

Dermatoglyphics in male patients with Schizophrenia

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Research Article

Abstract: Background and Objective: The study of epidermal ridge patterns of palms and soles is known as dermatoglyphics. Dermatoglyphic patterns are recognized by genetic factors. It has been proved that genetic factors are responsible for schizophrenia. The purpose of this study is to find out finger and palmar dermatoglyphic patterns in male schizophrenic patients and compare dermatoglyphic configurations of schizophrenics with normal population. **Study design:** Cross-sectional study. **Material and Methods:** Finger and palm prints of 50 male schizophrenic patients from 16 to 60 years of age were obtained from Kripamai Nursing Home, Miraj, Maharashtra, India. As control, prints of 50 normal males from the same age group were used. **Results:** Arch patterns are significantly reduced in the finger tips of schizophrenic males ($p < 0.001$). The 'atd' angle is also significantly increased in schizophrenic males (right hand: ($p < 0.001$), left hand: ($p < 0.05$) when compared to controls. **Conclusion:** When dermatoglyphic traits are studied in association with clinical features of schizophrenia, they will confirm the diagnosis. It will also help in early diagnosis of schizophrenia and may guide the clinician for further detailed investigations.

Keywords: Dermatoglyphics, Schizophrenia, Fingerprint patterns, Finger ridge count, 'atd' angle, Total finger ridge count

Introduction

Dermatoglyphics are the skin carvings. They are the patterns formed by the dermal ridges on the palms, fingers and toes of all primates. The word 'Dermatoglyphics' [derma: skin, glyphs: carvings] was first introduced in 1926 by the Anatomist, Harold Cummins of Tulane University in the United States. Originally it was defined to include only skin ridges and their configurations, but identification has since been broadened to include flexion creases and other secondary folds also. This term has now gained the universal acceptance. Once formed the dermatoglyphic patterns remain unchanged throughout the life except for absolute growth. Although the dermal configurations may be said to be stable after the fourth month, disturbances of embryonic growth and development prior to this time may be reflected in abnormal pattern types or frequencies. Dermatoglyphic studies in schizophrenia have been carried out by a large number of investigators since 1935. So far the evidence has been controversial, some authors claiming definite diagnostic features, while other studies point to no significant clinical value⁽¹⁾. Schizophrenia is a major

psychiatric illness and has the expectancy rate of 0.85% in general population⁽²⁾. Schizophrenia is characterized by disturbances in thinking, emotional and volitional faculties in the presence of clear consciousness; it usually leads to social withdrawal. Both the skin and brain develop from the same ectoderm and it is thought, therefore, that dermatoglyphics are informative for early disturbances in brain development in schizophrenia⁽³⁾. Dermatoglyphic abnormalities in schizophrenia may be environmental, that occurs when the developing brain may also be particularly vulnerable to such insult. Environmental and neurodevelopmental risk factors for schizophrenic disorders were studied. These supports the neurodevelopmental theory of the etiology of schizophrenia, since they suggest either genetically or epigenetically controlled faulty embryonic development of structures of ectodermal origin like brain and skin⁽⁴⁾. Dermatoglyphic patterns in schizophrenia are an expression of genes, whatever may be the exact genetics involved in schizophrenia, it can be externally visible on an imprint which constitutes dermatoglyphics. Dermatoglyphics does not throw light on gene action, it shows gene expression. This study attempts to analyse, whether there exists any pattern specific for schizophrenia and whether that serves as a diagnostic tool for early diagnosis of schizophrenia in newborns.

Materials and Methods

The method used for obtaining finger and palm prints in the present study was standard method (Ink method described by Cummins and Midlo⁽⁵⁾). The person was asked to clean both his hands to remove sweat, oil and dirt by washing them with soap and water. Then the hands were dried with clean towel.

Material used:

1. Wooden table of proper height
2. Porcelain tile
3. Kore's duplicating ink
4. Rubber roller
5. White executive bond paper of 15*20 size
6. Wooden rod of 30cm length
7. Wooden pad for supporting the paper
8. Soap, water, towel.

