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Original Research Article

DERMATOGLYPHICS STUDY IN CHILDREN WITH MENTAL RETARDATION

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ABSTRACT

Background: Mental retardation means persistently slow learning of basic motor and language skills during childhood and a below normal global intellectual capacity as an adult. Recently dermatoglyphic patterns have been utilized as a diagnostic tool in various disorders like mental retardation, diabetes mellitus, schizophrenia etc. Present study was undertaken to evaluate the dermatoglyphic features in mental retarded children.

Materials and Methods: The case control study was carried out in 100 mental retarded children and 200 children without mental retardation in the age group between 7 to 15 years. Comparison between the frequencies of finger print pattern of fingers and palms were made out on the basis of two groups in the time employing Chi- Square test.

Result: The dermatoglyphic finding observed in the present study in the mentally retarded children were high frequency of loop and arch patterns and a lower frequency of whorls. Palmar pattern frequency, loops in the third interdigital area, a higher total finger ridge count and absolute finger ridge count, a higher a-b ridge count, higher atd angle, a lower mainline index and increased frequency of simian crease and Sydney lines.

Conclusion: Dermatoglyphic markers can be used as a screening tool in early detection of mental retardation.

KEY WORDS: Dematoglyphics, Mental retardation, Loop, Finger print, Finger tip, Pattern.

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INTRODUCTION

Dermatoglyphics deals with the study of epidermal ridges and their configurations on the fingers, palm and sole. The word 'Dermatoglyphics" is derived from Greek word "Derma" meaning Skin and "Glyphic" meaning Carvings. The term dermatoglyphics was first coined by Cummin and Midlo in 1926. Each individual ridge configurations are unique and has been used for personal identification. The major advantage of the dermatoglyphics is that the epidermal ridge pattern on the hand and sole are fully developed at birth and remain unchanged throughout the lifetime of an individual and recording of their permanent impression can be accomplished rapidly, inexpensively and without any trauma to the patient[1].

Since there are definitive dermatoglyphic patterns established very early in life and rather at birth, it will be worthwhile to study the dermatoglyphic patterns of the children with

definite features of mentally challenged children with those of the healthy children. The genetic message contained in the genome - normal or abnormal is deciphered during the intrauterine period and is also reflected by dermatoglyphics.

Mental retardation(MR) is a common disorder which imposes medical, psychological and social burden. The incidence of mental retardation with an intelligence quotient below 70 is found to be 2-3% worldwide. About 4 per 1000 of general population are more severely handicapped with an I.Q below 50. Mental retardation means mental illness arrested or incomplete development of mind. It is a condition of sub average intellectual function combined with deficits in adaptive behavior. MR result from defect in structure and function of neuronal synapse[2]. Chromosomal aberration accounts for about 15% of mentally retarded individuals. The etiologic factors contributing to human developmental problems may be prenatal, perinatal and postnatal. There may be environmental, psychological, sociocultural and genetic risk factors.

Taking into consideration the genetic predisposition of dermatoglyphics and mental retardation, the present study was undertaken to evaluate the dermatoglyphics features and note any specific variations or diagnostic feature in mentally retarded children.

MATERIALS AND METHODS

This case control study was done in 300 children, out of which 200 children who did not exhibit any mental deficiency were used as control and 100 mentally challenged children were included as cases after random selection from a private school for mentally challenged children in Nagercoil, Tamilnadu, India.

After getting approval from Institutional Human Ethical Committee, Sree Mookambika Institute of Medical Sciences, Kulaseharum, the study was further carried out by getting informed consent from the parents of the children who were recruited in this study.

For the dermatoglyphic study Ink method of Purvis- Smith(1969) was followed to record the finger and palm prints[3,4]. Children were directed to wash their hands with soap and water and wipe them dry with a towel. A small amount of printer's ink was applied on the inking slab and spread with a roller to a thin even film. The hand was pressed firmly against the slab. The smeared palm and fingers of both hands were then kept on the white bond paper with firm pressure on the dorsum of hand and interdigital area. The dermatoglyphic patterns were thus recorded and the following parameters were studied.

1. Qualitative analysis of finger tip patterns – whorls, loops and arches.

2. Quantitative analysis of finger prints- total finger ridge count(TFRC) and the absolute finger ridge count(AFRC)

3. Palmar pattern

4. a-b ridge count

5. atd angle

6. Mainline index

7. Sydney line and simian line

The dermatoglyphic patterns on right and left hand were analyzed according to sex and were subjected to statistical test to evaluate significant pattern. Chi-Square test was used to determine the distribution of the parameters among the two groups. This test was used to determine the comparisons between the healthy and mentally challenged children.

