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### Original Article

## Dermatoglyphics an attempt to predict downs syndrome

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#### ABSTRACT

**ABSTRACT** The present study was aimed to evaluate the role of Dermatoglyphics in early detection of Downs syndrome, so 50 cases of Downs Syndrome (Between the age of 8 years and 18 years) were selected from schools of Mentally retarded children as DISHA and PRAYAS from Jaipur (Rajasthan) & compared with 50 controls for the establishment of correlation between two groups by presence and absence of specific dermatoglyphic patterns. Hand prints were taken by Indian ink method and examined for C-line pattern (qualitative parameter) & distal deviation of Axial triradii (quantitative parameter). In C- line pattern, radial pattern frequency is 58% on right side & 42% on left side in controls as compared as 68% on right side and 58% on left side in patients respectively. Although the difference is statistically insignificant but pattern frequency is more in patients than controls in both hands which showed that in future if more numbers of cases would be compared with controls for c- line pattern then they will differ significantly. Some genetic or non genetic factors which produces disorders by influencing foetal development during early intrauterine life, may also bring about a significant alteration in dermatoglyphics. The results showed that Radial C-line patterns are observed maximum in patients than controls. Absent type pattern is minimum (6% left side) in controls as compared to proximal pattern (6% on right side) in patients but statistically insignificant. Simian creases are seen in patients hands only. The right & left l and d were significantly higher in patients than controls ( $P < 0.001$ ). Both right and left sides showed statically significant increase in d/l % frequency in patients than controls ( $P < 0.001$ ). The findings indicate that dermatoglyphic abnormality may be used as diagnostic tool for predicting the possibilities of development of Down syndrome at later date.

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### 1. Introduction

In 18th century, Mayer [1] stated in his book An Atlas of Anatomical Illustrations that "Although the arrangement of skin ridges is never duplicated in two persons, nevertheless the similarities are closure among some individual. In others the differences are marked yet in spite of their peculiarities of arrangement, all have a certain likeness". This statement opens with the 1st clear enunciation of a basic principle of fingerprint identification. First time an autosomal abnormality in man is identified and described by John Langdon Down [2] was known as Downs syndrome, commonly as mongolism (G-Trisomy / 21-Trisomy). Only documented cases of Down syndrome were selected

for present study. The formation of dermal ridges takes place in fetus during IIIrd month as a result of physical and topographical growth forces. Dermal ridges and configuration once formed are not affected by age, development & environment changes in post natal life. So it has potential to predict various genetic and acquired disorders with genetic influence [3,4]. The significance of dermatoglyphics in Downs syndrome was first demonstrated by Cumins [5-9]. The dermatoglyphic study has few disadvantages like ready accessibility and its age & environmental stability. With rapid development of human genetics and discovering of chromosomal aberrations in man, the value of dermatoglyphics in clinical medicine has been proved. The scarcity of dermatoglyphic data about mongolism in populated Western India (Rajasthan) created an interest to attempt the present study to note specific variation in the patients for early detection of the disease.

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**2. Material and Methods**

50 Cases of Down syndrome (Age between 8 years to 18 years) were selected from schools of mentally retarded children as DISHA and PRAYAS and compared with the 50 controls.. Sex wise criteria was excluded. The documented Down syndrome cases were selected as subject and compared with normal.

The confirmation of Down syndrome in patients was based on their school record. Indian ink method cumins & midlow [2,3] was used for taking impression with camel duplicating ink.

**2.1.Material used were:** A double plain paper (8.5”X11”),a glass plate (8.5”X11”), a round bottle(10”X4”), a roller for spreading the ink, a table, a scale, a pointed H.B Pencil, a mercury lamp a biological pointer, a protractor, soap and ether for washing hands and a good quality magnifying lens.

The hands were washed with soap and water and humidity cleaned off with ether. Small daub of camel duplicating ink squeezed out on inking slab of roller into a thin film for direct inking of fingers. Palm was carefully and uniformly smeared with inked roller to cover the whole area of palm to be printed for examination.

The paper was set over the round bottle and the moderately open fingers and palm were successively rolled with some pressure on it for permitting the bottle and paper to move forward. Rolled finger prints were taken by rotation of fingers both in inking and printing to obtain complete impression of finger tips. This method enables to record the complete imprints of palm including palmer surface of all five digit in one attempt. These prints were studied with the help of a magnifying lens for observation under different heads. The family history was not mentioned as only documented cases of Down syndrome were taken and sibling study was not the part of present research work.

**3. Results**

The observation was recorded for C-line pattern (qualitative) and l/d % (quantitative) dermatoglyphic feature from hand prints of 50 patients and 50 controls. The control group has no history of mental retardation. C-line pattern was observed for absent, proximal, ulnar and radial varieties. Radial pattern frequency was 58 % on right hand and 42 % on left hand In controls as compared to 68 % on right hand and 58 % on left side in the patients.

