

# Axial triradius as a preliminary diagnostic tool in patients of mental retardation

M Vashist, R Yadav, Neelkamal, A kumar

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## Abstract

Mental Retardation (MR) is a life long human disability characterized by impairment of cognitive and adaptive skills. The degree of impairment is divided into mild (IQ 50-70), moderate (IQ 35-50), severe (IQ 20-35) and & IQ <20 are profound. In the present study dermatoglyphics of 500 mentally retarded and normal individuals of different age group and sex was analyzed for axial tri-radius from prints of left and right palms. Significant difference in the total t' angle of the left palm was observed between mentally retarded patients and control group. At d angle varied from 30° to 65° in normal individuals, where as in case of mental retardation < 30° to > 65° angle variation was observed. Patients who had delayed development, tri radius't' was shifted distally and at d angle was increased. Unusual dermatoglyphics in patients with various defects in chromosomes as well as other disorders have been reported in earlier studies. Appropriate evaluation of the various dermatoglyphic features in mentally retarded patients shall lead to acceptance as a diagnostic tool and serving in the study of human developmental biology.

## INTRODUCTION

Mental retardation (MR) is a common disorder which imposes a large medical, psychological and social burden. It affects about 3% of population, yet the pathogenesis is poorly understood. The degree of impairment of mental retardation has a wide range. It is generally divided into mild (IQ 50-70), moderate (35-50) and severe (IQ 20-35). Those cases in which the IQ is below 20 occasionally defined as profound. There are several hundred disorders associated with mental retardation. Most genetic disorders are difficult to diagnose but a patient's physical features and family medical history can provide valuable clues that may indicate the presence of a genetic disorder. In an individual, the presence of several unusual physical features can be associated with genetic disorders<sup>1</sup>.

Dermatoglyphics is literally, descriptive of patterns formed by epidermal ridges on fingers, palms and soles.

Dermatoglyphics may not be independent field of study but in many respects, it has been used as vehicle to resolve broader biomedical problems. It is a non invasive & non painful method of diagnosis. Dermatoglyphics aberrations do not suggest a specific disorder. It provides incentive to perform other test or reexamine the results of test of considered having normal. The phenogentic aspects of dermatoglyphic changes in aneuploidy syndromes are detailed studied by quantitative aspects. Cummins (1936)

has pointed out occurrence of a set of characteristic dermatoglyphic features (DGFs) in Down's syndrome patients like single transverse palm crease, wide at d angle in palm, increased occurrence of ulnar loops and a corresponding decrease in the frequency of the other three patterns i.e. whorl, radial loop and arch.<sup>2</sup> Dermatoglyphics assumed a role in medical research and diagnostic investigation and have gained the relationship between epidermal ridge configurations and specific medical disorders.

In clinical genetics, dermatoglyphics studies are of primary importance in chromosome abnormalities, limb formation. In many disorders, both chromosomal and non chromosomal, aneuploidy and polyploidy syndromes dermatoglyphics have been successfully employed<sup>3</sup>.

Studies indicate the evaluation of data of specific physical features may be responsible for improved yield in data analysis of chromosomal anomalies<sup>1</sup>. Reports of unusual dermatoglyphics in patients with chromosomal defects as well as other disorder continue to appear with considerable frequency. It has potential diagnostic value and significance to human developmental biology.

## MATERIAL AND METHOD

In the present study dermatoglyphics of 500 each of

mentally retarded patients and control group were analysed. Prints of fingers and palms were taken with ink pad method using black ink<sup>4,5</sup>. Dermatoglyphic data of normal individuals were taken as control group.