OBSERVATIONS AND RESULTS

On observing the finger tip patterns of the right hand of mentally retarded children, arches were more in the 1st, 3rd and 5th digits whereas 2nd and 4th digit had more loops compared to the controls who had more whorls in the 1st, 2nd, 4th and 5th digits and more loops in the 3rd digits [Table 1].

On observing the fingertip patterns of left hand of mentally retarded children, arches were more common in 1st, 3rd, and 4th digits whereas 2nd and 5th digit had more loops compared to the control who had more arches in the 2nd digit, more loops in the 1st, 3rd, 4th digit and more whorls in the 2nd & 5th digit [Table 2][Fig. 1].

Palmar pattern frequency in the interdigital area (D3) of right hand showed significant association (0.001). It was observed that mentally retarded children had more arches (10%) loops (24%) and whorls(10%), when compared with

Table 1: Percentage distribution of Finger tip pattern frequency in mentally retarded children and controls – right hand.

Finger Tip	Pattern	Mentally Retarded (100)	Control (200)	Total	Chi^2- Value	Significance
I	Arch	40 (40.0%)	14 (7.0%)	54 (18.0%)	60.04	0.001
	Loop	50 (50.0%)	107 (53.5%)	157 (52.3%)		
	Whorl	10 (10.0%)	79 (39.5%)	89 (29.7%)		
II	Arch	14(14.0%)	7{3.5%)	21(7.0%)	51.46	0.001
	Loop (ulnar)	83(83.0%)	112(56.0%)	195(65.0%)		
	Whorl	3(3.0%)	81(40.5%)	84(28.0%0		
III	Arch	44(44.0%)	13(6.5%)	57(19.0%)	65.78	0.001
	Loop	46(46.0%)	121(60.5%)	167(55.7)		
	Whorl	10(10.0%)	66(33.0%)	76(25.3%)		
IV	Arch	33(33.0%)	29(14.5%)	62(20.7%)	20.8	0.001
	Loop	54(54.0%)	106(53.0%)	160(53.3%)		
	Whorl	13(13.0%)	65(32.5%)	78(26.0%)		
V	Arch	11(11.0%)	14(7.0%)	25(8.3%)	18.67	0.001
	Loop	83(83.0%)	132(66.0%)	215(71.7%)		
	Whorl	6(6.0%)	54(27.0%)	60(20.0%)		

Table 2: Percentage distribution of Finger tip pattern frequency in mentally retarded children and controls – left hand.

Finger Tip	Pattern	Mentally Retarded (100)	Control (200)	Total	Chi^2- Value	Significance
I	Arch	39(39.0)	18(9.0%)	57(19.0%)	39.35	0.001
	Loop	44(44.0%)	123(61.5%)	167(55.7%)		
	Whorl	17(17.0%)	59(29.5%)	76(25.3%)		
II	Arch	20(20.0%)	8(4.0%)	28(9.3%)	38.64	0.001
	Loop	70(70.0%)	115(57.5%)	185(61.7%)		
	Whorl	10(10.0%)	77(38.5%)	87(29.0%)		
III	Arch	31(31.0%)	13(6.5%)	44(14.7%)	40.6	0.001
	Loop	57(57.0%)	116(58.0%)	173(57.7%)		
	Whorl	12(12.0%)	71(35.5%)	83(27.7%)		
IV	Arch	21(21.0%)	22(11.0%)	43(14.3%)	5.942	0.051
	Loop	59(59.0%)	125(62.5%)	184(61.3%)		
	Whorl	20(20.0%)	53(26.5%)	73(24.3%)		
V	Arch	10(10.0%)	16(8.0%)	26(8.7%)	11.48	0.003
	Loop	80(80.0%)	130(65.0%)	210(70.0%)		
	Whorl	10(10.0%)	54(27.0%)	64(21.3%)		

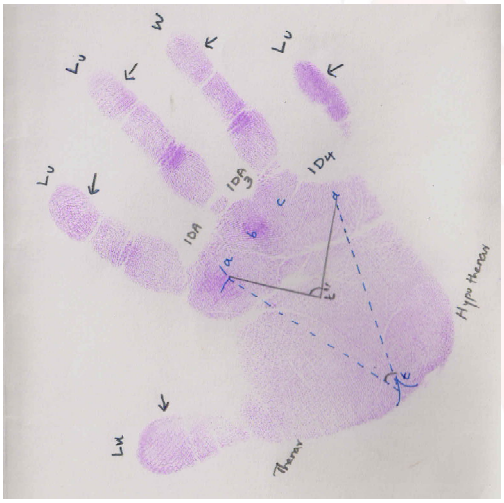


Fig.1: Right hand palm print of a Mentally retarded child having ulnar loops in the first, second, third and fifth digits(Lu). atd angle t" > 56. Palmar pattern (loop) frequency mainly in the third interdigital area.

