41.69 | 5.32 | 0.53 | 12.78 | 30-55 |
| | | Left | 40.77 | 6.1 | 0.61 | 14.99 | 14-55 |
| | Male | Right + Left | 41.23 | 5.73 | 0.4057 | 13.91 | 14-55 |
| | | Right | 41.91 | 9.18 | 0.918 | 21.9 | 31-75 |
| | | Left | 42.97 | 8.99 | 0.899 | 20.9 | 34-82 |
| | Female | Right + Left | 42.44 | 9.08 | 0.64 | 21.4 | 31-82 |
| | | Right | 41.8 | 7.488 | 0.5295 | 17.91 | 30-75 |
| | | Left | 41.87 | 7.749 | 0.5479 | 18.51 | 14-82 |
| | Male+ Female | Right + Left | 41.84 | 7.61 | 0.3805 | 18.19 | 14-82 |

Table no.7 shows calculations for atd angle. The mean value of atd angle in cataract males right and left hand taken together is 41 and that of cataract females is 41.56. In both the sexes mean are 41.28. The mean value for atd angle in control group, males 41.23, females 42.44 and in both the sexes 41.84.

**Table 8: Test of Significance for 'atd' Angle**

| COMPARISION | p VALUE | REMARK |
|---|---|---|
| CMR X NMR | 0.3317 | NS |
| CML X NML | 0.554 | NS |
| CFR X NFR | 0.7818 | NS |
| CFL X NFL | 0.556 | NS |
| C (M+F)R X N(M+F)R | 0.1496 | NS |
| C (M+F)L X N(M+F)L | 0.8294 | NS |
| C (M+F)(R+L) X N(M+F)(R+L) | 0.2499 | NS |

Table no. 8 shows test of significance for the atd angle. The atd angle calculations show no statistically significant observations among cataracts and controls.

**Table 9: Frequency Distribution of Triradii in Cataracts (M+F)**

| No. of palmar triradii | Right | | Left | | Right+Left | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| 3 | | 0 | | 0 | | |
| 4 | 20 | 10 | 45 | 22.5 | 65 | 16.25 |
| 5 | 172 | 86 | 150 | 75 | 322 | 80.5 |
| 6 | 7 | 3.5 | 5 | 2.5 | 12 | 3 |
| 7 | 1 | 0.5 | | 0 | 1 | 0.25 |

Table no.9 frequency distribution of triradii in cataracts. 16.25% have 4 triradii, 80.5% of cases show 5 triradii, 3% has 6 triradii and 0.25% has 7 triradii.

**Table 10: Frequency Distribution of Triradii in Controls (M+F)**

| No. of palmar triradii | Right | | Left | | Right+Left | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| 3 | 1 | 0.5 | 5 | 2.5 | 6 | 1.5 |
| 4 | 31 | 15.5 | 57 | 28.5 | 88 | 22 |
| 5 | 155 | 77.5 | 130 | 65 | 285 | 71.25 |
| 6 | 12 | 6 | 8 | 4 | 20 | 5 |
| 7 | 1 | 0.5 | | 0 | 1 | 0.25 |

Table no.10 frequency distribution of triradii in cataracts. 1.5% shows 3 triradii, 22% have 4 triradii, 71.25% of cases show 5 triradii, 5% 6 triradii and 0.25% has 7 triradii.

**Table 11: Significance Test for Total Number of Palmar Triradii**

| No. of palmar triradii | Comparison | x2 value | p value | Remark |
|---|---|---|---|---|
| 3 | N(M+F)(R+L)XC(M+F)(R+L) | 6.045 | 0.0139 | S DEC IN CASE |
| 4 | N(M+F)(R+L)XC(M+F)(R+L) | 4.275 | 0.0387 | S DEC IN CASE |
| 5 | N(M+F)(R+L)XC(M+F)(R+L) | 9.349 | 0.0022 | S INC IN CASES |
| 6 | N(M+F)(R+L)XC(M+F)(R+L) | 2.083 | 0.1489 | NS |
| 7 | N(M+F)(R+L)XC(M+F)(R+L) | 0.000 | 1 | NS |

Table no. 11 shows significance test for total number of palmar triradii. The cataracts shows significantly decrease in number of cases having 3 and 4 triradii. There is significant increase in cataracts having 5 triradii.

