IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 8, Issue 1 (May.- Jun. 2013), PP 01-05
www.iosrjournals.org

Role of Dermatoglyphic Fingertip Patterns in the prediction of Maturity Onset Diabetes Mellitus (Type II)

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Abstract: *Dermatoglyphic features are inherited by polygenic system with individual gene contributing a small additive effect. The present research aims to primarily study the various dermatoglyphic patterns in the patients of the Maturity Onset Diabetes Mellitus (Type II diabetes) and compare these statistically with the dermatoglyphic patterns in individuals not suffering from it. The present study was carried out on 101 (51 male and 50 female) clinically diagnosed patients of maturity onset diabetes mellitus. Healthy controls (n=100, 50 males and 50 females) were studied for comparison. Palmar prints were obtained in all the patients and controls and the dermatoglyphic patterns were analyzed using statistical considerations. Standard fingertip pattern configurations and landmarks were used in the study. Significantly higher frequency of arches and lower frequency of whorls were observed in female diabetics than controls. Dankmeijer's Index was highest in female diabetic group and Furuhata's Index was highest in the male control group. AFRC and TFRC were significantly lower in diabetic females than controls. Findings of the present study after a meticulous analysis of different fingertip dermatoglyphic variables highlights on the possible markers and indicate that there is scope for further study on a larger sample size.*

Keywords- *Arches, Dermatoglyphics, Maturity Onset Diabetes Mellitus, Palmar print, Ulnar loops, Radial loops, Whorls*

Submitted date 13 June 2013 **Accepted Date: 19 June 2013**

I. Introduction

Dermatoglyphic features are inherited by polygenic system with individual gene contributing a small additive effect. This has been reflected in number of diseases and can be used as a diagnostic aid in screening of genetically transmitted diseases. Prevalence and incidence of Maturity onset diabetes mellitus has increased globally, especially in newly industrialized and developing countries. Diabetic patients, if undiagnosed or inadequately treated, develop multiple chronic complications leading to irreversible disability and death [1]. Maternal insulin dependent diabetes mellitus is associated with two to threefold increase in the incidence of congenital anomalies in offsprings, like congenital heart disease, neural tube defects, sacral agenesis and femoral Hypoplasia [2]. Maturity onset diabetes mellitus has a strong hereditary background, and certain dermatoglyphic variations are expected in maturity onset diabetes mellitus.

The age of onset of the Maturity onset diabetes mellitus is rather late and there is no definite way of predicting which of the family member will develop the disease later on so that the susceptible person may be advised regarding preventing programme [3]. The present research aims to primarily study the various dermatoglyphic patterns in the patients of the Maturity Onset Diabetes Mellitus and compare these statistically with the dermatoglyphic patterns in individuals not suffering from it. The study also aims to analyze the dermatoglyphic patterns qualitatively and quantitatively to look for a possible marker, if any and study the feasibility of the marker as a screening procedure to predict the possibility of developing maturity onset diabetes mellitus in otherwise normal individuals

II. Materials And Methods

The present study was carried out on 101 (51 male and 50 female) clinically diagnosed patients of maturity onset diabetes mellitus. Healthy controls (n=100, 50 males and 50 females) were studied for comparison. Patients attending the out-patient department and indoor patients from Dr. D. Y. Patil Hospital Pimpri, Pune were included in the present study. For the control group, patients above the age of 50 years, with no family history of diabetes mellitus, normal blood sugar levels and without any other major illnesses were selected for the present study. The aim of the study and procedure to be employed was explained to the participants in detail and a written consent was obtained from the participants. Required information was

collected and recorded in the prepared proforma before taking the prints. Standard ink method was used in the present study.