Procedure:

A clean and dry porcelain tile was kept on the table. A small amount of duplicating ink was spread over the tile by means of rubber roller to obtain a thin, uniform film of ink over the tile. Palmar aspects of distal phalanges of the person's right hand were inked over a tile by firm pressure starting from the little finger. Executive bond paper kept on the edge of the wooden table was used for recording the finger print patterns from its right border to the left. The fingers were rolled from side to side to obtain complete print of ridged area on the distal phalanges. The same procedure was done for recording the finger prints of the left hand. Thus, finger prints of both hands were obtained and recorded.

Prints of the palm :

The palm of the person's right hand was inked with the help of rubber roller. Then, the bond paper was wrapped around a wooden rod and then placed on the table. The inked hand was horizontally pressed against the wooden rod with the fingers and palm thoroughly stretched. Then with that inked hand the rod was gradually rolled on the table and slight pressure on the back of the hand was applied during the process of the printing. Complete palm print along with the ridges on the hollow of the palm and also the ridges on the metacarpophalangeal areas were obtained satisfactorily over the bond paper. The same procedure was then followed to print the left palm. Thus, one set of the finger prints and palm print was obtained in the similar manner.

The quality of each print was immediately examined by using a magnifying hand lens and care was taken to include all essential details.

Collection of data:

Finger and palm prints of 50 schizophrenic patients were obtained from Kripamai Nursing Home, Miraj, India. All these patients were diagnosed as schizophrenic by Dr. V.B.Debsikdar (Consulting psychiatrist) and Dr. M.B.Debsikdar (M.D.Medicine). As control, prints of 50 normal males from the same age group were used.

All prints were studied and analyzed under the following parameters:

- 1) Qualitative analysis:
 - a) Finger-tip pattern
 - b) Thenar, Hypothenar, interdigital patterns i.e. Th/I₁, I₂, I₃, I₄ patterns
- 2) Quantitative analysis:
 - a) Finger ridge count
 - b) Total finger ridge count (TFRC)
 - c) 'atd' angle

From the data collected, Mean, Standard deviation (S.D.), 't' test, Chi Square test and 'p' value were calculated.

Results

Incidence of schizophrenia is dependent on various etiological factors. One amongst them is hereditary. Dermatoglyphic traits are also genetically determined hence qualitative and quantitative study of dermatoglyphic traits may give us a clue in diagnosis of schizophrenia. In present work 50 male schizophrenic patients of the age group between 16 to 60 years were studied. For such traits, observations were compared with normal control group of people in identical number and age group.

Table 1: Percentage frequency of fingerprint patterns in schizophrenic and normal Males

Pattern	Male patients		Normal males		χ^2	p value
	No.	%	No.	%		
Whorls	193	38.6	171	34.2	10.7	<0.02
Ulnar loops	284	56.8	288	57.6		
Radial loops	8	1.6	5	1		
Arches	15	3	36	7.2		

df=3 df - Degree of freedom, χ^2 - Chi-square test

Figure 1: Frequency distribution of fingerprint patterns in male schizophrenic and normal subjects

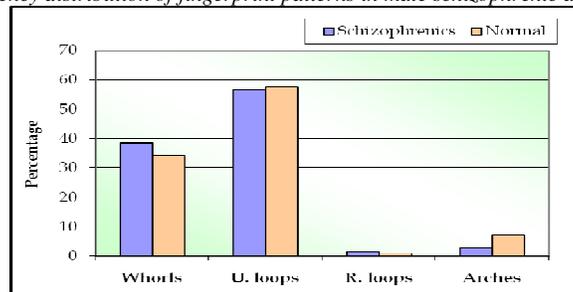


Table 1 and Figure 1 show the difference in the frequency of pattern distribution in control and schizophrenic males is statistically highly significant (p<0.02). This can be largely attributed to the difference in the frequency of arches, which is highly significant (p<0.001). The arches are significantly less in schizophrenic males as compared to their controls.