**Table 12: Frequency Distribution of Different Positions of Axial Triradii among Cataracts and Controls**

| Group | Sex | Side | Position of Axial Triradii | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | t0 | | t1 | | t2 | | t0t1 | | t0t2 | | t1t2 | | t0t1t2 | |
| | | | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Cases | | Right | 56 | 56 | 36 | 36 | 5 | 5 | 1 | 1 | 2 | 2 | 0 | 0 | | 0 |
| | | Left | 57 | 57 | 31 | 31 | 8 | 8 | 0 | 0 | 0 | 0 | 4 | 4 | | 0 |
| | Male | Right + Left | 113 | 56.5 | 67 | 33.5 | 13 | 6.5 | 1 | 0.5 | 2 | 1 | 4 | 2 | | 0 |
| | | Right | 61 | 61 | 30 | 30 | 5 | 5 | 1 | 1 | 2 | 2 | 0 | 0 | 1 | 1 |
| | | Left | 60 | 60 | 29 | 29 | 8 | 8 | 3 | 3 | 0 | 0 | 0 | 0 | | 0 |
| | Female | Right + Left | 121 | 60.5 | 59 | 29.5 | 13 | 6.5 | 4 | 2 | 2 | 1 | | 0 | 1 | 0.5 |
| | | Right | 117 | 58.5 | 66 | 33 | 10 | 5 | 2 | 1 | 4 | 2 | 0 | 0 | 1 | 0.5 |
| | | Left | 117 | 58.5 | 60 | 30 | 16 | 8 | 3 | 1.5 | 0 | 0 | 4 | 2 | 0 | 0 |
| | Male+ Female | Right + Left | 234 | 58.5 | 126 | 31.5 | 26 | 6.5 | 5 | 1.25 | 4 | 1 | 4 | 1 | 1 | 0.25 |
| Control | | Right | 75 | 75 | 19 | 19 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | | 0 |
| | | Left | 70 | 70 | 22 | 22 | 5 | 5 | 1 | 1 | 0 | 0 | 2 | 2 | | 0 |
| | Male | Right + Left | 145 | 72.5 | 41 | 20.5 | 6 | 3 | 4 | 2 | 1 | 0.5 | 3 | 1.5 | | 0 |
| | | Right | 55 | 55 | 27 | 27 | 7 | 7 | 2 | 2 | 5 | 5 | 2 | 2 | 2 | 2 |
| | | Left | 59 | 59 | 23 | 23 | 10 | 10 | 3 | 3 | 5 | 5 | 0 | 0 | | 0 |
| | Female | Right + Left | 114 | 57 | 50 | 25 | 17 | 8.5 | 5 | 2.5 | 10 | 5 | 2 | 1 | 2 | 1 |
| | | Right | 130 | 65 | 46 | 23 | 8 | 4 | 5 | 2.5 | 6 | 3 | 3 | 1.5 | 2 | 1 |
| | | Left | 129 | 64.5 | 45 | 22.5 | 15 | 7.5 | 4 | 2 | 5 | 2.5 | 2 | 1 | 0 | 0 |
| | Male+ Female | Right + Left | 259 | 64.75 | 91 | 22.75 | 23 | 5.75 | 9 | 2.25 | 11 | 2.75 | 5 | 1.25 | 2 | 0.5 |

**Table 13: Significance Test for Different Positions of Axial Triradii**

| Pattern Type | Comparison | X2 Value | p value | Remark |
|---|---|---|---|---|
| | NM(R+L) X CM(R+L) | 11.18 | 0.0008 | S |
| | NF(R+L) X CF(R+L) | 0.5055 | 0.4771 | NS |
| t0 | N(M+F)(R+L) X C(M+F)R+L) | 3.304 | 0.0691 | NS |
| | NM(R+L) X CM(R+L) | 8.574 | 0.0034 | S |
| | NF(R+L) X CF(R+L) | 1.021 | 0.3122 | NS |
| t1 | N(M+F)(R+L) X C(M+F)R+L) | 7.746 | 0.0054 | S |
| | NM(R+L) X CM(R+L) | 2.708 | 0.0999 | NS |
| | NF(R+L) X CF(R+L) | 0.5766 | 0.4477 | NS |
| t2 | N(M+F)(R+L) X C(M+F)R+L) | 0.1957 | 0.6582 | NS |
| | NM(R+L) X CM(R+L) | 1.823 | 0.177 | NS |
| | NF(R+L) X CF(R+L) | 0.1137 | 0.736 | NS |
| t0t1 | N(M+F)(R+L) X C(M+F)R+L) | 1.163 | 0.2808 | NS |
| | NM(R+L) X CM(R+L) | 0.3359 | 0.5622 | NS |
| | NF(R+L) X CF(R+L) | 3.692 | 0.0547 | NS |
| t0t2 | N(M+F)(R+L) X C(M+F)R+L) | 3.329 | 0.0681 | NS |
| | NM(R+L) X CM(R+L) | 0.1454 | 0.703 | NS |
| | NF(R+L) X CF(R+L) | 2.010 | 0.1563 | NS |
| t1t2 | N(M+F)(R+L) X C(M+F)R+L) | 0.1124 | 0.7375 | NS |

