



## STUDY OF PALMAR CREASES IN CHILDREN WITH MENTAL RETARDATION: A CASE CONTROL STUDY IN TERTIARY HOSPITAL IN NORTH INDIA

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### ABSTRACT

**Introduction-** Etiology of mental retardation is multi-factorial which include various genetic and environmental factors. Minor physical anomalies are commonly observed in these children. Abnormal palmar creases are one of them.

**Aim-** To compare prevalence of abnormal palmar creases in children with mental retardation and typically developing children.

**Methodology-** Case controlled cross sectional study conducted on children with mental retardation and typically developing normal children. Photographs of palm were clicked using high resolution camera, digitally saved and evaluated later on.

**Results-** The prevalence of abnormal palmar creases is increased in children with mental retardation. Correlation between increasing severity of mental retardation and abnormal palmar creases was noticed only in the right hand.

**Conclusion-** Abnormal palmar creases are one of the minor physical anomalies found in children with mental retardation. Its presence would prompt clinicians for early screening and diagnosis which would increase possibility of early intervention.

**KEYWORDS :** child, dermatoglyphics, hand, intellectual disability

### INTRODUCTION

Neurodevelopmental disorders are characterized by developmental deficits that produce impairments of social, academic, occupational, or personal functioning and it manifests in early childhood. Mental retardation is one of the most common neurodevelopmental disorders. [1,2]

The etiology of mental retardation is complex, with genetic factors accounting for 30% to 50% of cases. Genetic factors along with environmental factors cause aberrant neurodevelopment which leads to mental retardation as well as minor physical anomalies. [3,4,5,6] As brain and skin are derived from the same neuroectodermal layer, so these anomalies could reflect aberrant neurodevelopment during embryogenesis. [7]

Palmar creases are one of the minor physical anomalies found in children with mental retardation. These are formed well within the first trimester of pregnancy (7<sup>th</sup> to 9<sup>th</sup> week of gestation) and there is no alteration thereafter. Any insult at this stage of organogenesis would lead to altered brain development and abnormal palmar creases. [8,9,10]

Though no cause-effect relationship can be established between mental retardation and abnormal palmar creases, the literature points association between them. So it may be worth screening children with abnormal palmar creases at an early stage for neurodevelopmental disorders. Keeping these in mind, the present study has been planned.

The purpose of the present study was to compare the prevalence of abnormal palmar creases in children with mental retardation with that of typically developing normal children and to study the relationship of the pattern of palmar creases with the severity of mental retardation if any.

### MATERIALS AND METHOD

The study was a case-controlled cross-sectional study conducted in the outpatient departments of Psychiatry and Pediatrics at Pt. B.D. Sharma, PGIMS, Rohtak. Ethical clearance was sought from the Institutional Ethics Committee. Assent from children and written consent from the parents were taken to participate in the study.

The case group was selected by purposive sampling from the outpatient department of Psychiatry. It comprised of one hundred children of age group 4-16 years of either gender (along with their parents), who met the diagnosis of mental retardation according to ICD-10. The final clinical diagnosis was confirmed by the consultant psychiatrist. Children with a severe autism spectrum disorder, with postnatal CNS insult (ruled out by detailed history) including hypoxic-

ischemic encephalopathy (HIE) and cerebral palsy, were excluded from this group.

A control group of one hundred typically developing children (screened by history and clinical examination) matched for age and gender with case group, along with their parents were selected from the outpatient department of Pediatrics. Children with major congenital malformations were excluded from the control group.

An especially designed proforma was used to gather various socio-demographic and clinical details about the children and their parents. The intelligence quotient (I.Q.) was assessed by the clinical psychologist.

A camera of 13 megapixels was used to click photographs of the palm of both the cases and controls by keeping a white sheet of paper as a clear background. Photographs were evaluated later on in both the groups for palmar crease patterns.

The data gathered was subjected to statistical evaluation. Descriptive statistics were used for analyzing discrete and continuous variables. Chi-square test was used for comparing categorical variables and student t-test for continuous variables, using 0.05 as the level of significance.

### RESULTS

The sample consisted of a total of 200 children, hundred in case, and control group. Table I shows the comparison of study groups in various sociodemographic variables. The majority of the children in both groups were in the age range of 8 - 11 years and were males. The majority of the children in both groups were of first birth order and belonged to the nuclear family of rural background. There was a statistically significant difference between the two groups in terms of the educational status of children. The majority of the children in the case group never attended the school as compared to the children in the control group. As compared to parents of children in the control group, the mean age of both parents of children with mental retardation was higher.

