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Dermatoglyphic Study In Diabetes Mellitus

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Abstract

Dermatoglyphics is the science that studies the carvings over the volar aspect of skin over palms, soles & fingers. (Derma = skin, glyphics = carve) The markings are due to underlying interlocking patterns of dermal papillae & overlying corresponding epidermal ridges. These features were found to be permanent variables and were inherited by polygenic system with individual gene contributing a small additive effect. Dermatoglyphic investigation has been undertaken to ascertain the reliability of dermatoglyphics as a predictive diagnostic tool for diabetes.

The present research aims to primarily study the various dermatoglyphic patterns in the patients with Diabetes Mellitus and compare these statistically with the dermatoglyphic patterns innon diabetic individuals. The present study was carried out on 164 (96 male and 68 female) clinically diagnosed patients of diabetes mellitus and165 healthy controls (111 males and 54 females) were studied for comparison. Palmar prints were obtained in all the patients and controls and the dermatoglyphic patterns were analyzed using statistical considerations. Analysis of fingertip pattern like arch, radial loop, ulnar loop and whorls did not show any significant difference. TFRC, a-b ridge count, a-t-d angle and number of triradiirevealed increased frequency in the diabetic cases as compared to controls.

Keywords*:* Arch*;* Dermatoglyphics; Diabetes Mellitus; Radial Loop; Ulnar Loop; Whorl.

Abbreviations

ATD - 'A' as tri radius found below the index finger, 'T' as axial tri radius above the wrist crease, 'D' as tri radius present below the little finger *TFRC*: Total finger ridge count.

Introduction

Diabetes mellitus comprises a group of common metabolic disorders which is characterized by hyperglycemia. Several distinct types of diabetes mellitus exist & are caused by complex interaction of genetics, environmental factors & life style choices. Diabetes affects an estimated 16 million people in United States, as many as half of whom are undiagnosed [1]. Worldwide more than 140 million people suffer from diabetes making this one of the most common non-communicable diseases [2]. Prevalence of diabetes has risen dramatically in past two decades. The number of affected individuals with diabetes is expected to double by 2025 & countries with largest number of diabetes are India, China & United States [1].

Major genes that predispose to this disorder have yet to be identified, but it is clear that the disease is polygenic & multifactorial.Thedermatoglyphic pattern is determined by expression of multiple genes & individual gene contributing to small additive effect. Once formed in intrauterine life around 12th to 16th week these dermatoglyphic patterns are not altered thereafter and they form the basis of individual identity, as they are unique to every individual [3].

Dermatoglyphics is one of the advanced branches of medical sciences, where the dermal ridge patterns are studied & used in prediction of genetic disorders for diagnosis of twins, questioned paternity & other hereditary disorders. Some diseases are known to be caused by abnormal genes. Whenever there is any

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abnormality in the genetic makeup of parents, it is inherited by the children & reflected in the dermatoglyphics pattern. Hence the study of dermatoglyphics proved to be very useful in predicting the hereditary diseases in patients.

The present study was designed to compare the dermatoglyphic patterns of patients suffering from diabetes mellitus with normal individuals. It was also designed to compare it with previous studies and to know which quantitative and/or qualitative dermatoglyphic parameters show variation with respect to previous studies.

Materials and Methods

The present study was carried out in Endocrinology OPD in our tertiary health care institute on 164 patients of both type 1 and type 2 diabetes mellitus confirmed by clinical and laboratory assessment. The control group for study consisted of 165 subjects.

Cases and Controls were selected after taking a brief history for ruling out any known genetic disorder, any congenital disease or fingerprint or other dermatoglyphic abnormalities.

The purpose of study was explained to both cases and controls. Then proper information regarding the procedure of recording prints was given to members of both groups who agreed for the study. After their written consent the palm and finger prints were taken. Personal data of subject (name, age, address etc.) and history was recorded in case record form.

Ink method was used as described by Cummins & Midlow[4]which requires ink slab, inverted 'T' shaped pad, Kore's duplicating ink, white paper, magnifying lens, protractor, scale, soap & pencil.Hands were thoroughly washed with soap before taking prints.Then requisite amount of ink was placed on the ink slab & inverted 'T' shaped pad was soaked in it.The ink was evenly spread on the ink slab by light dusting. Then fingers were rolled laterally on the slabon which ink was transferred. Then they were placed on a white paper with one lateral edge & then rolled over in opposite direction. To take palm print palm was lightly dusted with the same 'T' pad. The palm was then kept on white paper & firm pressure was given on the center of the dorsum of hand &interdigital areas.Thus dermatoglyphic patterns were recorded & studied with magnifying lens.

Results

In this study 164 cases & 165 controls were analyzed for their dermatoglyphic patterns.