Palms and fingers were cleaned with soap and water to remove oily dirt, sweat and other dirt from palm and fingers. Spirit was used to remove remaining oil and other dirt and keep the hand clean and dry. Same procedure was repeated after taking prints. A dab of 'Kores' duplicating ink was applied on the slab and spread on slab evenly by rolling the roller over the ink on the slab so that a thin layer of ink is formed on the slab surface. Ink was used and an ink-roller was employed to spread ink on the palm and fingers evenly. The prints were taken on white sheets; one sheet was used for one hand i.e. for palm and fingers of one hand. Finger prints are taken by rolled prints with the help of roller, which was already covered by a layer of ink, was rolled on the finger. It requires rotation of finger for inking as well as for printing to get complete pattern of balls of fingers. After taking the rolled prints of all 5 fingers in the space specified for each finger, palmar print was taken. After this, same procedure was repeated for other hand on a separate paper. To avoid the failure of print of hollow of palm, pressure pad was used below the paper to be printed, and adjusted so as to come under hollow of the palm. The inked palm was then pressed on the paper and mild pressure on the dorsum of hand was applied for uniform printing of hollow of palm. Printing was started with ulnar border, which, was pressed first, then the whole of the palm was pressed on the paper in order to get complete pattern of the palm.

Palmar prints were taken in all the patients and controls and the dermatoglyphic patterns were analyzed according to Galton's method. Standard fingertip pattern configurations and landmarks were used in the study. The quantitative data, qualitative data and the indices were calculated from dermatoglyphic prints. To find out any association of dermatoglyphic patterns with diabetes, the patterns were compared between male and female diabetics and male and female controls respectively. In the present study, the arches, whorls, ulnar and radial loops are studied. Quantitative analysis of ridges was done as Absolute finger ridge count (AFRC) and Total finger ridge count (TFRC). The Goodness of fit X^2 and t-test were applied to study statistical significance of the qualitative and quantitative data respectively. Dankmeijer's Index and Furuhata's Index were calculated for the fingertip patterns.

Dankmeijer's Index is calculated by following formula-

$$\left[\frac{\%\ \text{of Arches}}{\%\ \text{of Whorls}}\right] \mathbf{X}\ 100$$

Furuhata's Index is calculated by following formula-

$$\left[\frac{\%\ \text{of Whorls}}{\%\ \text{of Loops}}\right] \mathbf{X}\ 100$$

III. Results

Table1. shows the frequency (%) distribution of fingerprint patterns among male diabetics and controls. A higher frequency of arches and ulnar loops was seen in male diabetic patients than the respective control group. For whorls, the frequency was lower among male diabetics than male controls. The results were statistically not significant in male group.

Table 1 Frequency (%) Distribution of Fingertip Patterns and Tests of Significance in Male Diabetics and Controls

Pattern	Diabetics			Controls			X^2 & (p- value)		
	Rt. H	Lt. H	Rt.H +Lt. H	Rt. H	Lt.H	Rt.H +Lt. H	Rt. H	Lt. H	Rt. H + Lt. H
Arches	3.15	5.49	4.32	0.78	4.31	2.55	2.470 (0.116)	0.129 (0.719)	1.749 (0.186)
Ulnar Loops	59.4	57.2	58.3	56.4	53.6	55	0.364 (0.547)	0.543 (0.461)	1.020 (0.312)
Radial Loops	2.36	2.74	2.55	5.2	2.4	3.8	#Tests not applied		
Whorls	35.4	34.9	35.2	39.2	38.8	39	0.612 (0.434)	0.665 (0.415)	1.429 (0.232)

Rt. H- Right hand, Lt. H- Left hand, # Frequency of radial loops was least for fingertip patterns and difference between diabetics and controls was least, hence statistical tests not applied.

Table2. Shows frequency (%) distribution of fingerprint patterns and tests of significance in female diabetics and controls. A higher frequency of arches was observed in female diabetic patients than the control

group. The difference was more marks in left hand as compared to right hand. The results for arches were statistically significant in left hand ((X^2 =7.472, P=0.006)) as well as combined right and left hands of female group (X^2 =10.139, P=0.001).

For whorls, the frequency was lower among female diabetics than female controls. The difference was more marked on right side. Statistically significant results were observed for combined right and left hands (X^2 =10.571, P=0.001).