**Table I. Comparison of case and control groups on socio-demographic variables**

	Variables	Cases (n=100)	Controls (n=100)	t/x <sup>2</sup>	p-value
1.	Age			0.000	1.000
	4-7 years	23	23		
	8-11 years	39	39		
	12-16 years	38	38		

2. <b>Gender</b>				0.000	1.000
Male	75	75			
Female	25	25			
3. <b>Educational status</b>				61.29 0	< 0.01*
Never attended	79	24			
Primary (up to 5th standard)	14	41			
Secondary (6 <sup>th</sup> -10 <sup>th</sup> )	7	35			
4. <b>Birth order status</b>				0.755	0.686
1	44	45			
2	37	32			
3 or >3	19	23			
5. <b>Family structure</b>				4.679	0.096
Nuclear	73	63			
Extended	13	25			
Joint	14	12			
6. <b>Number of family members</b>				1.719	0.633
3-5	62	57			
6-8	24	29			
9-11	14	14			
7. <b>Neighborhood status</b>				1.003	0.317
Rural	61	54			
Urban	39	46			
8. <b>Mean age of parents (years)</b>					
Paternal age	38.67±6.196	36.61±6.490	2.295	0.023*	
Maternal age	34.24±5.494	32.57±5.313	2.185	0.030*	
9. <b>Father(F) and mother(M) educational level</b>	F	M	F	M	1.659(F) 0.894(F)
Illiterate	12	27	12	23	3.104(M) 0.796(M)
Upto 5 <sup>th</sup>	25	27	24	31	
6 <sup>th</sup> to 10 <sup>th</sup>	25	17	26	19	
11 <sup>th</sup>	21	16	21	11	
Graduate	12	10	15	12	
Post graduate	5	3	2	4	
10. <b>Father(F) and mother(M) profession</b>	F	M	F	M	4.613(F) 0.329(F)
Unemployed	2	85	2	86	0.083(M) 0.999(M)
Unskilled	33	5	37	5	
Skilled	51	7	38	6	
Clerical	2	1	5	1	
Professional	12	2	18	2	
11. <b>Family monthly income (Rupees)</b>					3.005 0.223
< 20000	51	52			
20000 to 50000	41	33			
>50000	8	15			

\* p value <0.05 for comparison between case and control group; All values in no.

The majority (65%) of the children in the case group had a mild level of mental retardation followed by moderate (18%), severe (10%) and profound mental retardation (7%). Normal palmar crease pattern was the most common type of palmar crease pattern noticed in both the study groups. The overall prevalence of abnormal palmar creases in children with mental retardation was 45% as compared to 15.5% in the control group (Table II); it is 47% in the right hand and 43% in the left hand in the case group (Table II) and was statistically much higher than that for the control group.

**Table II. Palmar crease patterns (right hand, left hand and both hands) in case and control groups**

Palmar crease pattern	Right hand		Left hand		Both hands	
	Cases (n=100)	Controls (n=100)	Cases (n=100)	Controls (n=100)	Cases (n=200)	Controls (n=200)
Normal	53 (53%)	85 (85%)	57 (57%)	84(84%)	110 (55%)	169 (84.5%)
Simian	27 (27%)	11 (11%)	27 (27%)	9 (9%)	54 (27%)	20 (10%)
Sydney	17 (17%)	4 (4%)	11 (11%)	7(7%)	28(14%)	11(5.5%)
Suwon	3 (3%)	0	5 (5%)	0	8 (4%)	0
p value*	<0.001*		<0.001*		<0.001*	

\* p value <0.05 for comparison between case and control group; All values in no. (%).

When two groups were compared for the abnormal palmar creases in individual hands, the case group had higher prevalence for abnormal palmar creases in both hands as compared to control group and this difference was statistically significant. None of the children in the control group showed the Suwon crease (Table II).

The case group was analyzed for correlation between the increasing severity of mental retardation and abnormal palmar creases, it was noticed that it was significant in the right hand, but not in the left hand (Table III, Table IV).

**Table III. Correlation of palmar crease patterns (right hand) with severity of mental retardation**

Level of I.Q.	Right hand				Total	p value*
	Normal	Simian	Sydney	Suwon		
Mild MR	36(55.4%)	20(30.8%)	6(9.2%)	3(4.6%)	65(100.0%)	0.002
Moderate MR	12(66.7%)	3(16.7%)	3(16.7%)	0	18(100.0%)	
Severe MR	2(20.0%)	1(10.0%)	7(70.0%)	0	10(100.0%)	
Profound MR	3(42.9%)	3(42.9%)	1(14.3%)	0	7(100.0%)	
Total	53(53.0%)	27(27.0%)	17(17.0%)	3(3.0%)	100(100.0%)	

\*p value <0.05 correlating palmar crease pattern with severity of mental retardation; All values in no. (%); I.Q.: Intelligence Quotient; MR: mental retardation.