There were 207 males (96 diabetic & 111 controls) and 122 females (68 diabetic & 54 controls) in both diabetic & non-diabetic group. Qualitative parameters {fingertip patterns – arches, radial & ulnar loops, whorls & quantitative parameters [TFRC (total finger ridge count),'a-t-d' angle, a-b ridge count & no. of triradii were studied &analysed using statistical methods. Statistically significant parameters were noted and tabulated.

From Table 1 it is clear that fingertip pattern like arch, radial loop, ulnar loop and whorls in diabetic cases and controls is not significant statistically.

From Tablen 2 it is clear that females had more no.of arches as compared to males in both diabetic cases and controls (P value =0.005,Chi square test significant). Radial loop pattern does not show any difference between male versus female in both diabetic and control subjects. Also it has been observed that males had more no.of ulnar loops (P value =0.009,Chi square test significant) and whorls(P value =0.0360,Chi square test significant) as compared to females in both diabetic cases and controls.

Quantitative parameters like TFRC, a-t-d angle, a-b ridge count and no. of triradii were analysed in diabetic case and controls. It was found that the mean TFRC in diabetic cases was 68.71 with standard deviation of 11.810 and mean TFRC in controls was 63.76 with standard deviation of 10.984 and was statistically significant (Chi square test).

Analysis of a-t-d angle revealed that a-t-d angle was significantly increased in diabetic patients (DM) than non diabetic control (CT) subjects. (p value <0.0001, unpaired 't' test).

Further analysis of males & females revealed that diabetic patients (DM) had significantly more mean a-t-d angle than non-diabetic control (CT) subjects. (P value <0.0001, Kruskal Wallis test for both).

Analysis of a-b ridge count revealed that there were significantly more number of a-b ridges in diabetic patients (DM) as compared to non-diabetic control (CT) subjects (P value <0.0001, Kruskal Wallis Test).

Analysis of number of triradii revealed that diabetic patients (DM) had significantly more number of triradii than in non-diabetic control (CT) subjects. (P value <0.0001, Kruskal Wallis test).

Similarly further sub-group analysis of mean number of triradii revealed that diabetic males & females had significantly more number of triradii than non diabetic males & females. (P value < 0.0001, Kruskal Wallis test).

Table 1: Fingertip pattern distribution in diabetic cases and controls

Pattern	DM			Controls			P value	Test of significance Chi square
	Rt. hand	Lt.hand	Rt+Lt.	Rt. hand	Lt.hand	Rt+Lt.		
Arch	163	114	277	200	171	371	0.210	NS
RL	166	145	311	218	238	456	0.129	NS
UL	167	218	385	250	282	532	0.279	NS
Whorl	324	341	665	159	134	293	0.113	NS

Rt-Right, Lt.-Left, NS-Not Significant, RL-Radial loop, UL-Ulnar loop

Table 2: Analysis of fingertip pattern as per sex, diabetic status and hand

Sr. No.	Fingertip pattern	Sex	Diabetic cases		Controls		Total	P value	Test of Significance
			Rt. hand	Lt. hand	Rt. hand	Lt. hand			
1	Arch	M	64	49	61	51	225	0.005	Chi sqare test
		F	99	65	139	120	423		
2	Radial loop	M	100	89	143	163	495	0.71	Chi sqare test
		F	66	56	75	75	272		
3	Ulnar loop	M	94	125	177	189	585	0.009	Chi sqare test
		F	73	93	83	93	342		
4	Whorl	M	187	201	108	84	580	0.0360	Chi sqare test
		F	137	140	51	50	378		

Rt-Right, Lt.-Left

Table 3: Analysis of quantitative parameters such as a-t-d angle, a-b ridge count and no. of triradii

Sr. No.	Fingertip pattern	Sex	Diabetes		Controls		P value	Test of Significance
			Rt. hand	Lt. hand	Rt. hand	Lt. hand		
1	a-t-d angle	M	55.54 ± 1.18	59.27 ± 0.85	45.30 ± 0.63	44.37 ± 0.48	<0.0001	Kruskal Wallis test
		F	57.46 ± 1.18	57.94 ± 1.14	44.43 ± 1.04	45.48 ± 0.60	<0.0001	Kruskal Wallis test
		Mean	56.18 ± 0.85	58.72 ± 0.69	45.01 ± 0.54	44.73 ± 0.38	<0.0001	Unpaired t test
2	a-b ridge count	M	33.89 ± 0.71	30.57 ± 0.74	28.88 ± 0.64	29.92 ± 0.61	<0.0001	Kruskal Wallis test
		F	33.47 ± 0.80	31.00 ± 0.86	28.20 ± 0.88	30.46 ± 0.93	<0.0001	Kruskal Wallis test
		Mean	33.71 ± 0.53	30.75 ± 0.56	28.66 ± 0.52	30.10 ± 0.51	<0.0001	Kruskal Wallis test
3	No. of triradii	M	6.01 ± 0.08	6.17 ± 0.06	5.22 ± 0.04	5.08 ± 0.03	<0.0001	Kruskal Wallis test
		F	6.21 ± 0.09	6.13 ± 0.09	5.24 ± 0.07	5.06 ± 0.03	<0.0001	Kruskal Wallis test
		Mean	6.10 ± 0.06	6.15 ± 0.05	5.22 ± 0.04	5.07 ± 0.02	<0.0001	Kruskal Wallis test