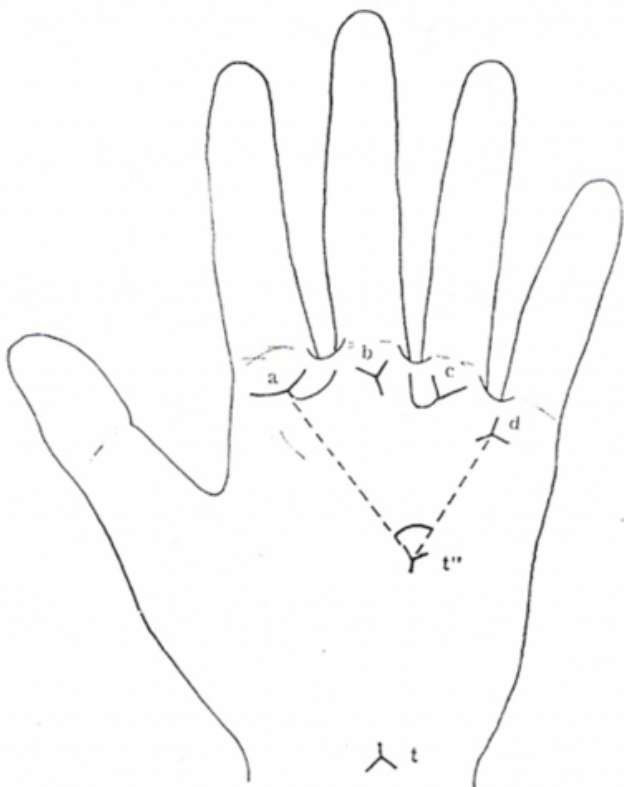
**ATD ANGLE MEASUREMENT**

For atd angle measurement, entire palm was inked including wrist creases and hypothermal border. Sheet of paper was placed on foam rubber pad on a flat stable surface. Pressure was applied to the back of hand to fill the concavity of palm otherwise black areas will appear in the centre of palm. Wrist of the person was placed on the bottom of paper and then the rest of the palm was pressed on the paper. Back of the hand was pressed down

firmly for printing the centre. These palm prints were carefully observed for atd angle. The atd angle formed between lines drawn from the triradii at the base of index and little finger to the axial triradius was measured. Axial triradius was designated as t and 't' or "t'" (Fig. I) depending upon the proximity to the lower margin of the palm<sup>6</sup>.

**Figure 1**

FIGURE I: Palm print and atd angle (t and t')



The value of the angle of less than 45° corresponding of the axial triradius was designated as t, values intermediate to 45° and 56° as 't' and values above 56° as t''<sup>7</sup>. [Fig. II & III]. The

student 't' test was used for statistical analysis and to find out any correlation between axial triradius and mental retardation.

**Figure 2**

FIGURE II: Palm print of mentally retarded (MR) having atd angle t' (45 to 56) and t''(>56)



**Figure 3**

FIGURE III: Palm print of control or normal person having atd angle t (



**OBSERVATIONS AND RESULTS**

In present study of 500 patient’s angle t was seen in 47.4 %, t’ in 24.8% and t’’ in 27.8% of right palm of mentally retarded patients, whereas in control group their frequency were 74.8 %, 21.0% and 4.2% respectively (Table 1).

**Figure 4**

Table 1: Percentage frequency of different atd angles (t, t’, t’')

Palm of individuals	t		t’		t’’	
	C	MR	C	MR	C	MR
Right	74.8	47.4	21.0	24.8	4.2	27.8
Left	78.0	45	22.0	22.8	-	31.6
Average	76.5	46.2	21.5	23.8	4.2	29.7

C-Control or Normal, MR-Mentally Retarded

Significantly the left palm showed maximum difference between cases of mental retardation and control group. The frequency of t was 78% in control group and 45% in mentally retarded patients, where as t’ had the same frequency in both groups considered. No case had t’’ in control group where as it showed a value of 31.6% in the cases of mental retardation (Table 1).

Atd angle calculated from the palm prints of control group and mentally retarded patients was grouped into nine different classes ranging from <30 ° to > 65°. Remarkable variations were observed in all the classes. In right palm 27% of mentally retarded patients showed angle greater than 65° (Fig. II) while 1.2% showed angle less than 30°, whereas angle < 30° and > 65° was not formed in control group (Fig III). Similarly in left palm 22.2% of mentally retarded patients showed > 65° and 3.6 % showed angle <30°, whereas angle <30° & > 65° & maximum individuals had angle range between 35° -45° (Table 2).

