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Comparative Study of Finger Tip Pattern in Epilepsy and Normal Individuals

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Abstract: ***Background: Dermatoglyphics is the study of quantitative and qualitative patterns of ridge in palms and soles.it includes study of finger tip pattern. It is being investigated in disease having genetic bases. The recent evidence from adoption studies has provided bases for the genetic contribution in generalized tonic clonic seizures. Objectives: To study the finger tip patterns in generalized tonic clonic seizure patients and to compare finger tip patterns of cases with the normal populations. Methods: The ink method was followed to take finger prints. The prints of 50 epileptic patients and 50 normal individuals of both sexes were collected for the study. Results: There is statistically significant decrease in frequency of arches and ulnar loops in Epileptics, whereas frequency distribution of whorl patterns and radial loops is considerably increased in epileptics when compared to normal. Conclusion: There is significant difference in epileptic patients in finger tip patterns when compared to controls. Hence it is possible to identify' at risk' population with the help of finger tip pattern.***

Keywords: Dermatoglyphics, Epilepsy, finger tip patterns, Arches, Whorls

1. Introduction

The entire human body is clothed with the skin which happens to be the largest and most important organ of the body. However the skin on the ventral side of the hands is exclusively designed and is corrugated with the ridges and configurations which are functionally useful as they help in the grasping without which the objects would easily slip away from the hands. Dermatoglyphics is the science which deals with the study of dermal ridge configuration on the digits, palm and soles. Cummins in 1926 for the first time coined the term dermatoglyphics in this field of science. Derma- skin, glyphe- carve. It gives the impression that something has been carved out of skin. These features of dermatoglyphics are formed during the 13th / 14th weekof the developing foetus and once formed remain permanent and never changethroughout the life except in the dimensions which commensurate with thegrowth of an individual.The scientific value of dermatoglyphics largely derives from the factthat dermal ridges appear in the third to 5th month of foetal development andthe patterns then formed never change. Hence dermatoglyphic study proves to be a very useful, easily applicable, inexpensive, indispensable tool as an indicator in the diagnosis of hereditary diseases in patients.[1]

The etiology of the epilepsies allows a classification of syndrome features into two groups – idiopathic or cryptogenic epilepsy, which has isolated primary symptoms without apparent cause and is probably hereditary and palm and finger print configurations are inherited with an embryonic origin common to nervous system. Their attractions indicate pleiotropic effects of the genotype responsible for enaphalographic irregularity and convulsive seizures. So in this study we are studying the finger tip pattern in epilepsy and normal individual and then comparing it with each other.[8]
Finger tip pattern:

The patterns on the finger tip are classified into three basic pattern types Arches , Loops, and Whorls.

2. Literature

Dermatoglyphic Configurations Ridge Detail (Minutiae):
Epidermal ridges are having irregularities of direction, discontinuities and branching. Such characters are collectively termed minutiae or ridge characteristic.

The following terms are in general use to describe some common types:

- ***Island*** - a small independent ridge, approximately circular in outline, sometimes called a point. Strictly, it contains only one sweat gland pore.
- ***Short ridge*** – a ridge which contains from two to five pores.
- ***Fork*** – the bifurcation of a ridge, sometimes called a Y formation.
- ***Enclosure*** – any continuous ridge outline which surrounds a furrow. Commonly an enclosure is formed by two forks in opposition on the same ridge.
- ***End*** – termination of a ridge.
- ***Interstitial line*** – it is a narrow subsidiary ridge in the furrow between individual ridges. It is inconstant and omitted on ridge counting.

Dermatoglyphic Landmarks
The dermatoglyphic landmarks are type lines, cores and triradius or delta.

- **Type lines:** They are the innermost ridges that bound the pattern area. These ridges run parallel, then diverge or separate and tend to surround the pattern area of an impression. The type lines are appropriately termed as skeleton of the pattern. They are important for determining the location of delta.
- **Cores:** They are the central part of the patterns. They may also be called as inner terminus of the patterns. The core can be a circle, an ellipse, a straight ridge, a hook shaped ridge or an island. If there is a rod like line in the centre, the midpoint is taken as core. In ridge counting, not the whole core but the point of core only is used.
- **Triradius or Delta:** A triradius is defined as the centre of the delta shaped or deltoid junction of three regions, each

containing curved streams of approximately parallel ridges i.e., three ridge systems. Geometrically, the triradial point should be the meeting place of three radiants which make angles of 120° with one another and demarcate the three regions. Unless each of the angles between the radiants is 90° or more, no triradius is deemed to exist.[1,2]

Pattern Configurations

Configurations on fingers:
The patterns on the finger tip are classified into three basic pattern types: Arches (5%), Loops (70%) and Whorls (25%).

