ORIGINAL ARTICLE

Association of Palmar Ridge Count Density and Diabetes Mellitus: A Prospective Study

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Abstract:

Background: Dermatoglyphics is the scientific study of epidermal ridges and their configurations on the palmar region of hand and plantar region of foot. Dermatoglyphic ridges once formed never change throughout the life except in the dimension in proportion to the growth of an individual. Thus, dermatoglyphics helps in predicting the onset of diabetes mellitus in an early detection programme. *Aim*: The present study was done to identify the ridge counts on finger tips and palms in Diabetics and non-Diabetics. *Material and Methods*: The present study was carried out on 80 Diabetic patients and 80 normal healthy individuals (controls) in the S.S. Institute of Medical Sciences and Research Centre, Davangere district of Karnataka, India. The palm prints of patients and controls were taken by INK Method as described by CUMMINS and MIDLO. The parameters like total finger ridge count, absolute finger ridge count and a-b ridge count in both hands were noted. *Results*: The mean absolute finger ridge count was decreased in diabetics when compared to controls which was statistically significant. The total finger ridge count and a-b ridge count were increased in diabetics when compared to controls which were statistically significant. *Conclusion***:** Palmar ridge counting helps in predicting the onset of diabetes mellitus in early detection programme.

Keywords: Dermatoglyphics, Diabetes Mellitus, Absolute finger ridge count, Total finger ridge count, a-b ridge count

Introduction:

The scientific study of epidermal ridges and their configurations on the palmar region of hand and fingers and plantar region of foot and toes is known as dermatoglyphics.[1] The ridge pattern depends upon the cornified layer of epidermis and dermal papillae. The ridges are differentiated in their definitive forms during third and fourth month of foetal life.[2] Once formed, it remains permanent and never change throughout the life except in the dimension in proportion to the growth of an individual.[3] Thus, it helps in predicting the onset of many diseases such as diabetes mellitus in an early detection programme.[4] Dermatoglyphic analysis can be done by

Ridge counting:

Ridge counting indicates the pattern and size. It is primarily utilized in finger tips as a way of expressing the distance between digital triradii to the ridge density in a given area. The largest count is scored in a pattern with more than one possible count. Both simple and tented arches have "0" count. To some extent, ridge count reflects the pattern type (Holt SB, 1961).[5] The two counts are specified as first radial and second ulnar counts. Types of ridge counting are   a) Total Finger Ridge Count (TFRC): *TFRC* represents the sum of ridge counts of all ten digits, where only he larger count is used on those digits with more than one ridge count. *It* expresses the size of pattern. b) Absolute Finger Ridge Count (AFRC): AFRC is the sum of the ridge counts from all the separate triradii on the fingers. It reflects the pattern size as well as pattern intensity which depends on the pattern type. c) a - b Ridge Count: It is the number of ridges between triradii "a" and "b". Dermatoglyphics was selected from the various methods because of its simple technique, low cost, clarity of prints, rapid, permanent & can be inspected qualitatively & quantitatively. As there was less data available in this region, the present study was aimed at analyzing the absolute finger ridge count, total ridge count and a-b ridge count in diabetes mellitus patients and controls which would help in detection of Diabetes mellitus in early detection programme.

Material and Methods:

Source of data: A cross sectional study was conducted on 80 Diabetic patients in S.S. Institute of Medical Sciences and Research Centre, Davangere district of Karnataka, India which was compared with 80 normal healthy individuals. Inclusion criteria: Individuals diagnosed with type 2 Diabetes Mellitus with fasting blood sugar