Table 2: Digit wise frequency of fingerprint patterns among schizophrenic and normal males

Digit	Subject	Whorls		Ulnar loops		Radial loops		Arches	
		R	L	R	L	R	L	R	L
1	Patients	25	26	25	23	0	0	0	1
	Normal	20	18	29	29	0	0	1	3
2	Patients	16	25	25	20	4	2	5	3
	Normal	21	16	22	23	1	3	6	8
3	Patients	12	16	38	27	0	2	0	5
	Normal	9	11	38	32	0	1	3	6
4	Patients	25	19	25	30	0	0	0	1
	Normal	27	24	20	22	0	0	3	4
5	Patients	9	20	41	30	0	0	0	0
	Normal	12	13	37	36	0	0	0	1

df= 1 R- Right, L- Left, 1-Thumb, 2-Index finger, 3-Middle finger, 4-Ring finger, 5-little finger

Table 2 shows:

- R1- There is increase of whorls, but decrease in ulnar loops and arches in schizophrenic males.
 - R2- There is increase in ulnar and radial loops but decrease in whorls and arches in schizophrenic males.
 - R3- There is increase of whorls but decrease in arches in schizophrenic males.
 - R4- There is increase in ulnar loops, but decrease in whorls and arches in schizophrenic males.
 - R5- There is increase in ulnar loops but decrease in whorls in schizophrenic males.
 - L1- There is increase of whorls, but decrease in ulnar loops and arches in schizophrenic males.
 - L2- There is increase of whorls, but decrease in ulnar loops, radial loops and arches in schizophrenic males.
 - L3- There is increase of whorls, radial loops but decrease in ulnar loops and arches in schizophrenic males.
 - L4- There is increase in ulnar loops, but decrease in whorls and arches in schizophrenic males.
 - L5- There is increase of whorls, but decrease in ulnar loops and arches in schizophrenic males.
- But all these differences are not statistically significant (p>0.05).

Table 3: Frequency distribution of patterns in thenar, hypothenar and interdigital areas of right hand of schizophrenic males and normal males

Palmar area	Subject	Presence of pattern	%	Absence of pattern	%	χ^2	p value
Th/I ₁	Male patients	2	4	48	96	0.344	>0.05
	Normal males	1	2	49	98		
I ₂	Male patients	4	8	46	92	0.154	>0.05
	Normal males	3	6	47	94		
I ₃	Male patients	25	50	25	50	1.999	>0.05
	Normal males	18	36	32	64		
I ₄	Male patients	21	42	29	58	0.378	>0.05
	Normal males	18	36	32	64		
Hypo	Male patients	15	30	35	70	1.974	>0.05
	Normal males	9	18	41	82		

df=1, Th/I₁- thenar/first interdigital area, I₂, I₃, I₄Second, third and fourth interdigital areas, Hypo-hypothenar area

Table 3 shows higher percentage of frequency of presence of patterns in all five interdigital areas of right hand in schizophrenic males as compared with their controls. But these differences are not statistically significant (p>0.05).

Table 4: Frequency distribution of patterns in thenar, hypothenar and interdigital areas of left hand of schizophrenic males and normal males.

Palmar area	Subject	Presence of pattern	%	Absence of pattern	%	χ^2	p value
Th/I ₁	Male patients	2	4	48	96	0	-
	Normal males	2	4	48	96		
I ₂	Male patients	0	0	50	100	3.093	>0.05
	Normal males	3	6	47	94		
I ₃	Male patients	10	20	40	80	0	-
	Normal males	10	20	40	80		
I ₄	Male patients	24	48	26	52	0.364	>0.05
	Normal males	21	42	29	58		
Hypo	Male patients	9	18	41	82	1.974	>0.05
	Normal males	15	30	35	70		

df=1

From above table 4 it is clear that percentage frequency of presence of patterns in I₂ and hypothenar areas is lower in schizophrenic males as compared to that of controls. I₄ interdigital areas of schizophrenic males show higher percentage frequency of patterns as compared to that of controls. But these differences are not statistically significant (p>0.05).