| | | | | |
|---|---|---|---|---|
| | NM(R+L) X CM(R+L) | 2.010 | 0.1563 | NS |
| | NF(R+L) X CF(R+L) | 0.3359 | 0.5622 | NS |
| t0t1t2 | N(M+F)(R+L) X C(M+F)R+L) | 0.3346 | 0.563 | NS |

Table no. 13 shows significance test for positions for axial triradii. The t0 position is observed significantly higher in control males than cataract males. The t1 position is found significantly higher in cataract males.

## 5. Discussion

The hypothesis, that antenatal factors may be involved in the pathogenesis of a disorder which becomes apparent later in life, would be suggested if a relationship between a prenatal event such as dermal ridge formation and the disorder could be established. Thus, the dermal ridges have various notable characteristics which make them important, not only in personal identification of a person but also in human biology for various reasons such as

1. Unlike many bodily traits the dermal ridges and configuration once formed remain unchanged except in dimensions.
2. The ridges are environment stable and begin to appear from 5$^{th}$ month of I. U. life.
3. Although the patterns formed by ridges vary in size, shape and detailed structures, still they can be classified into definite main types. Realizing the need for objective means to study genetics many investigators have been exploiting the quantitative and qualitative features of dermal ridges such as ridge counting, angles, etc.,

Prior to 1926 when word "Dermatoglyphics" was not proposed, there had been no satisfactory term embracing the skin patterning of fingers, toes, palms and soles. Dermatoglyphics is a collective name for all those integumentary features, within the limit to be defined and it also applies to the division of Anatomy which embraces their study. Thus H. Cummins emphasized that dermatoglyphics is a division of anatomy.

At present there is an agreement that dermatoglyphic features confirm to polygenic system with individual genes contributing a small additive effect. A genetic theory put forward by Herman M. Slats assumes that the basic finger print pattern sequence is all ulnar loops and that various genes cause deviations from this pattern sequence.[9]

In recent past, a number of investigators have focused their attention in finding out an association of morphological and genetical characters with a number of pathological conditions. Dermatoglyphics determined by polygenic inheritance is one of such tools, used in scientific studies. It has been demonstrated by many that dermatoglyphics is of aid in the diagnosis and understanding the genetics of many human pathogenic abnormalities.[9]

Cataract and diabetes mellitus both have strong hereditary background. Diabetes mellitus acts as major predisposing factor for cataract, so certain dermatoglyphic variations are supposed to be expected in cataract associated with diabetes mellitus.

The present study consists of 200 cases including 100 men and 100 women having cataract associated with diabetes mellitus. This study group is compared with the control group consisting of 100 men and 100 women of same age group with no observable genetic abnormality.

The sample has been drawn from the heterogeneous group in central India region. Taking into consideration the nature of dermatoglyphic variations in the given region, the social and ethnic variations are minimal in homogenous background. Hence, some conspicuous variations can be observed apart from the regular variations found in the general population.

The parameters observed among the diabetic cataract and control groups are

1. Main line index.
2. Main line formula.
3. 'atd' angle.
4. Total number of palmar triradii.
5. Position of axial triradius.

These observations were subjected to test for statistical significance. The categorical variables were compared using chi square test and the continuous variables were subjected to unpaired two tailed t-test of significance.

Literature is available on dermatoglyphic variations in cataract and in diabetes but few studies are available on dermatoglyphics in cataract associated with diabetes mellitus. Hence, the findings of the present study are compared with the above studies.

The findings of the present study are discussed and compared under following headings.