Absent type pattern is minimum (6 % on left hand) in control as compared to proximal pattern ( 6 % on right side ) in patients and difference was statistically insignificant (P> 0.05) when compared with side wise (right & left hands) in patients and controls. Simian creases distribution In patients were 12 % and 16% in right and left hands respectively.

Definitely the simian creases were observed in present study because it is a diagnostic tool for early detection of the Down syndrome and showed in Figure-3 with c-line pattern in present study.Simian creases were seen only in patients of Down syndrome only. The percentage distribution of simian creases in cases were 12% and 16% in right and left hands respectively. The distal deviation of axial triradii were made (according to WALKER classification) [13,14] as under-

- (1) Distance between the triradius and distal wrist crease (d).
- (2) Length of palm from the distal wrist crease to the proximal crease of the middle finger (l).
- (3) The length of triradii is then calculated as a percentage of the palm length as d/l%.

The walker [13,14] observed three positions of triradii as-

- t' =triradii in low position from 0 to 14.9 %.
- t'' = triradii in intermediate position from 15 to 39.9 %.
- t''' = triradii in high position from 40.0 % and above.

The maximum distribution of l belongs to range group 85-94 In controls and 95-104 in patients respectively. The right l mean values in controls (89.70) and in patients (97.08 ) differed significantly ( P< 0.001).The left l mean value in controls (89.94) and patients (95.64) also showed significant difference ( P< 0.001). The maximum distribution of d belongs to range group 15-24 and 35-44 in controls and patients respectively. The right d mean values in controls (20.50) and patients (46.52) differed significantly (P< 0.001).The left mean values in controls (19.60) and patients (40.38) also showed significant difference. The d/l% frequency lies maximum in range group 15-24 in controls and 45-54 in patient's .The mean values of distal deviation d/l % in controls were 22.85 & 22.19 on right & left hands respectively. The mean value of distal deviation in patients was 42.77 And 44.72 on right and left hands respectively. Both right and left sides showed statistically significant increase in d/l % frequency in patients when compared with controls (P< 0.001).

**Table I: Age and Sex wise percentage distribution of patients & controls.**

Age group	Case			Control		
	M	F	T	M	F	T
7-10	8(16)	3(6)	11(22)	15(30)	3(6)	18(36)
11-14	13(26)	12(24)	25(50)	22(44)	5(10)	27(54)
15-18	10(20)	4(8)	14(16)	3(6)	2(4)	5(10)
TOTAL	31(62)	19(38)	50(100)	40(80)	10(20)	50(100)

Figures given in parenthesis showing percentage.

M= Male  
F = Female  
T = Total

Mean Age(case)	MeanAge (control)
Male - 12.96±2.93	11.65±1.98
Total - 12.98±2.63	11.90±2.02
Female - 13.00±2.13	11.70±1.97

Sex criteria was excluded in present study because dermatoglyphics is not affected by sex , age, development and environmental changes. Table – 1 is only showing the percentage frequency of male & female , taken as cases and controls .It also proved that different age of cases does not affect the dermatoglyphic study.

**(Dermatoglyphics in Mongolism)**

**Table II: P-Value significance of various types of C-line patterns**

Types	Case (Mean)			Control (Mean)			P-Value significance
	R	L	T	R	L	T	
ABSENT	4	6	10	5	3	8	X=0.225,df=1 P>0.05, NS
PROXIMA	3	5	8	4	9	14	X=0.025,df=1 P>0.05, NS
LULNAR	9	10	19	11	17	28	X=0.299,df=1 P>0.05, NS
RADIAL	34	29	63	29	21	50	X=0.182,df=1 P>0.05, NS

R= Righthand

L= Left hand

NS= Not significant

(Dermatoglyphics in Mongolism)

**Table III: P-Value significance of l, d, and d/1%.**

Distal deviation	Side	Mean $\pm$ SD		P-value	Significance
		Control	Case		
L	R	89.70 $\pm$ 6.78	97.08 $\pm$ 10.21	<0.001	Significant
	T				
D	L	89.94 $\pm$ 6.38	95.64 $\pm$ 11.13	<0.001	Significant
	T				
d/1%	R	20.50 $\pm$ 9.46	41.52 $\pm$ 10.46	<0.001	HS
	T				
d/1%	L	19.60 $\pm$ 9.91	40.38 $\pm$ 10.08	<0.001	HS
	T				
d/1%	R	22.85 $\pm$ 10.42	42.77 $\pm$ 9.70	<0.001	HS
	T				
d/1%	L	22.19 $\pm$ 10.59	44.72 $\pm$ 9.09	<0.001	HS
	T				

l = Length of palm from the distal wrist crease to the proximal crease of the middle finger (l).

d = Distance between the triradius and distal wrist crease (d).

d/1% = The length of triradii is then calculated as a percentage of the palm length.