levels greater than 110mg/dl and postprandial blood sugar levels greater than 180mg/dl (according to World Health Organization) between the age group 30 to 60 years were included as cases. Normal healthy individuals with fasting blood sugar levels less than 110mg/dl and postprandial blood sugar levels less than 180mg/dl between the age group 30 to 60 years were included as controls. Exclusion criteria: Patients with diseases like Hypertension, Cardiovascular diseases, Kidney disorders, Type 1 Diabetes Mellitus patients and chronic skin diseases having infection, scars, congenital or acquired anomalies due to trauma on the fingers were excluded from the study. Individuals aged below 30 years and above 60 years were excluded from the study. Method: Dermatoglyphic prints were taken by the "INK METHOD" as described by CUMMINS (1936), [6] CUMMINS and MIDLO (1961) [7] after obtaining Institutional Ethical Committee clearance. After obtaining informed written consent, the subjects were asked to clean their hands with soaps and water. They were also asked to dry their hands but to leave some moisture. The requisite amount of ink daub 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. 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. The palm was examined for the uniformity of the ink and if found otherwise ink was also applied to the hollow of the palm with the help of cotton puffs. Left hand of the 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 reverse order, from the distal to proximal end. The fingers were also printed below the palmar print by rolled finger print method. The tips of the fingers were rolled from radial to ulnar side to include all the patterns. The same procedure was repeated for right hand on separate paper. The printed sheets were coded with name, age and sex for case group and control group. The prints were then subjected to detail dermatoglyphic analysis with the help of magnifying hand lens. Ridge counting was done with the help of a sharp needle. The details of type of dermatoglyphic patterns like arches, whorls and loops (ulnar and radial loops) were identified on both the hands in cases and controls. The Ridge counting was noted on the same paper with the pencil. The counting was done along the straight lines connecting the core and the triradius.

Ridges containing triradial point and point of core were excluded. In case of whorl with two triradii and at least one point of core, two different counts were made from each triradii. Each count was made along a line drawn between the triradial point and the nearer point of core as shown in figure 1. a-b ridge count was done from triradii "a" to triradii "b" as shown in figure 2. Quantitative analysis of TFRC, AFRC and a-b ridge count were calculated for both 80 cases and 80 controls.[8] Sample size was estimated by using formula - 4pq÷d2.[9] Where p = prevalence of diabetes mellitus, q=1-p, d (allowable error) =5, CI (confidence interval)= 95%. Statistical analysis of finger prints was done by using chi-square test.

Results:

Table 1: Comparison of mean of total finger ridge count (TFRC) between males and females in diabetics & controls

Mean TFRC	Males (n=40)	Females (n=40)	P value	Significance
Cases	75.06	74.05	<0.0000001	Significant
Controls	59.4	54.1	<0.0000001	Significant

Table 2: Comparison of mean of total finger ridge count (TFRC) in diabetics & controls

Total	Cases (n=80)	Controls (n=80)	P value	Significance
Mean TFRC	74.55	56.75	<0.0000001	Significant

Table 3: Comparison of mean of absolute finger ridge count (AFRC) between males and females in diabetics & controls

Mean AFRC	Males (n=40)	Females (n=40)	P value	Significance
Cases	37.14	55.98	<0.0000001	Significant
Controls	50.33	45.33	<0.0000001	Significant

Table 4: Comparison of mean of absolute finger ridge count (AFRC) in diabetics & controls.

Total	Cases (n=80)	Controls (n=80)	P value	Significance
Mean AFRC	46.56	47.83	<0.0000001	Significant

There was an increase in TFRC in males & females & combined series of male & female diabetics which was statistically significant when compared to controls. There

was statistically significant increase in AFRC in female diabetics & decreased AFRC in male diabetics when compared to controls.

Table 5: Comparison of mean of a-b Ridge Count between males and females in diabetics & controls on left side

Mean a-b RC (Left Side)	Males (n=40)	Females (n=40)	P value	Significance
Cases	42.1	38.36	<0.0000001	Significant
Controls	34.8	44.4	<0.0000001	Significant

Table 6: Comparison of mean of a-b Ridge Count between males and females in diabetics & controls on right side

a-b RC (Right Side)	Males (n=40)	Females (n=40)	P value	Significance
Cases	40.1	40.2	<0.0000001	Significant
Controls	34.36	38.6	<0.0000001	Significant

Table 7: Comparison of mean of a-b Ridge Count in diabetics & controls

Total	Cases (n=80)	Controls (n=80)	P value	Significance
Mean a-b RC	80.36	74.58	<0.0000001	Significant