**Palmar Pattern:**

In present study it is observed that there is increase in the frequency of pattern in 3$^{rd}$ interdigital area in diabetic cataract males. Also there is decreased frequency of patterns in 4$^{th}$ interdigital area in diabetic cataracts of both the sexes. Further hypothenar area in diabetic cataract females shows slight increase in pattern frequency.

**Jullian Verbow (1973)** studied the palmar pattern in diabetes mellitus patients and found that the males show a high frequency of pattern in 4th interdigital area.[10] **G. Eswaraiah, R. S. Bali (1997)** found that the pattern in 4th and 2nd interdigital areas were significantly lower in male and female diabetics respectively.[11] **S. K. Angra et al (1990)** found significant increase in palmar patterns in 4th interdigital areas and hypothenar area in congenital cataract patients.[12] **Ziegler A. G. et al (1993)** found lower frequency of patterns in 4th interdigital and hypothenar area in patients with diabetes mellitus.[13] **P.K. Dam et al (2006)** studied dermatoglyphic patterns in diabetes mellitus patients and non-diabetics lower frequency of occurring true pattern in 4th interdigital area and lower frequency of occurring true pattern in thenar area.[14]

Thus the findings of the present study correlate with the findings of G. Eswaraiah, R. S. Bali (1997), Ziegler A. G. et al (1993) and P.K. Dam et al (2006) regarding their findings of lower frequency of patterns in 4th interdigital area.

**Main line index:**
In present study it is observed that the main line index shows no significant variations in diabetic cataracts of both sexes when compared to controls.

**S. K. Angra (1987)** demonstrated the study of congenital cataract; he found that there is no variation in main line index.[15] **S. K. Angra, A. Panda et al (1990)** in their study on congenital cataract observed that there is no alteration in main line index in patients and controls.[16] **R. Ravindranath et al (2005)** in their study of dermatoglyphics in non insulin dependent diabetes mellitus found main line index and palmar angle in controls and non insulin dependent diabetes mellitus (NIDDM) were not significant.[17]

Thus these findings correlate with the previous studies.

**Main Line formula:**
In present study 11 9 7 pattern is most common pattern in both the groups. 7 5"5', 11 0 7, 9 7 5', 9 0 5' and 9 7 5" are other common patterns in diabetic cataract males, while in cataract females the other significant patterns are 9 7 5", 9 7 5', 9 5"5', 11, 7 5', and 11 0 7.

In control males the other significant patterns are 7 5" 5', 9 7 5", 9 7 5', 11 0 7, 11 11 7. In control females the patterns are 9 0 5', 11 0 7, 7 5" 5', 11 9 5', 11 0 5'.

As there is no similar study is found for comparison, the findings cannot be correlated with any other study. However following studies has been cited regarding main line formula among cataract and diabetes.

**G. Eswariah and R. S. Bali (1997)** observed the differences between main line formulae in diabetes and controls and it was found significantly different in male diabetics. The difference between c-line types of patients and controls were found significant in both sexes.[11] **T. Padma and J. S. Murthy (1980)** studied palmar prints of patients of different types of cataract for main line termination. The result showed the significant variations for all the four main line terminations; D, C, B, A in senile and cortical cataracts, while among other type of cataract congenital cases differed significantly in D and A line, zonular in C and A and nuclear in B and A line variations.[18]

**S. M. Sant et al (1983)** shown in their study on diabetes that the frequency of C- radial is increased and frequency of C-ulnar and C-abortive is decreased in diabetic females. They further found that frequency of C-absent was increased and frequency of C-ulnar was decreased in diabetic males.[19]

**S.K. Angra (1987)** in his study of dermatoglyphics in congenital cataract found the different changes in B, C, and D main line terminations.[15]

**S. K. Angra, A. Panda et al (1990)** in their study in congenital cataract observed variations in all main line terminations.[12]

**Ziegler A. G. et al (1993)** shown on their study of dermatoglyphics in diabetes that ending of the main line A in a specific sector 5` and 5`` compared with controls.[13]

**`atd` angle:**
In the present study there are no significant variations observed in atd angle in diabetic cataract males as well as diabetic cataract females when compared to controls.