Table 3: Palmar pattern frequency in mentally retarded children and control- right hand.

Interdigital areas	Pattern	Mentally Retarded(100)	Control(200)	Total	Chi^2- Value	Significance
D2	Arch	0 (0.0%)	4 (2.0%)	4 (1.3%)	3.508	0.32
	Loop	15 (15.0%)	21 (10.5%)	36 (12.0%)		
	Whorl	3 (3.0%)	4 (2.0%)	7 (2.3%)		
	None	82 (82.0%)	171 (85.5%)	253 (84.3%)		
D3	Arch	10(10.0%)	4(2.0%)	14(4.7%)	42.125	0.001
	Loop	24(24.0%)	16(8.0%)	40(13.3%)		
	Whorl	10(10.0%)	3(1.5%)	13(4.3%)		
	None	56(56.0%)	177(88.5%)	233(77.7%)		
D4	Arch	0(0%)	3(1.5%)	3(1.0%)	10.058	0.018
	Loop	19(19.0%)	15(7.5%)	34(11.3%)		
	Whorl	2(2.0%)	4(2.0%)	6(2.0%)		
	None	79(79.0%)	178(89.0%)	257(85.7%)		
Hypothenar	Arch	0(0%)	3(1.5%)	3(1.o%)	2.704	0.439
	Loop	8(8.0%)	11(5.5%)	19(6.3%)		
	Whorl	4(4.0%)	5(2.5%)	9(3.0%)		
	None	88(88.0%)	181(90.5%)	269(89.7%)		

Table 4: Palmar pattern frequency in mentally retarded children and control – Left Hand.

Interdigital areas	Pattern	Mentally Retarded	Control	Total	Chi^2- Value	Significance
D2	Arch	1(1.0%)	9(4.5%)	10(3.3%)	3.522	0.318
	Loop	16(16.0%)	23(11.5%)	39(13.0%)		
	Whorl	5(5.0%)	11(5.5%)	16(5.3%)		
	None	78(78.0%)	157(78.5%)	235(78.3%)		
D3	Arch	7(7.0%)	1(0.5%)	8(2.7%)	43.343	0.001
	Loop	27(27.0%)	12(6.0%)	39(13.0%)		
	Whorl	9(9.0%)	10(5.0%)	19(6.3%)		
	None	57(57.0%)	177(88.5%)	234(78.0%)		
D4	Arch	1(1.0%)	5(2.5%)	6(2.0%)	2.544	0.467
	Loop	11(11.0%)	15(7.5%)	26(8.7%)		
	Whorl	5(5.0%)	6(3.0%)	11(3.7%)		
	None	83(83.0%)	174(87.0%)	257(85.7%)		
Hypothenar	Arch	0(0%)	5(2.5%)	5(1.7%)	3.306	0.347
	Loop	7(7.0%)	15(7.5%)	22(7.3%)		
	Whorl	7(7.0%)	9(4.5%)	16(5.3%)		
	None	86(86.0%)	171(85.5%)	257(85.7%)		

those of controls. But in D2,D4 and hypothenar areas significant differences were observed [Table 3].

Palmar pattern frequency in the interdigital area (D3) of left hand showed significant association (0.001). It was observed that mentally retarded children had more arches (7%) loops (27%) and whorls(9%), when compared with those of controls. But in D2, D4 and hypothenar areas significant differences were observed [Table 4].