1. ***Arch***: It is the simplest pattern having no triradius. Ridges beginning on one side make sweeping gentle curve on the opposite side. Arch may be

Simple arch or *Tented arch*.
- *Simple arch*: It is composed of ridges that cross the finger tip from one side to other without recurving.
- *Tented arch*: If the ridges meet at a point so that their smooth sweep is interrupted, a tented arch is formed.

2. ***Loop***: It is the most common pattern on the finger tip. In this configuration, a series of ridges enter the pattern area on one side of the digit, recurve abruptly and leave the pattern area on the same side. Loop may be *Ulnar loop* or *Radial loop*.
- *Ulnar loop*: A single loop with a core which is directed towards the ulnar side of the finger is called an ulnar loop. The corresponding triradius is on the radial side.
- *Radial loop*: Here the loop core is directed towards the radial side and the corresponding triradius is on the ulnar side.

3. ***Whorl***: It is the most complicated of the three patterns, having at least two triradii; one triradius is on the radial side and the other on the ulnar side of the pattern. Whorls can be classified into two types : *True whorl and Composite whorl*.

True whorls may be classified as:
- Single spiral whorl: when the ridges form only one spiral around the core.
- Double spiral whorl: In this case, the ridges form two distinct spirals around one or two different cores.
- Concentric circle whorl: The presence of a succession of concentric rings of ridges around the core.

Composite whorls may be classified into:
a) Central pocket loop (CP): It is a pattern containing a loop within a small whorl.
b) Double loop (DL): These are comprised of two interlocking loops.
   - Twin loop
   - Lateral pocket loop
c) Accidentals: These are complex patterns characterized by more than two triradii. They represent a combination of two or more configurations such as a loop and a whorl, triple loop and other unusual formations.[1]

3. Materials and Method

Source of data: The patient diagnosed as generalised tonic clonic seizure attending medical services at chigateri general hospital and bapuji hospital attached to JJM Medical College, Davangere. The finger prints of consecutive patients diagnosed as GTCS were collected for the study.

Sample size: 50 cases and 50 controls.

Inclusion criteria:
Age between 15y to 60y
Both male and female sex included

Exclusion criteria
Patients associated with other psychiatric illnesses
- Patients associated with mental retardation
- Patients with history of trauma and other medical illnesses
- Equal number of age and sex matched individuals who have no medical and psychiatric illnesses, with no past history or family history of seizures served as controls

Materials used

Kores quick drying duplicating ink, rubber roller, wooden roller, inking slab, cotton puff, spirit, scale, crystal bond paper, pencil, protracter, magnifying lens, soap, Towel.

Figure 1: Materials used

4. Methodology

Standard INK method as described by Cummins and Midlo was adapted to take prints in present study. The hands of the subjects were cleaned with soap and water and dried. Subsequently the hands were wiped with spirit lightly to remove any greasy particles. Required amount of daub was placed on glass slab. It is uniformly spread by rubber roller to get a thin even ink film on glass slab.

The fingers of the individual's right hand were inked with the rubber roller starting from the thumb. The crystal bond paper kept over the wooden table was used for recording the finger print pattern. The finger was first placed on a paper with edge down and then rolled until the opposite margin was in contact. For ease, the thumb was placed downward

and rolled towards the body and the other finger were placed radial edge downward and rolled away from the body. The same procedure was followed for recording the finger print of the left hand. Thus rolled prints of all the fingers were obtained and recorded. The types of loops were ulnar loops, radial loops, whorls. Finger ridge count is undertaken by counting the no of ridges crossing the line joining the triradius and core. The whorl has two readings because it has two triradius represented as fraction. For the Arch the core and the triradius is at the same point, so the count is zero. Here it is considered only the types of finger tip pattern.