Table 2. Frequency (%) Distribution of Fingertip Patterns and Tests of Significance in Female Diabetics and Controls

Pattern	Diabetics			Controls			X^2 & (p- value)		
	Rt. H	Lt. H	Rt.H +Lt. H	Rt. H	Lt. H	Rt.H +Lt. H	Rt. H	Lt. H	Rt. H + Lt. H
Arches	7.63	10.8	9.22	4	4	4	2.343 (0.126)	7.472 (0.006) ***	10.139 (0.001) ***
Ulnar Loops	65.46	56	60.72	58.4	53.6	56	2.169 (0.141)	0.202 (0.653)	1.991 (0.158)
Radial Loops	2.4	3.2	2.8	2.8	2.8	2.8	#Tests not applied		
Whorls	24.49	30	27.25	34.4	39.6	37	5.550 (0.018) **	4.663 (0.031) *	10.571 (0.001)***

** Significance at 5%, ** Significance at 2%, *** Significance at 1% levels*

The Dankmeijer's index was higher in diabetics than controls in both sexes and highest in Female Diabetic group (33.69) and lowest in Male control group (6.52). The Furuhata's Index was lower in diabetics than controls and highest in Male control group (64.69) and lowest in Female diabetic group (42.99). Frequency distribution of fingertip patterns with Furuhata's and Dankmeijer's indices is depicted in Tables 3.

Table 3: Frequency distribution of fingerprint patterns with Furuhata's and Dankmeijer's Indices among diabetics and controls

Subject	Sex	Side	Whorls (%)	Arches (%)	Loops (%)	Furuhata's Index	Dankmeijer's Index
Diabetics	**Males**	Right	35.3	3.1	61.6	57.30	08.78
		Left	34.9	5.5	59.6	58.55	15.75
		Both	35.1	4.3	60.6	57.92	12.25
	Females	Right	24.5	7.6	67.9	36.08	31.02
		Left	30.0	10.8	59.2	50.67	36.00
		Both	27.3	9.2	63.5	42.99	33.69
Controls	**Males**	Right	38.5	0.8	60.7	63.42	2.07
		Left	38.1	4.3	57.6	66.14	11.28
		Both	38.3	2.5	59.2	64.69	06.52
	Females	Right	34.4	4.0	61.6	55.84	11.62
		Left	39.6	4.0	56.4	70.21	10.10
		Both	37.0	4.0	59.0	62.71	10.81

Analysis of Absolute Finger Ridge Count (AFRC) shows that, the highest percentage of AFRC (14.85%) belongs to the class interval (101-125) in Diabetic group. In Control group the highest percentage (18.00%) belongs to the class interval (126-150). Mean AFRC in diabetic group was less than control group in males and females. With regard to Total Finger Ridge Count (TFRC), in Diabetic group the highest percentage of TFRC (23%) was observed in the class interval (101-125) whereas in the control group the highest percentage (29%) was observed in the class interval (126-150). Mean TFRC in diabetic group was less than control group in males and females. Descriptive statistics for AFRC and TFRC among males (diabetics and controls) and females (diabetics and controls) are presented in Table 4 respectively. Statistically significant differences in AFRC and TFRC are evident in females only.

Table 4 Descriptive Statistics for AFRC and TFRC for Diabetics and Controls

Pattern	Males				Females			
	Diabetics	Controls	t- value	p-value	Diabetics	Controls	t- value	p-value
AFRC	153.72± 64.83	161.04± 63.26	0.574	0.567	133.00± 67.72	161.04± 63.26	2.097	0.039*
TFRC	116.74± 37.64	119.24± 29.66	0.376	0.708	103.48± 43.34	121.00± 34.13	2.302	0.023*