Table 5: Finger ridge count in schizophrenic and normal males

Finger	Male patients		Normal males		Z value	p value
	Mean	S.D.	Mean	S.D.		
R1	17.28	5.74	16.8	5.866	0.414	>0.05
R2	11	5.897	10.6	6.459	0.323	>0.05
R3	12.56	3.955	11.36	5.656	1.229	>0.05
R4	14.98	4.529	14.3	6.316	0.619	>0.05
R5	12.08	4.584	11.16	5.064	0.952	>0.05
L1	17.9	5.164	14.32	5.926	3.22	<0.001
L2	11.18	5.906	10.38	6.845	0.626	>0.05
L3	12.66	5.608	12.1	6.899	0.445	>0.05
L4	15.1	4.358	14.48	6.481	0.561	>0.05
L5	12.82	4.397	12.36	4.737	0.503	>0.05

R- Right, L- Left

Table 5 shows higher mean ridge counts for both hands in schizophrenic males as compared to that of controls. But the differences are not statistically significant except for the finger L1, which shows highly significant increase in ridge counts in schizophrenic males as compared to that of controls (p<0.001).

Table 6: Test of significance for TFRC (total finger ridge count) in schizophrenic and normal males

Group	Mean(S.D.)	Z value	p value
Male patients	137.56 (38.389)	1.067	>0.05
Normal males	127.86 (51.521)		

From the above Table 6, it is evident that mean TFRC is higher in schizophrenic males as compared with control. But these differences are not statistically significant (p>0.05).

Table 7: Frequency distribution of Total Finger Ridge Count (TFRC) in schizophrenic and normal males

TFRC	Subject	No.	%
0-50	Male patients	1	2
	Normal males	5	10
51-100	Male patients	7	14
	Normal males	8	16
101-150	Male patients	22	44
	Normal males	21	42
151-200	Male patients	19	38
	Normal males	12	24
201-250	Male patients	1	2
	Normal males	4	8

From above Table 7, it is evident that schizophrenic males have less frequency of TFRC in 0-50 range but more frequency in 151-200 range as compared to the control males.

Table 8: Mean 'atd' angle (in degree) in schizophrenic and normal Males

Hand	Male patients		Normal males		Z value	p value
	Mean	S.D.	Mean	S.D.		
Right	43.88	5.623	40.2	4.777	3.527	<0.001
Left	43.76	6.203	41.22	5.433	2.178	<0.05

Above Table 8 shows that values of mean 'atd' angle in both palms are higher in schizophrenic males as compared to that of controls. These differences are statistically highly significant in right hand (p<0.001) as well as significant in left hand (p<0.05).

Discussion

Dermatoglyphics as a diagnostic aid is now well established in a number of diseases which have strong hereditary basis. Schizophrenia being a disease with strong hereditary background, certain dermatoglyphic variations are to be expected in schizophrenics. The prints were obtained by the ink method and analyzed to find variations in dermatoglyphic features among patients and controls. These observations were subjected to nonparametric tests of statistical significance. The findings of the present study are compared with other studies of dermatoglyphics in schizophrenia. The finding of this study are processed, compared and discussed under following heads.

Finger Tip Patterns :

Arches :

In the present study frequency of arches has been found to be decreased in male schizophrenics (3%) compared to normal males (7.2%) and this difference is highly significant (p<0.001). This finding is similar to Singh S.⁽⁶⁾, Pollendnak⁽⁷⁾ and Vishwanatham C. P.⁽⁸⁾. But this finding is in contrary to Moller⁽⁹⁾, Raphael and Raphael⁽¹⁰⁾, Beckman and Noring⁽¹¹⁾.

Loops :

In the present study loops were found to be slightly reduced in male schizophrenics (58.4%) compared to normal males (58.6%). This finding agrees with Raphael and Raphael⁽¹⁰⁾, Beckman and Noring⁽¹¹⁾,

Singh S.⁽⁶⁾ and Vishwanatham C. P.⁽⁸⁾. But this finding does not agree with Poll⁽¹²⁾, Murthy and Wig⁽¹⁾.

Whorls :

The present study shows an increase in frequency of whorls in male schizophrenics (38.6%) compared to normal males (34.2%). This finding agrees with Raphael and Raphael⁽¹⁰⁾, Beckman and Noring⁽¹¹⁾, Singh S.⁽⁶⁾ and Vishwanatham C. P.⁽⁸⁾. Poll⁽¹²⁾, Murthy and Wig⁽¹⁾ and Moller⁽⁹⁾ found reduction in frequency of whorls in male schizophrenics.