Descriptive statistics were presented as mean and standard deviation for continuous data and number and percentage for categorical data. Z test/unpaired "t" test was used for comparing the means of two groups. Categorical data was analysed by chi square test and fisher's exact test wherever necessary P- value of 0.05 or less was set for statistical analysis.

5. Results

- In present study, the right hand arches are more in control group(16%) than in epilepsy cases(9.6%).Double loops are more in cases(0.8%) than in controls(0.4%).Radial loops are more in cases(10.4%) than in controls(4.0%).Ulnar loops are more in controls(65.6%) than in cases(40.4%).Whorls are more in cases(38.8%) than in controls(14.0%)
- In left hand the arches are more in controls(13.6%) than in cases(12%).Double loops are more in cases(3.2%) than in controls(0.4%).The radial loops are more in cases(16.4%) than in control(3.2%).Ulnar loops are more in controls(74.4%) than in cases(42.2%).Whorls are more in cases(26%) than in controls(8.4%).
- The maximum whorls are seen in digit I and IV of both cases and controls. The maximum ulnar loops are seen in digit V of epileptic patient. The maximum radial loops are seen in digit II of epileptic patients.
- The no of arches and ulnar loops are considerably decreased in epileptics
- The no of whorls and radial loops are considerably increased in epileptics

6. Discussion

Over the past 150yrs, dermatoglyphics and finger tip pattern has been a useful tool in understanding basic questions in biology, medicine, genetics and evolution in addition to being the best and most widely used method for personal identification[4].

In present study of 50 epileptics and 50 controls. Arches – epileptics(10.8%), controls(14.8%). Radial loops- epileptics (13.4%), controls(3.6%). Ulnar loops- epileptics(41.4%), control(70.0%). Whorls- epileptics (32.4%), controls(11.2%). Epileptics have significant increase in radial loops and whorls and decrease in ulnar loop.

William Herschel (1858) was first to experiment with finger prints in India. He noticed the use of thumb prints as a form of signature amongst illiterate Indians and clearly established the fact that finger prints did not change their form over time[4].

Galton (1892) divided the ridge patterns on the distal phalanges of finger tips into three groups, arches, loops, and whorls.

Schaumann and Mayersdorf(1979) found an increase in radial loops in white adult patients with idiopathic epilepsy. In nonwhite group the tented arch pattern was completely absent in male generalised epilepsy and their control[6].

On comparision of epileptics with controls in males, with hands combined, loops(52.24%) and arches(7.93%) were increased and whorls(39.83%) were decreased. In females with hand combined, arches(13.1%) and whorls(36.43%) were increased and loops(50.48%)[9]

M A B Mattos- Fiore and P H Saldanha[6] observed in white individuals, the loop frequencies of both hands of male sample were higher in patients of GE(72.6%), while normal controls showed 61.19%. In female sample, these proportions showed GE-70.63%, Controls-66.19%

Significantly larger frequency of loops on finger III of right hand were found in white female patients in GE group. Among males, whorls were more frequent on finger I, II, III of left hand.

Nandalal [7]observed the finger tip pattern distribution in cases of epilepsy shows lightly more no of whorls and loops than controls. Radial loops 13% in cases, 9% in controls. The no of whorls was more in controls(13.40%) especially in digit in II than in cases of epilepsy(12%). The maximum distribution of arch pattern is seen in II digit of both groups. In cases it is 8% and in controls 11%.

Table 1: Number and percentage of patterns of individual fingers in the right palm of male cases and controls

Pattern	CASES (25)										CONTROLS (22)									
	I		II		III		IV		V		I		II		III		IV		V	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
A	3	12	3	12	3	12	1	4	2	8	4	18.2	4	18	6	27	5	23	4	18
DL	-	-	1	4	-	-	-	-	-	-	-	-	-	-	1	4.5	-	-	-	
RL	1	4	4	16	5	20	2	8	6	24	-	-	4	1	3	14	-	-	-	
UL	5	20	4	16	13	52	8	32	15	60	14	63.6	14	64	9	45	14	64	14	64
W	16	64	13	52	4	16	14	56	2	8	4	18.2	3	14	2	9	3	14	4	18

