



Dermatoglyphics in healthy and type 1 diabetes mellitus

KEYWORDS

arch, dermatoglyphics, loop, type I diabetes mellitus, whorl

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ABSTRACT **Introduction:** Dermatoglyphics is the study of the epidermal ridges and their configurations on the Palmar and plantar regions. It is estimated that India is housing about 97,700 children with type 1 diabetes mellitus (T1DM) and it is increasing by 3% every year. The etiology of T1DM is multifactorial. Dermatoglyphics may help in early diagnosis of Type 2 diabetes mellitus is well described in recent study and it also can be used for T1DM. Hence, this study is planned to compare dermatoglyphics of healthy normals with the patients of type 1 diabetes mellitus.

Material and Methods: This was an observational, case control study. We enrolled 50 cases of T1DM and 100 controls. We collected finger prints of cases and controls by ink method. Finger ridge pattern is divided into three groups, that are whorl, arch and loop. Chi square test is used for statistical analysis.

Result: Ulnar loop was found most frequently in male (51.60%) and female (60.20%) controls. On bisexual comparison, in male, whorl and arch were significantly more on right side and arch on left side. Overall combination, that is combination of male and female and right and left side, showed significant increase of whorl and decrease in loop in cases as compare to controls.

Conclusion: In controls, ulnar loop was most common in male and female, followed by whorl. On comparison of cases with controls, we found significant increase in whorl and significant decrease in ulnar loop in cases of T1DM.

Introduction

Dermatoglyphics deals with the study of the epidermal ridges and their configurations on the fingers, palms and soles. The word dermatoglyphics is coined by Commins and Midlo in 1926.^[1] The dermal ridges and the configuration formed at 3 to 4 month of intrauterine life and are permanent. Development of dermatoglyphics pattern is under genetic control^[2] and so, it has the potential to predict various genetic and acquired disorders with a genetic influence.^[3] Dermatoglyphics is also used in forensic medicine in individual identification, physical anthropology and human genetics.

It is estimated that India is housing about 97,700 children with type 1 diabetes mellitus (T1DM) and it is increasing by 3% every year.^[4] The etiology of T1DM is multifactorial. Diagnosis in prediabetic phase is important for early intervention. Dermatoglyphics may help in early diagnosis of Type 2 diabetes mellitus is well described in recent study^[5] and it also can be used for T1DM.^[6] However there is paucity of studies regarding dermatoglyphics and T1DM.

Hence, this study is planned to compare dermatoglyphics of healthy normals with the patients of Type 1 diabetes mellitus.

Material and methods:

This was an observational, case control study carried out at Government medical college of Maharashtra during the period of 2014 to 2016. Fifty cases of T1DM (25 male and 25 female) and hundred healthy controls were enrolled in the study and all were from Vidarbha region of Maharashtra. Cases were in the age group of 3 to 34 years and diagnosed with appropriate investigations. Controls were first year medical students in the age group of 17 to 21 years, 50 were male and 50 were female, with no history of T1DM, type 2 diabetes mellitus or any congenital disease in family. The study has been approved by ethical committee of institution.

We collected finger prints of cases and controls by ink method.^[1] The subjects were asked to clean their hands with soap and water, and then dry till to keep some moisture. Ink from glass inking slab is spread uniformly by rubber roller into a thin even slab. Inking should be done from end of finger to flexion creases of distal interphalangeal joint. Finger print is made by rolled print method which involved rotation of finger from radial to ulnar side.

Finger ridge pattern is divided into three groups that are whorl, arch and loop.^[7]

Whorl: Any ridge configuration having two or more triradii forms the whorl. One triradius is on radial and other on ulnar side of the pattern. The ridges in simple whorl are commonly arranged as a succession of concentric rings. Such rings are described as concentric whorl.

Arch: It is the simplest pattern found on the finger tips. It is formed by succession of more or less parallel ridges, which traverses the pattern area and form a curve that is concave proximally. The arch pattern is subdivided into two types, simple arch and tented arch. Simple arch is composed of ridges that cross the finger tips from one side to the other without recurving. If ridges meet at a point so that their smooth sweep is interrupted, a tented arch is formed.

Loop: It is the most common pattern on finger tips. In this configuration, series of ridges enter the pattern area on one side of digit, recurve abruptly and leaves the pattern area on the same side. The loop has single triradius. Triradius is usually located laterally on the finger always on the same side where loop is closed. If the ridges open on ulnar side the resulting loop is termed as ulnar loop, whereas if it opens toward the radial side, it is called as radial loop.

Comparison of dermatoglyphics of both hands, both sexes

and between cases and controls were done. Chi square test is used at 5% level of significance with approximate degree of freedom and the significance of difference noted accordingly. Result was considered significant if p value is less than 0.05.