Palmar patterns :

A study of palmar patterns revealed no significant difference between schizophrenic males and normal males. However, there is increase in frequency of patterns on the right hand (42%) and on left hand (48%) in male schizophrenics as compared to right hand (36%) and left hand (42%) in normal males. This finding is in perfect agreement with Rosner and Steinberg⁽¹³⁾, Beckman and Noring⁽¹¹⁾ found an increase in I₄ pattern frequency only on left hand of male schizophrenics. Vishwanatham C. P.⁽⁸⁾ found significant increase in I₃ pattern frequency. Singh S.⁽⁶⁾ found no significant difference in frequency of palmar patterns in male schizophrenics.

Finger ridge count :

In the present study there is no significant difference between schizophrenics and controls in the mean finger ridge count for all fingers except the digit L1 in male schizophrenics showed significant increase ($p < 0.001$) in mean finger ridge count as compared to that of normal males.

This finding coincides with that of Singh S.⁽⁶⁾. However, he found higher mean ridge count in schizophrenic males for digits R4, R5, L3, L4, and L5.

Total finger ridge count (TFRC) :

In the present study it has been found that there is no significant difference in total finger ridge counts of male schizophrenics when compared to that of normal male. However, the mean of total finger ridge count was found to be greater in schizophrenics than that of controls.

Murthy and Wig⁽¹⁾ found no any significant difference in TFRC of male and female schizophrenics Vishwanatham C. P.⁽⁸⁾ who studied only male cases found no significant change in TFRC in male schizophrenics. Reduced TFRC was also reported by Kemali⁽¹⁴⁾.

'atd' angle :

Male schizophrenics studied presently show a significant increase in 'atd' angle in their right hand ($p < 0.001$) as well as in the left hand ($p < 0.05$) as compared to that of controls. These finding are very much similar to that of Mellor C. S.⁽¹⁵⁾ who found significant ($p < 0.001$) increase in 'atd' angle of male and female schizophrenics. Singh S.⁽⁶⁾ found increase in 'atd' angles of male and female schizophrenics except in the left hand of female schizophrenics; but the

differences were not significant. Vishwanatham C. P.⁽⁸⁾ found slight increase in 'atd' angles in male schizophrenics without any significant difference. Balgir R. S., Murthy R. S. and Wig N. N.⁽¹⁶⁾ found wider 'atd' angle in schizophrenics with and without family history of schizophrenia in both sexes than in controls, but the differences was significant only in females ($p < 0.01$).

Conclusion

The study of epidermal ridge patterns of palms and soles is known as dermatoglyphics. It is recognized since long as a valuable method for medicolegal and anthropological studies. The awareness of clinical significance of dermatoglyphics is increasing with development in human cytogenetics. This study attempts to analyse, whether there exists any pattern specific for schizophrenia and whether that serves as a diagnostic tool for early diagnosis of schizophrenia in newborns. Arch patterns are significantly reduced in the finger tips of schizophrenic males ($p < 0.001$) with no significant differences in mean counts of whorls and loops when compared with controls. No significant differences are observed in mean finger ridge counts of schizophrenics when compared with controls except in digit L1 of male schizophrenics which shows significant increase ($p < 0.001$) in mean finger ridge count. Total finger ridge count (TFRC) is increased in schizophrenics, but this difference is statistically insignificant. 'atd' angle is significantly increased in schizophrenic males (right hand: ($p < 0.001$, left hand: ($p < 0.05$) when compared to their respective controls. Thus, though there are some advantages of dermatoglyphic traits as a diagnostic tool, it has its own limitations when used alone in an individual case. However, when it is combined with other clinical features it plays an important role in the diagnosis of medical disorders. In this study, only palm and finger print dermatoglyphic patterns were studied. A study of plantar prints could provide additional information. A community based large study, including the healthy parents of schizophrenics and their unaffected siblings would serve as a useful way of comparing the patterns of schizophrenics with others because the genetic print of the family would be similar.

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