**Table IV. Correlation of palmar crease patterns (left hand) with severity of mental retardation**

Level of I.Q.	Left hand				Total	p value
	Normal	Simian	Sydney	Suwon		
Mild MR	36(55.4%)	18(27.7%)	6(9.2%)	5(7.7%)	65(100.0%)	0.180
Moderate MR	11(61.1%)	5(27.8%)	2(11.1%)	0	18(100.0%)	
Severe MR	7(70.0%)	0	3(30.0%)	0	10(100.0%)	
Profound MR	3(42.9%)	4(57.1%)	0	0	7(100.0%)	
Total	57(57.0%)	27(27.0%)	11(11.0%)	5(5.0%)	100(100.0%)	

Values in no. (%); I.Q.: Intelligence Quotient; MR: mental retardation.

Table V shows the relationship of gender with palmar crease patterns. However no correlation of abnormal palmar creases was noticed with gender in both the groups.

**Table V. Correlation of palmar crease patterns (both hands) of case group with gender**

Palmar Crease Pattern	Males (150 hands)	Females (50 hands)	p value
Normal	80 (53.33%)	30 (60%)	0.310
Simian	39 (26%)	15 (30%)	
Sydney	23 (15.33%)	5 (10%)	
Suwon	8 (5.33%)	0	

All values in no. (%).

## DISCUSSION

Minor physical anomalies are morphological abnormalities of the cranio-fascial region and limbs that indicate deviant morphogenesis during the early development of the fetus.[11] Various genetic and environmental factors are considered to be important in their genesis. Abnormal dermatoglyphics and abnormal palmar creases are one of the minor physical anomalies commonly seen in persons with mental retardation.[12] Palmar creases are formed during the early development of a fetus i.e. between 7 to 14 weeks of gestation.<sup>9,10,13</sup> Any alteration in developing hands and brain during morphogenesis would lead to abnormal palmar creases and mental retardation.[13].

In our study, we had observed that the majority of the children with mental retardation had mild level of mental retardation i.e. 65%, while moderate, severe, and profound levels of mental retardation contributed 18%, 10%, and 7% respectively. These findings are consistent with the earlier studies from the West where mild mental

retardation constituted the major subgroup and profound mental retardation the smallest.[14,15] Similar trend is seen in the study from developing country Nepal.[16]

The major focus of our study was to find the prevalence of different palmar crease patterns in children with mental retardation and to compare those with normal children. Our findings suggest an overall prevalence of abnormal palmar creases to be 45% in the case group and 15.5% in the control group and the difference was statistically significant in terms of abnormal palmar creases. Detailed analysis of patterns of palmar creases revealed that normal palmar crease pattern was the most prevalent pattern in both the groups. The simian crease was found to be the most prevalent abnormal palmar crease followed by the Sydney crease and the Suwon crease in children with mental retardation. It is in keeping with the findings of previous studies from the West that also report that normal palmar creases are more prevalent than abnormal palmar creases and incidence of normal palmar creases is higher in persons with mental retardation as compared to their healthy counterparts. [17,18,19,20] Studies from India also report similar results i.e. the Simian crease is the most frequent abnormal palmar crease followed by the Sydney crease in children with mental retardation.[21,22,23,24] Study by Kiran et al in children with mental retardation found that the incidence of the Simian crease was 72.4% in males and 54.2 % in females while the incidence of the Sydney line was 19.75% in males and 41.7% in females. The investigators concluded that incidence of the Simian line and the Sydney line is higher in children with mental retardation, and the Simian line being more prevalent than the Sydney line.[21]

We further tried to analyze any correlation between the severity of mental retardation and different palmar crease patterns. Though there was a statistically significant correlation found for the same but it was only restricted to abnormal crease patterns in right palm. This differential finding of lateralization of abnormal palmar creases to the right palm can be an artifact of the small sample size. Further, the case group was constituted mainly by the children with mild mental retardation (65%) and children with other levels of mental retardation (35%) represented only small subsets of the group. So it is possible that if we had a larger sample of severe forms of mental retardation, results could have reflected more of such associations. To our best of the knowledge, no work is done in this particular area. To get more promising results large sample size should be evaluated.

Strengths of the present study are that we tried to assess different abnormal palmar creases like the Simian, the Sydney, and the Suwon creases in children with mental retardation which was not there in the previous studies. Previous studies focused on the Simian and the Sydney crease. We had also tried to assess the association of these creases with the severity of mental retardation. Comparison with the typically developing children further added strength to our study. The limitation of the present study is that majority of the case group comprised of a mild level of mental retardation. If a large sample of children with other levels of mental retardation were included than findings of association of severity of mental retardation with abnormal palmar creases could be better analyzed.

## CONCLUSION

The abnormal palmar crease patterns are one of the minor physical anomalies commonly associated with neurodevelopmental disorders such as mental retardation. Their presence may prompt clinicians for early screening and diagnosis and if needed timely institution of appropriate interventions may lead to better outcomes in affected children as well as alleviation of parental stress and burden.

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