Results:

Dermatoglyphics of 50 cases (25 male and 25 female) of T1DM and 100 controls (50 male and 50 female) were noted.

In male controls, ulnar loop was found most frequently (51.60%). Ulnar loop was more frequently found on third and fifth digit. Whorl was found in 35.45% and frequently found on second and fourth digit. Radial loop and arch were found least frequently. In female controls, ulnar loop was frequently found (60.20%) and found on second and third digits commonly. Occurrence of whorl was 35.45%.

On bimanual comparison of dermatoglyphics in controls, we found difference was significant for whorl (more over left hand), ulnar loop (more over right hand) and radial loop (more on left hand), only in female. On combination of male and female, difference between right and left hand was significant for radial loop only. [Table1]

Table 1: Bimanual comparison of dermatoglyphics in controls

Pat-tern	Comparison	Chi square test	DF	P	Remark
Whorl	MR & ML	0.6	1	0.1	N.S
	FR & FL	4.6	1	0.05	S
	(M+F)R & (M+F)L	0.02	1	0.5	N.S
Arch	MR & ML	1.0	1	0.5	N.S
	FR & FL	2.92	1	0.05	N.S
	(M+F)R & (M+F)L	0.02	1	0.5	N.S
Ulnar loop	MR & ML	0.01	1	0.5	N.S
	FR & FL	10.2	1	0.01	S
	(M+F)R & (M+F)L	3.41	1	0.05	N.S
Radial loop	MR & ML	0.8	1	0.1	N.S
	FR & FL	7.09	1	0.01	S
	(M+F)R & (M+F)L	8.43	1	0.01	S

DF- degree of freedom, p- probability, MR- male right, ML- male left, FR-female right, FL-female left, M-male, F- female, R-right, L- left, S- significant, NS- not significant

On bisexual comparison, in male, whorl and arch were significantly more on right side and arch on left side, and for all others, difference was not significant [Table 2].

Table 2: Bisexual comparison of dermatoglyphics in controls

Pat-tern	Comparison	Chi square test	DF	P	Remark
Whorl	MR & FR	6.7	1	0.01	S
	ML & FL	0.02	1	0.5	N.S
Arch	MR & FR	7.7	1	0.01	S
	ML & FL	4.2	1	0.05	S
Ulnar loop	MR & FR	14.5	1	0.001	N.S
	ML & FL	0.01	1	0.5	N.S
Radial loop	MR & FR	1.0	1	0.1	N.S
	ML & FL	1.6	1	0.1	N.S

DF- degree of freedom, p- probability, MR- male right, ML- male left, FR-female right, FL-female left, M-male, F- female, R-right, L- left, S- significant, NS- not significant

In cases of T1DM, we found ulnar loop most frequently (49.2%) followed by whorl (44.20%), arch (5.60%) and loop (1.60%) [Table 3].

Table 3: Distribution of dermatoglyphic pattern in controls and cases

Groups	M/F	R/L	Whorl		Arch		Ulnar loop		Radial loop	
			No.	%	No.	%	No.	%	No.	%
Control (Normal)	M	R	105	42.0	18	7.2	126	50.4	01	0.4
	M	L	96	38.4	18	7.2	132	52.8	04	1.6
	M	R+L	201	40.2	36	7.2	258	51.6	05	1.0
	F	R	77	30.8	05	2.0	168	67.2	00	0.0
	F	L	100	40.0	10	4.0	133	53.2	07	2.8
	F	R+L	177	35.4	15	3.0	301	60.2	07	1.4
	M+F	R	182	36.4	23	4.6	294	58.8	01	2.0
	M+F	L	196	39.2	28	5.6	265	53.0	11	2.2
	M+F	R+L	378	37.8	51	5.1	559	55.9	12	1.2
	JDM (Case)	M	R	68	54.4	06	4.8	50	40.0	01
M		L	51	40.8	08	6.4	64	51.2	02	1.6
M		R+L	119	47.6	14	5.5	114	45.6	03	1.2
F		R	54	43.2	05	4.1	64	51.2	02	1.6
F		L	48	38.4	06	4.8	68	54.4	03	2.4
F		R+L	102	40.8	11	4.4	132	52.8	05	2.0
M+F		R	122	48.8	11	8.8	114	45.6	03	1.2
M+F		L	99	39.6	14	5.6	132	52.8	05	2.0
M+F		R+L	221	44.2	25	5.6	246	49.2	08	1.6

M-male, F- female, R-right, L- left

On comparison of dermatoglyphics of cases and controls, we found following observations. In whorl pattern, increased whorl pattern over right hand was statistically significant in both male and female, also on combination of male and female. In both male and female, right and left combination has not shown significant difference. However, overall combination, that is combination of male and female and right and left side, showed significant increase of whorl in cases. In arch, difference between cases and controls was not significant separately and also not in combination of male and female.