**Figure 5**

Table 2: Percentage frequency of different atd angle range of mentally retarded (MR) and control group(C).

atd angle range	MR (Right)	MR (left)	Control (Right)	Control (Left)
<30	1.2	3.6	-	-
30-35	7.6	8.2	8.4	3.2
35-40	24.6	22.0	40.6	36.0
40-45	20.4	20.0	33.2	36.0
45-50	9.4	11.2	6.0	8.6
50-55	3.4	4.2	9.0	13.6
55-60	3.4	4.6	2.4	2.6
60-65	3.0	4.0	0.4	-
>65	27.0	22.2	-	-

Percentage frequency of angle range between 55 °-60 °, 60°-65 °, and > 65° of left hand of mentally retarded cases and control group showed highly statistical significant value at 0.1% level (Table 3,4).

**Figure 6**

Table 3: Quantitatively analyzed atd angle range of left palms of mentally retarded (MR) and control group

Atd angle	Left (Control group) mean±SD	left(MR) mean±SD
<30	-	26.8±1.196
30-35	33.312±1.62	33.45±1.39
35-40	38.19±1.51	38.45±1.55
40-45	43.11±3.17	43.01±1.422
45-50	47.75±1.31	47.633±1.71
50-55	53.00±1.32	52.76±1.33
55-60	57.76±1.091	57.73±1.42***
60-65	-	62.5±1.00***
>65	-	79.53±6.85***

\*\*\*highly significant p<0.001

**Figure 7**

Table 4: Quantitatively analyzed atd angle range of right palms of mentally retarded (MR) and control group.

Atd angle	Right(control group) mean±SD	Right(MR) mean±SD
<30	-	26.5±1.224
30-35	33.47±1.48	33.58±1.37
35-40	38.21±1.59	38.41±1.644
40-45	42.898±1.41	42.906±1.93
45-50	47.82±1.46	47.725±1.93
50-55	52.69±1.31	52.31±1.35
55-60	57.75±0.96	58.17±1.42
60-65	64±1.41	62.33±1.34
>65	-	78.95±7.37

Frequency of sum of total Atd angle (R+L) of mentally retarded patients and control group revealed non significant difference. However sum total of angle t value of left palm came out to be of great significance. (Table 5)

**Figure 8**

Table 5: Quantitative analysis of atd angle in mentally retarded (MR) and control (C) cases

Palm	M.R.	Control group
Right	48.989±16.06	48.124±10.84
Left	49.098±16.15***	45.474±9.14

\*\*\*highly significant p<0.001

**DISCUSSION**

In dermatoglyphics any deviation from normal pattern will be strong indicative of certain anomaly. However, the prints will not establish a diagnosis by themselves but they would prompt the physician to make a more thorough examination than usual to find out any hidden abnormality. In the present study of dermatoglyphics, more than 75% normal individuals showed the atd angle in the range of 35° – 40°, whereas only 4.2% persons had above 55°. Literature reports average angle of normal individual in range of 44.5°. Higher range of Atd angle was reported in some cases of mental retardation<sup>8,9,10,11</sup>.

Dermatoglyphics studied in present group of 500 patients of Haryana is first of its kind and remarkable significant figures were observed in mentally retarded as compared to earlier reports of dermatoglyphics from other regions<sup>9,11</sup>. Normal Atd angle range was from 30° to 65°, where as cases of mental retardation revealed a range of <30° to >65°. The pattern in hypothenar area may be the cause for presence of the distal triradius in palm of mentally retarded. Several approaches like this strongly influence diagnosis yield in the evaluation of an individual with mental retardation. Dermatoglyphics may act as a non invasive diagnostic & assessment tool for the mental retardation.

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**Author Information**

**Minakshi Vashist**

Associate Professor, Deptt. of Genetics, M.D.University

**Ritu Yadav**

Research scholar, Deptt. of Genetics, M.D.University

**Neelkamal**

Research scholar, Deptt. of Genetics, M.D.University

**Amit kumar**

Research scholar, Deptt. of Genetics, M.D.University