**Julian Verbow (1973)** observed in dermatoglyphic findings of diabetes mellitus, the maximum `atd` angle.[10] **S. K. Angra (1987)** in his study in congenital cataract found marked variation in `atd` angle.[15] **R. Ravindranath, I. M. Thomas (1995)** found no significant difference in mean values of `atd` angle in study of diabetes mellitus.[20] **G S Oladipo, M. B. Ogunnowo (2004)** analyzed dermatoglyphic pattern in diabetes mellitus observed significant difference in `atd` angle.[21] **R. Ravindranath et al (2005)** in their study of dermatoglyphics in non insulin dependent diabetes mellitus found main line index and palmar angle in controls and non insulin dependent diabetes mellitus(NIDDM) were not significant.[17] **Vadgaonkar Rajanigandha et al (2006)** found statistically significant increase in the 'atd' angle that was noted on both hands of both sexes in diabetics when compared to the controls, who showed narrower angles.[22] **M. Pramila Padmini, B. Narasinga Rao and B. Malleswari (2011)** found increased incidence of atd angle in male diabetics than in control. No significant features were recorded for atd angles in female diabetes and in control.[23]

Thus present study correlates with the previous studies done by R. Ravindranath, I. M. Thomas (1990), R. Ravindranath et al (2005).

**Total Number of Palmar triradii:**
In present study the number of triradii found is significantly higher in diabetic cataract males and females as compared to controls.

**Sherke A. R., Parchand M. P., Kamble R. A., Shende M. R., Fulpatil M. P. (2003)** studied dermatoglyphics in cataract associated with diabetes mellitus observed significant increase in number of triradii when compared with controls.[24]

Thus present study correlates with the previous study.

**Position of Axial triradii:**
In present study it is observed that significant increase in t1 triradii in male diabetic cataracts when compared to controls.

**G. Eswaraiah and R. S. Bali (1997)** in their study of dermatoglyphics in diabetes found significant axial triradii in female patients and controls.[11] **Ziegler A. G. et al (1993)** in their study of dermatoglyphics in diabetes found higher frequency of palmar triradii t1 and t2.[13] **Sherke A. R., Parchand M. P., Kamble R. A., Shende M. R., Fulpatil M. P. (2003)** Observed significant increase in t2 triradius in patients with cataract associated with diabetes mellitus.[24] **Vadgaonkar Rajanigandha, Pai Mangala, Prabhu Latha, Saralaya Vasudha (2006)** noted presence of an additional axial triradii (t'/t") in diabetic patients as significant in both sexes when compared to normal subjects.[22]

Thus present study correlates with findings of Ziegler A. G. et al (1993), Vadgaonkar Rajanigandha, Pai Mangala, Prabhu Latha, Saralaya Vasudha (2006).

## 6. Conclusion

The present study was undertaken with an aim to evaluate the dermatoglyphic pattern in diabetic cataract patients.
Significant variations are observed in the various dermatoglyphic parameters among normal population and persons having cataract associated with diabetes mellitus.

Observations and results in this study conluded are

1. Increase in the frequency of pattern in $3^{rd}$ interdigital area in diabetic cataract males. Also there is decrease frequency of patterns in $4^{th}$ interdigital area in diabetic cataracts of both the sexes. Further hypothenar area in diabetic cataract females shows slight increase in pattern frequency.
2. Main line index shows no significant variations in diabetic cataracts of both sexes when compared to controls.
3. The main line formulae 11 9 7 pattern is most common pattern in both the groups.
4. 7 5"5', 11 0 7, 9 7 5', 9 0 5' and 9 7 5" are other common patterns in diabetic cataract males, while in cataract females the other significant patterns are 9 7 5", 9 7 5', 9 5"5', 11, 7 5', and 11 0 7.
5. In control males the other significant patterns are 7 5" 5', 9 7 5", 9 7 5', 11 0 7, 11 11 7. In control females the patterns are 9 0 5', 11 0 7, 7 5" 5', 11 9 5', 11 0 5'.
6. No significant variations are observed in atd angle
7. Total number of triradii found is significantly higher in diabetic cataract males and females as compared to controls.

On the basis of results obtained, the study can be used for early detection of the predisposed persons from the normal population so that they can be subjected to preventive measures, to avoid the future burden of the disease on the community. However, further extensive studies are necessary to find out other hidden dermatoglyphic features.

The advantages observed during the project are as follows:

1. The method is very simple and readily accessible for the study.
2. Patterns can be recorded quickly.
3. Materials required for the test are simple and cost effective.
4. This method is non-invasive and non-traumatic.
5. The simplicity of test qualifies it for mass screening of large population.

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