In ulnar loop, females showed significant decrease in ulnar loop pattern in right hand and specifically over first and fourth digit. On combination of male and female, significant difference is found on right hand. However, overall combination, that is combination of male and female and right and left side, showed significant decrease of ulnar loop pattern in cases. In radial loop, difference between cases and controls was not significant separately and also not in combination of male and female [Table 4].

Table 4: Statistical analysis of dermatoglyphic of cases and controls

Pattern	Comparison involved	Chi square	DF	Probability (p)	Remarks	
Whorl	RMP & RMN	5.15	1	0.05	S	
	LMP & LMN	0.20	1	0.5	N.S	
	MP(R+L) & MN(R+L)	3.73	1	0.05	N.S	
	RFP & RFN	5.63	1	0.05	S	
	LFP & LFN	0.08	1	0.5	N.S	
	FP(R+L) & FN(R+L)	2.08	1	0.1	N.S	
	RP (M+F) & RN(M+F)	10.63	1	0.001	S	
	LP(M+F) & LN(M+F)	0.01	1	0.5	N.S	
	P(M+F) & N(M+F)	5.69	1	0.05	S	
	RMP & RMN	3.61	1	0.05	N.S	
Ulnar loop	LMP & LMN	0.08	1	0.05	N.S	
	MP(R+L) & MN(R+L)	2.40	1	0.1	N.S	
	RFP & RFN	9.04	1	0.01	S	
	LFP & LFN	0.04	1	0.5	N.S	
	FP(R+L) & FN(R+L)	3.74	1	0.05	N.S	
	RP (M+F) & RN(M+F)	11.70	1	0.001	S	
	LP(M+F) & LN(M+F)	0.02	1	0.5	N.S	
	P(M+F) & N(M+F)	6.01	1	0.02	S	
	Arch	MP(R+L) & MN(R+L)	0.68	1	0.5	N.S
		FP(R+L) & FN(R+L)	0.97	1	0.5	N.S
Radial loop	P(M+F) & N(M+F)	0.06	1	0.5	N.S	
	MP(R+L) & MN(R+L)	0.06	1	0.5	N.S	
	FP(R+L) & FN(R+L)	0.38	1	0.5	N.S	
	P(M+F) & N(M+F)	0.40	1	0.5	N.S	

DF- degree of freedom, p- probability, P-patient (case), N-normal (control), RMP-right male patient, RMN- right male normal, LMP- left male patient, LMN- left male normal, RFP-right female patient, RFN- right female normal, LFP- left female patient, LFN- left female normal, MP- male patient, MN-male normal, Fp- female patient, FN-female normal, M-male, F- female, R-right, L- left, S- significant, NS- not significant

Discussion:

Use of dermatoglyphics for diagnosis of chromosomal disorders like Down's syndrome, Turners syndrome, Klinefelter syndrome, Patau syndrome and Edward's syndrome is well studied. [8],[9],[10] Association of specific dermatoglyphics in diseases with probable genetic etiology like schizophrenia, diabetes mellitus (Type 1 and 2), Alzheimer's disease, congenital heart disease, epilepsy, carcinoma breast, carcinoma

ma cervix and sickle cell anemia. [5],[11],[12],[13] is also reported in literature. Recently, correlation of dermatoglyphics with early childhood caries has been reported. [14] Dermatoglyphics is widely used as it is very cheap, non-invasive and permanent.

We examined dermatoglyphics of 50 cases of T1DM and 100 healthy controls from Vidarbha region of Maharashtra. We used ink method for obtaining finger prints.

In control, we found ulnar loop most frequently followed by whorl in both male and female, which is similar to the recent Indian studies. [15],[16] Recent study by Buchwald W found morphological diversity of dermatoglyphic patterns on fingers more in males and more on right hand in both sexes. [17] We found significant increase of whorl and significant decrease of ulnar loop in cases of T1DM. A study by Tarca A, et al enrolled 133 cases of T1DM and found decreased frequency of loop and increased frequency of whorl and arch in cases. They also found that there was no bimanual difference in cases. [18] Vera M, et al enrolled cases of T1DM with limited joint mobility and found increased arch and decrease in total ridge count. [19]

We have not measured atd angle and a-b ridge count. Similar multicentre studies should be carried out to confirm association of specific dermatoglyphic pattern in T1DM and then, it can be defined as risk factor for T1DM.

Conclusion:

In controls, ulnar loop was most common in male and female, followed by whorl. On bisexual comparison, in male, whorl and arch were significantly more on right side and arch on left side. On comparison of cases with controls, we found significant increase in whorl and significant decrease in ulnar loop in cases of T1DM.

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