HS = Highly significant.

**Acknowledgment**

The observation was recorded for C-line pattern (qualitative) and l/d % (quantitative) dermatoglyphic feature from hand prints of 50 patients and 50 controls. The control group has no history of mental retardation. C-line pattern was observed for absent, proximal, ulnar and radial varieties. Radial pattern frequency was 58 % on right hand and 42 % on left hand In controls as compared to 68 % on right hand and 58 % on left side in the patients.

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Definitely the simian creases were observed in present study because it is a diagnostic tool for early detection of the Down syndrome and showed in Figure-3 with c-line pattern in present study. Simian creases were seen only in patients of Down syndrome only. The percentage distribution of simian creases in cases were 12% and 16% in right and left hands respectively. The distal deviation of axial triradii were made (according to WALKER classification) [13,14] as under-

FIG. 1 : Showing the technique used in taking a print.

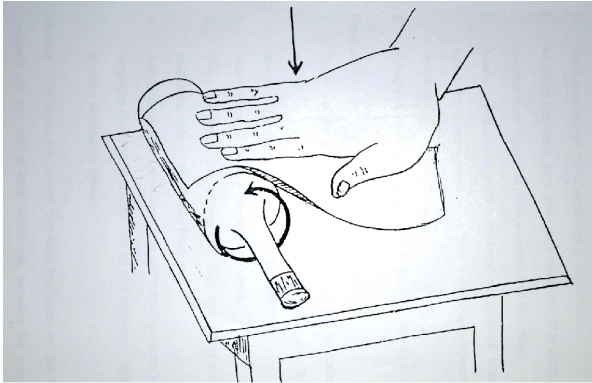


FIG. 2 : Illustration showing the measurement of l and d in righthand

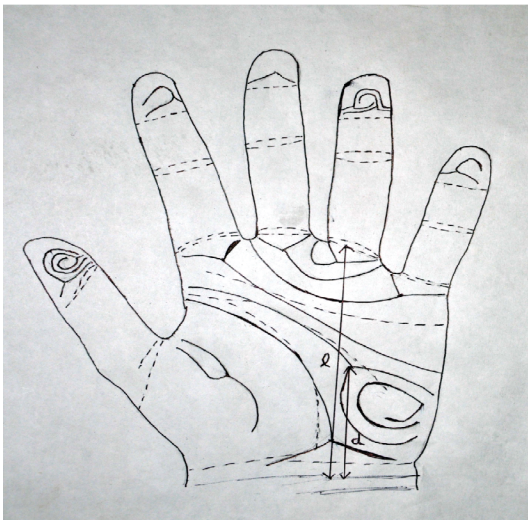


FIG. 3 : The actual print showing Radial type C-line pattern and distally placed axial triradius.



Table : 4. P-Value significance of (a-b) ridge count

Ridge Count	Side	Mean ±SD		P-value	Significance
		Control	Case		
L	R	36.54±4.45	31.64±4.88	<0.001	Significant
	T				
	L	36.36±5.41	31.28± 3.72	<0.001	Significant
	T				

RT = Right

LT = Left

(Dermatoglyphics in Mongolism)

Table : 4. P-Value significance of (a-b) ridge count

Ridge Count	Side	Mean ±SD		P-value	Significance
		Control	Case		
L	R	36.54±4.45	31.64±4.88	<0.001	Significant
	T				
	L	36.36±5.41	31.28± 3.72	<0.001	Significant
	T				

RT = Right

LT = Left

(Dermatoglyphics in Mongolism)

#### 4. Discussion

In present study, both groups (patients and controls) showed higher frequency of radial and ulnar type C-line patterns which differed insignificantly ( $P > 0.05$ ). This finding is consistent with the results of Borboller L et al [10-15] who observed higher frequency of radial type C-line pattern.

The mean value of d/l % is more than 40 which represent the high (distal) position of axial triradii (t") in palm.

The distal deviation of axial triradii (d/l %) is statistically significant in cases of Down syndrome. This finding is in accordance with the findings of S. Rajangam et al [10,12], Cumins & Midlo [2,3], Penrose [8,9], Schmidt [12, 13], kumar & kumar [6] and Gupta et al [5] who showed distally placed axial triradii (t") in both hands of patients.

Dermatoglyphics is one field which gets affected by genetic changes as shown in cases of Down syndrome, Schizophrenia, Huntington's chorea and syndactyly. These associations have generated considerable interest in clinical medicine in light of their potential for providing inexpensive and non invasive screening methods for certain disease as well as insight into etiology of disease.

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