Table 2: Number and percentage of patterns of individual fingers in the left palm of male cases and controls

Pattern	Cases(25)										Controls(27)									
	I		II		III		IV		V		I		II		III		IV		V	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
A	4	12	3	12	3	12	1	4	2	8	4	18.6	4	18	6	27	5	23	4	18
DL	-	-	1	4	-	-	-	-	-	-	-	-	-	-	1	4.5	-	-	-	
RL	1	4	4	16	5	22	2	8	6	26	-	-	4	1	3	14	-	-	-	
UL	5	20	8	16	13	52	8	32	15	60	14	63.6	14	64	9	45	14	64	14	64
W	16	64	13	52	4	16	14	56	2	8	4	18.2	3	14	2	9	3	14	4	18

Table 3: Number and percentage of patterns of individual fingers in the right palm of female cases and controls

Pattern	Cases(25)										Controls(28)									
	I		II		III		IV		V		I		II		III		IV		V	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
A	2	8	2	8	4	16	1	4	3	12	2	7	3	11	3	11	5	18	4	14
DL	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RL	1	4	1	4	2	8	1	4	3	12	1	4	1	4	-	-	3	11	1	4
UL	9	36	10	40	12	48	9	36	16	64	19	68	19	68	24	86	14	50	22	79
W	12	48	12	48	7	28	14	56	3	12	6	21	5	18	1	4	6	21	1	4

Table 4: Number and percentage of patterns of individual fingers in the Left palm of female cases and controls

Pattern	Cases(25)										Controls(28)									
	I		II		III		IV		V		I		II		III		IV		V	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
A	4	16	3	12	4	16	4	16	2	8	-	-	4	14	5	18	5	18	4	14
DL	2	8	-	-	-	-	-	-	-	-	-	-	-		1	4	-	-	-	-
RL	4	16	3	12	3	12	1	4	1	4	-	-	1	4	2	7	1	4	1	4
UL	6	24	11	44	10	40	12	48	15	60	25	89	21	70	20	71	18	64	22	79
W	9	36	8	32	8	32	8	32	2	8	3	11	2	7	-	-	4	14	1	4

Table 5: Distribution of finger tip pattern in the right hand of cases and controls

Pattern	Cases(50) (M+F)		Control(50) (M+F)		Z	P value	
	N	%	N	%			
A	24	9.6	40	16	2.15	0.03	S
DL	2	0.8	1	0.4	0.58	0.56	NS
RL	26	10.4	10	4	2.79	0.005	S
UL	101	40.4	164	65.6	5.83	<0.001	HS
W	97	38.8	35	14	6.55	<0.001	HS

Z - Test for proportion, P <0.05 significant, p<0.001 Highly significant

Table 6: Distribution of finger tip pattern in the left hand of cases and controls

Pattern	Cases(50) (M+F)		Controls(50) (M+F)		Z	P value	
	No	%	No	%			
A	30	12	34	13.6	0.54	0.59	NS
DL	8	3.2	1	0.4	2.37	0.02	S
RL	41	16.4	8	3.2	5.09	<0.001	HS
UL	106	42.4	186	74.4	7.67	<0.001	HS
W	65	26	21	8.4	5.36	<0.001	HS

Z - Test for proportion, P <0.05 significant, p<0.001 Highly significant

Table 7: Distribution of finger tip pattern in cases and controls

Pattern	Cases(M+F) (R+L)		Controls(M+F) (R+L)		Z	P value	
	No	%	No	%			
A	54	10.8	74	14.8	1.34	0.18	NS
DL	10	2	2	0.4	1.65	0.10	NS
RL	67	13.4	18	3.6	3.99	<0.001	HS
UL	207	41.4	350	70.0	6.72	<0.001	HS
W	162	32.4	56	11.2	5.94	<0.001	HS

Z - Test for proportion, P <0.05 significant, p<0.001 Highly significant

7. Conclusion

This study has added on to the importance of dermatoglyphics and finger tip patterns. With the knowledge of finger print pattern of typical epileptic, it helps us to set a standard finger tip pattern in epilepsy and also it becomes imperative for the clinician to have basic awareness of a dermatoglyphic pattern of idiopathic epilepsy, so that patients are informed and warned to avoid certain trigger factors of epilepsy.

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