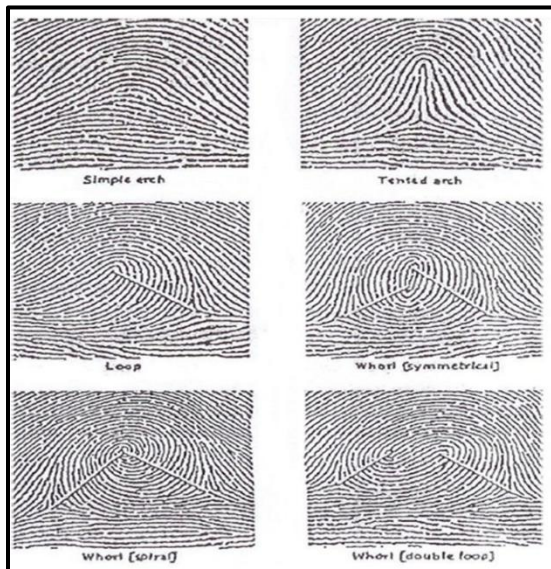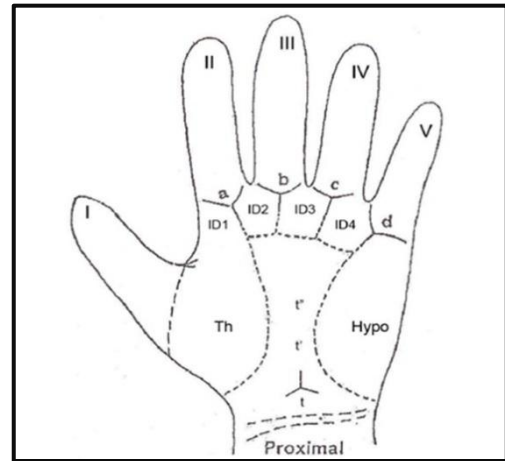**Figure 1: Finger Ridge Counting in different Patterns**

Figure 2: Ridge count between triradii 'a' and 'b'

a, b, c, d and t -triradius, ID- interdigital area, Th- thenar area, Hypo- hypothenar area

There was decreased AFRC in diabetics in combined series of male & female diabetics when compared to controls which was statistically significant. There was a significant increase in a-b ridge count in male diabetics when compared to male controls & increased a-b ridge count in female diabetics when compared to female controls in the right hand. There was a significant increase in a-b ridge count in male diabetics but decrease in ridge count of female diabetics in the left hand when compared to controls. In combined series of male & female diabetics there was a significant increase in a-b ridge count of diabetics when compared to controls.

Discussion:

TFRC: There was an increase in the mean values of total finger ridge count in males, females & combined series of males & females when compared to controls which was statistically significant in present study. M. Vera observed that there was a decrease in digital total ridges in diabetic patients which was statistically significant when compared to controls.[10]

AFRC: There was a decrease in the mean values of absolute finger ridge count in males & increase in the mean values of absolute finger ridge count in females, & combined series of males & females, when compared to controls which was statistically significant in present study. In the observations made by Manoj Sharma, there was an increase in total finger ridge count & absolute finger ridge count in diabetics as compared to controls which was statistically significant.[11]

a-b ridge count: In the present study, the mean a-b ridge count of left hand of diabetics was significantly increased when compared to controls. In female diabetics, a-b was significantly decreased when compared to controls. There was a significantly increase in a-b ridge count in male diabetics when compared to

male controls & significantly increased a-b ridge count in female diabetics when compared to female controls in the right hand. There was a significant increase in a-b ridge count in male diabetics but decrease in ridge count of female diabetics in the left hand when compared to controls. In combined series of male & female diabetics there was a significant increase in a-b ridge count of diabetics when compared to controls. Hossein Rezaei Nezhad observed that the a-b ridge count in male and female patients had decreased comparatively to control group, but the reduction was not significant comparative to control group.[12] In the observations made by Manoj Sharma, there was an increase in a-b ridge count in diabetics as compared to controls which was statistically insignificant.[11] Significant lower a-b ridge count was noted by Zeigler AG in diabetic patients compared to control.[13]

Conclusion:

The mean value of absolute finger ridge count was significantly decreased in diabetics when compared to controls. The a-b ridge count & TFRC were significantly increased in diabetics when compared to controls. Thus, Dermatoglyphics helps in predicting the onset of many diseases such as diabetes mellitus in an early detection programme.

Sources of supports: Nil

Conflicts of Interest: Nil

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