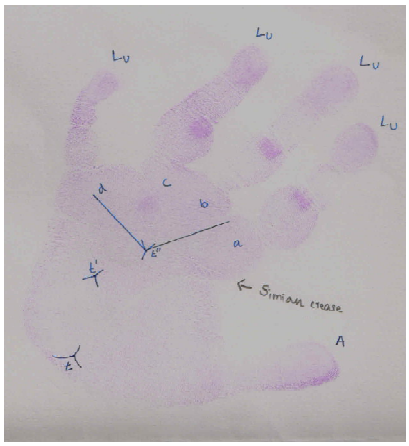
The TFRC(Total finger ridge count) was found to be higher in right hand of MR children with the mean and Standard deviation of 73.94±13.20 and in control it was 70.24±14.05. On observing, the AFRC (Absolute finger ridge count) was significant in the MR group with mean ± standard deviation values of 94.42±19.25 compared to the control with value of 81.72±19.79 in right hand. The a-b ridge count was statistically significant with mean ± standard deviation value in MR children was 25.63±5.87 and in control was 15.17±4.17 in the right hand.

The TFRC was found to be higher in left hand of MR children with the mean and Standard deviation of 87.24±13.89 and in control it was 69.83±13.18. On observing the AFRC, it was significant in the MR group with mean ± standard deviation values of 107.34±19.38 compared to the control with value of 83.57±20.07 in the left hand. A significant difference was observed between mentally retarded children and controls of left hand in their a-b ridge count.

MR children had a significantly highest value 25.23±5.13 whereas controls had lower value 14.68±3.40.

A significant difference was observed in the right and left hands of MR children and control in their atd angle, with the mean and standard deviation of 80.31±3.99 and 76.61±7.509 respectively in the MR children and 39.46±4.37 and 39.56±4.39 respectively in the control group. [Fig. 2]

Fig. 2: Palm print of a Mentally retarded child showing simian crease and ulnar loops in 2nd, 3rd, 4th and 5th digits and increased atd angle.



Mainline index was found to be lower in the right and left hand of mentally retarded children with mean and standard deviation of 14.86±2.87 and 16.44±3.80 respectively where as controls were found to have higher mean and standard deviation of 26.22±3.91 and 28.31±3.80 respectively.

Abnormal palmar crease type (Sydney line and

simian crease) were found in 43% in MR children and was absent in control group in both hands. [Fig.3]

Fig. 3: Palm print of a Mentally retarded child showing simian crease.

DISCUSSION

The study of various dermatoglyphic features and its evaluation has been of value in screening variety of disorder which could be either chromosomal or genetic. The selection of cases for evaluation is of importance. It is necessary to conduct all findings based on sex and side.

In the fingerprint pattern, there was an elevated frequency of ulnar loops noticed in MR group than any other finger tip pattern. The elevated frequency of loop associated with decrease of whorls which is also similar to the observation made out by Holt [5] and Shiono et al [6]. A marked increase in the ulnar loop on the fingertips is virtually a constant feature of the dermatoglyphics in Down's syndrome. Some authors found no significant sex difference in the frequency of fingertip patterns between males and females with Down's syndrome [7, 8, 9, and 10]

In this study, maximum frequency of palmar patterns in the mentally retarded children were seen in the third interdigital area and minimum pattern in hypothenar area which was a very significant finding. The increased ulnar loop in the third interdigital area was also reported by Kim DK et al [11].

Total finger ridge count and absolute finger ridge count were found to be significantly higher in the mentally retarded children than in control. This is similar to the observations of Saxena Mathur [12] but lower values were reported by Alter and Bruhl [10] and Sontakke BR et al [13].

A statistically significant increase in mean value of atd angle in mentally retarded children of both sexes were observed in our study. Similar findings were reported by Vashist yadav [14], Alter et al [10], and Kim Dk et al [11]. a-b ridge count is statistically higher in mentally retarded children than in controls but decreased a-b ridge count was reported by Rosa A et al [15], Shiono H et al [16] and Sontakke BR et al [13].

Regarding the mainline index, mentally retarded children of both sexes of the present study showed lower values than those of control children. Similar findings were noticed by Purandare et al [17]. Since the mainline index reflects the ridge direction, a high value indicates a tendency for the palmar ridge direction to be horizontal [18].

An increased tendency towards palmar creases such as single transverse palmar crease (simian crease) and Sydney line were seen in MR children [10, 19, 20, and 21]. Plato et al reported increased frequencies of Sydney lines in Down's syndrome [22].

CONCLUSION

With these inexpensive and noninvasive screening procedures the doubtful cases such as preschool children with lack of abilities to perform skills, school age group with lack of learning ability and older children with inability to lead an independent life can be spotted out and trained adequately.

ABBREVIATIONS

MR- Mental Retardation

D2- 2nd interdigital area

D3- 3rd interdigital area

D4- 4th interdigital area

AFRC- Absolute Finger Ridge Count

TFRC- Total Finger Ridge Count

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Conflicts of Interests: None

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