** Statistically significant*

IV. Discussion

In the present study percentage of arches was more in diabetic group than in the control group. Present study shows an increased frequency of arches in diabetic males and females. The difference observed in male group is not statistically significant. The difference is more marked in diabetic females, difference being more on the left side. S. M. Sant *et al*. [4].and Jullian Verbov [5] found an increased frequency of arches in female diabetic patients. Roopa Ravindranath, Thomas I.M. [6] found increased frequency of arches in diabetic males and females than controls while Sarthak Sengupta [7] found increased frequency of arches in male diabetics. Our findings thus, correlate with findings of above workers. In the present study frequency of ulnar loops was found to be more in diabetic group than control group. S. M. Sant *et al.* [4] observed that the frequency of ulnar loops and radial loops is decreased in both sexes. Roopa Ravindranath, Thomas I.M. [6] found statistically significant increased frequency of ulnar loops in both sexes, more marked in left hand of diabetic females. In the present study there was increase in the frequency of ulnar loops in diabetic group in both sexes than controls but the difference is statistically not significant. Our findings for ulnar loops correlate with findings by other workers except with S.M. Sant et al. [4]. Sample size in the present study was small compared to other workers. That could be the reason for statistically non-significant results. The findings showed a trend towards increase in frequency of ulnar loops in diabetic patients. S. M. Sant *et al.* [4] and Roopa Ravindranath, Thomas I.M. [6] reported reduced frequency of radial loops. In our study difference in frequency of radial loops was minimal. Frequency of whorls was significantly reduced in diabetic group than control group. S.M. Sant et al [4] reported an increased frequency of whorls in diabetic males and females. Jullian Verbov [5] found a decreased frequency of whorls in diabetic females. R. Ravindranath, I. M. Thomas [6] reported a decreased frequency of whorls in diabetic males and in left hands of diabetic females and Sarthak Sengupta [7] found increased frequency of whorls in male diabetics. In the present study whorls are significantly decreased in diabetics than controls. This correlates with the findings of Jullian Verbov [5] and R. Ravindranath [6] . Vadgaonkar et al. [8] reported that pattern frequencies found in their study was not statistically significant. Table 5 shows comparison of fingertip patterns noted by various researchers.

Table 5 Comparison of Fingertip Patterns

Researcher	Arches	Ulnar Loops	Radial Loops	Whorls	AFRC	TFRC
Jullian Verbov (1973)	↑ DF	—	—	↓ DF	—	—
Barta (1978)	—	—	—	—	—	↑ DM& DF
Iqbal (1978)	—	—	—	—	—	↑ DM
S. M. Sant (1983)	↑ DM	↓ DM&DF	↓ DM	↑ DM& DF	—	—
Roopa Ravindranath (1995)	↑ DM	↑ DM& DF(left)	↓ DM	↓ DM&DF(left)	↓ DM&DF	↓ DM&DF
Sarthak (1996)	↑ DM	—	—	↑ DM& DF	—	↓ DM&DF
Mandasescu (2006)	——	——	——	——	——	No difference
Present Study (2007)	↑ DM& DF(left)	↑ DM& DF(left)	No difference	↓ DM&DF	↓ DM&DF	↓ DM&DF

DM- Diabetic Male, DF- Diabetic Female

R. Ravindranath and I.M. Thomas [6] and Sarthak Sengupta [7] observed significant difference in AFRC and TFRC. They found significantly decreased mean values in diabetics than controls in both sexes while Barta[9] and Iqbal [3] found increased mean values in diabetics than controls in both sexes. S Mandasescu *et al*. [10] did not find any significant difference in diabetics and controls. In the present study, the mean values of AFRC and TFRC are lesser in diabetic group than control group in both sexes. In females both the parameters show statistically significant difference. Our findings correlate with the findings of R. Ravindranath and I.M. Thomas [6] and Sarthak Sengupta [7].

V. Conclusion

The present study was undertaken to comparatively analyze the dermatoglyphic patterns in maturity onset diabetes mellitus patients and normal healthy controls and find a possible association between dermatoglyphic patterns and maturity onset diabetes mellitus. The aim was to find out the marker if any, and to study the feasibility of the marker as a screening procedure to predict the possibility of developing maturity onset diabetes mellitus in otherwise normal patients. The present study shows that significantly higher frequency of arches and lower frequency of whorls in female diabetics than controls. Dankmeijer's Index was highest in female diabetic group and Furuhata's Index was highest in the male control group. AFRC and TFRC were significantly lower in diabetic females than controls.

Although researchers have been trying to study an association of various diseases with dermatoglyphics, the results so far observed are far from satisfaction. Contradictory results have been observed mostly from different populations due to a vast difference among the patterns or ridge counts in various populations. This situation calls for more caution in using dermatoglyphic patterns as markers or diagnostic tools. Findings of the present study after a careful analysis of different palmar dermatoglyphic variables highlights on the possible markers and indicate that there is scope for further study on a larger sample size.

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