Table 4: Comparison of dermatoglyphic parameters

Study	Arch	UL	RL	Whorl	TFRC	a-b ridge	a-t-d angle	No. of triradii
Verbove et al	↑DF	---	NS	↓DF	-----	↓	--	↑DF
Sant et al	↑DM	↓DM &DF	↓DM	↑DM & DF	-----	---	----	----
Vera et al	↑DF	---	NS	----	↓	----	-----	↑
Bets et al	↑DM	↓DF	↓	---	----	----	-----	----
Ravindranath et al	↑DM	↑DM &DF	↓DM & DF	↓DM & DF	↓DM & DF	---	-----	----
Panda et al	↑DM & DF	↑	↑	↓	↑	---	----	-----
Rajanigandha et al	NS	NS	NS	NS	-----	NS	↑	↑
Mandascue et al	NS	NS	NS	NS	-------	NS	↓DM (RH)	---
Batra et al	--------	----	---	-----	↑DM &DF	-----	----	-----
Ziegler et al	-------	----	----	----	------	↓	-----	↑
Iqbal et al	-----	----	---	-----	↑DM	-----	-----	------
Sarthak et al	↑DM	---	-----	↑DM & DF	↓DM & DF	-----	-----	-----
Burutepushpa et al	↑DM &DF (LH)	↑DM & DF (LH)	NS	↓DM & DF	↓DM &DF	----	-----	----
Sharma M et al	NS	NS	NS	NS	↑	NS	↑	----
Ahuja et al	-----	------	-----	-----	↑	-----	-----	-----
Present study	↑DF	NS	↑DM	↑DM	↑	↑	↑DM &DF	↑

DM-Diabetic Male, DF-Diabetic Female,'!-increased, "!-decreased, NS-Not Significant,LH-left hand, RH-right hand

Discussion

In the present study, Qualitative parameters {fingertip patterns – arches, radial & ulnar loops, whorls in diabetic cases and controls did not show any statistical significant difference and hence it can be concluded that distribution of qualitative fingertip pattern is same in both diabetic cases and controls.Verboveet al [5] and Vera et al [6] found increased incidence of arch pattern in female diabetics only. Sant et al [7] , Bets et al [8] Ravindranath et al [6] and Sarthak et al [10] found increased incidence of arch pattern in male diabetics only whereas Burute et al [11] found increased arch pattern in male diabetics and female diabetics in left hand only. Rajanigandhaet al [12], Mandascue et al [13] and Sharma et al [14] did not show any significant difference in arch pattern. Present study showed females had more no. of arches as compared to males in both diabetic cases and controls. Sant et al [7], Bets et al [8] found decreased incidence of UL, Ravindranath et al [9], Panda et al [15] and Burute et al [11] found increased incidence of UL whereas UL pattern was not significant in Rajanigandha et al [12], Mandascue et al [13] and Sharma et al [14]. In the present study males had more no.of ulnar loops as compared to females in both diabetic cases and controls. RL pattern was decreased in Sant et al [7] , Bets et al [8] and Ravindranath et al [9] and was found increased in Panda et al [15] whereas it was not significant in Rajanigandha et al [12], Mandascue et al [13], Burute et al [11] and Sharma et al [14] and in the present study also. Whorl pattern was found decreased in the study of Verboveet al [5], Ravindranath et al [9], Panda et al [15], Burute et al [11] and found increased in Sant et al [7], Sarthak et al [10]. Whorl pattern was not significant in Rajanigandhaet al [12], Mandascue et al [13], Sharma et al [14]. In the present study males had more no.of whorls as compared to females in both diabetic cases and controls.

Quantitative fingertip pattern TFRC was found decreased in the study done by Vera et al [6], Ravindranath et al [9], Sarthak et al [10], Burute et al [11] and was increased in study done by Panda et al [15], Batra et al [16] , Iqbal et al [17], Sharma et al [14] and Ahuja et al [18] and also in the present study, a-b ridge count was found decreased in the study of Verbove et al [5], Ziegler et al [19] and was found increased in the present study. A-t-d angle was found increased in the study of Rajanigandha et al [12], Burute et al [11] and in the present study but was found decreased in Mandascue et al [13]. It was oserved that diabetic cases had prescence of additional axial triradius as compared to controls and was seen in the study of Verbove et al [5], Vera et al [6], Rajanigandha et al [12], Batra et al [16] and in the present study.

Conclusion

So from the above discussion it can be concluded that qualitative fingertip parameters like arch, radial loop, ulnar loop, whorl and the quantitative parameters like total finger ridge count (TFRC) and a-b ridge count show variations with previous studies and hence not useful for pre detection of diabetes. The only parameters which does not show variation with previous studies are 'a-t-d' angle, number of triradii. Hence it can be concluded that these parameters can be useful for pre detection of diabetes by dermatoglyphic method and to identify the persons who are at risk,but needs to be studied in a larger population to be used as a diagnostic tool.

References

1. AnirbanMaitra, Abul K. Abbas. "The Endocrine System", Pathologic Basis of Disease by Robbins & Cotran, Chapter 24, 7th edition, Elsevier publications. 2004; 1189-1206.
2. Alvin C. Powers. "Diabetes Mellitus", Harrison's Principles of Internal Medicine by Kasper, Braunwald, Fauci, Hauser, Longo, Jameson, 16th edition, Volume II, McGrawHill publications. 2005; 2152-2180.
3. Patricia Collins, Lawrence H. Bannister. Gray's Anatomy 38th Edition.194-298: 380.
4. Cummins H. and Midlow C. (1961). "Fingerprints, palms and soles; An introduction to dermatoglyphics", Dover Publishing Company, New York.
5. Verbov JL. "Dermatoglyphics in early onset diabetes mellitus". Hum Hered. 1973; 23(6): 535-542.
6. Vera M, Cabrera E, Guell R. "Dermatoglyphics in insulin dependentdiabetic patients with limited joint mobility". Acta Diabetol. 1995; 32(2): 78-81.
7. Sant SM, Vare AM, Fakhruddin S." Dermatoglyphics in diabetes Mellitus". Journal of Anatomical Society of India. 1983; 32(3): 127-130.
8. Bets LV, Dzhanibekova IV. "Constitutional and dermatoglyphic characteristics of children with diabetes mellitus" PMID: 8165221 [PubMed - indexed for MEDLINE] 1994 Jan-Feb; 40(1): 6-9.
9. Ravindranath R, Thomas IM." Finger ridge count and finger print pattern in maturity onset diabetes mellitus". Ind J Med Sci. 1995; 49(7): 153-156.
10. Sarthak Sengupta, JinaBorush, Finger dermatoglyphic

patterns in diabetes mellitus, *J Hum. Ecol7(3).* 1996; 203-206.

11. Burute P, Kazi SN, Vatsalaswamy, Arole V. "Role of Dermatoglyphic Fingertip Patterns in the prediction of Maturity Onset Diabetes Mellitus (Type II)"IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. May- Jun 2013; 8(1): 01-05. www.iosrjournals.org
12. Rajanigandha V. PaiMangala, Prabhulatha, Saralya Vasudha: Digito-palmar complex in Non insulin dependent diabetes mellitus. Turk Journal of Medical Sciences. 2006; 36(6): 353-355.
13. Mandasescu S, Richards B, Cadman J. "Detection of pre-diabetics by palmar prints: a low costtool". [AccessedinJanuary2006fromhttp://atlas.ici.ro/ehto/MEDINF99/papers/Bernard/detection_of_pre.html].
14. Sharma MK, Sharma H. "Dermatoglyphics: A Diagnostic Tool To Predict Diabetes". Journal of Clinical and Diagnostic Research. 2012.
15. Panda M, Chinara PK, Nayak AK. **"**Dermatoglyphics In Diabetes Mellitus". Journal of Anatomical Society of India. 2004; 53(1): 36(abstract).
16. Barta L, Vari A, Susa E. Dermatoglyphic pattern of diabetic children. Acta Pediatrica, *Academic Scientiarum of Hungrarical.* 1970; 11: 71-74.
17. Iqbal MA, Sahay BK, Ahuja YR. Finger and palmer ridge count in diabetes mellitus. *Acta Anthropogenetica.* 1978; 2(3): 35-38.
18. Ahuja YR, Khub Chand J, Plato CC, Sahay BK. *Dermatoglyphics of diabetes mellitus.* Revised in Human Biology–Recent advances. 1981; 21-24, New Delhi, India. Today nasd tomorrow's printers and publishers.
19. Zeigler AG, Mathies R, Ziegelmayer G, Baumgarti HJ, RodewaldA,Chopra V, Standi E. Dermatoglyphics in type I diabetes mellitus.*Diabetic Medicine.* 1993; 10(8): 720-24.