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MEASUREMENT OF THE ATD ANGLE IN THE PATIENT OF DIABETICS MELLITUS: A RELIABLE MARKER.

Clinical Anatomy

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ABSTRACT

Background: DM has been shown to be associated with certain dermatoglyphic traits and Indians in particular have been shown to be predisposed to DM. It can be used for early and inexpensive screening of individuals at risk for DM. Aim of present study was to measure the atdangle in the patient of Diabetics Mellitus and compare it with control. **Material & Methods:** The present comparative case control study was conducted in the Department of Medicine, Saraswati Medical College&Hospital, Unnao.100clinically diagnosed diabetic patients in study group werecompared with same age group of 100 non- diabetic patients. Patients with deformity of hand, Chromosomal abnormalities like Klinefelter's syndrome, Turner's syndrome etc. and diseases like congenital anomalies, neurological disorders, carcinomas and psychiatric diseases were excluded from the study. **Observation:** The mean atd angles were significantly lower in DM group and mean dat angles were significantly higher in DM group than controls whereas adt angles were significantly higher in left and significantly lower in right of the DM group ($p<0.05$). It was noted thatmean atd angles in both male and femaleparticipant was significantly lower in DM group in both hand and mean dat angles were significantly higher in DM than controls group; whereas adt angles in both male and female participants were higher significantly in left and insignificantly lower in right of the DM group ($p<0.05$). **Conclusion:** The mean Atd angles were significantly decreased in DM group, angle 'Adt' showed significant increase in left hand and mean dat angles were significantly increased in both hands of the cases as compared to controls.

KEYWORDS

Fingerprint, Dermatoglyphics, Diabetes Mellitus, atd Angle.

INTRODUCTION

The skin of palm of hands and plantarsurface of the feet is designed, and corrugated with ridges.[1] The epidermal ridges of these region formdifferent types of configuration. Theseconfigurations of epidermal ridges of palms, fingersand soles are known as dermatoglyphics.Dermatoglyphics (Fingerprints) refers to study of all features of ridged skin.[2] Cummins and Midlo first formulated this term in 1943, derived from Greek words "dermato" meaning skin and "glyphics" means carvings.[3] The ridged skin (also known as friction ridges skin) located on digit, and palmar surface of hands (well-known as fingerprints, and palm prints), andon plantar surface, and the toe of feet. It's believed that mechanical function of such ridges conveys the firmer grip, and prevents slippage,[4] and is also enhances the sense of touch.[5]

The epidermal ridges produce grooves on thesurface of the palm. In palm, in relation to base of II, III, IV, and V digit a,b,c, and dtriradius are located respectively. Axial triradiior 'ttriradii' generally found in axis of 4th digit.CumminD and Midlo in 1961 stated that axial triradiilies commonly near the point where the palm isconnected to the wrist, in the interval betweenthenar and hypothenar eminences.[6] The atd angle isformed by drawing lines from 'triradius a' to axialor 'ttriradius' and from 'triradius d' to axial or 'ttriradius'. The atd angle averages about 48º amongthe normal individuals. Atd angle is measured inadducted palm. The abducted palm gives moremeasurement by 10º. The instruction fordetermining the atd angle of the palm was given byPanrose in 1954.[7]

The patterns of the ridges that develop in palm aredetermined genetically.[8] Once established,the dermatoglyphic patterns stay unchangedthroughout life except in the dimension incommensurate to the growth of an individual.[1] Anydisturbance by the genetic factors could produce unusualor abnormal dermatoglyphics during intra-uterinelife.[9]

Dermatoglyphics are of considerable importance in anthropology, criminology, medicine, chromosome abnormalities such as Trisomy 21.[10] The study of the fingerprints as a method of identification is also known as Dactylography, or Dactyloscopy[11] and currently it is also known as the Henry-Galton system of identification. Dactylography is the process of taking the impressions of epidermalridges of the fingertips for the purpose of identification of a person. Epidermal ridges and their arrangement exhibit a number of properties that reflect the biology of an individual. Finger print patterns are statistically different between the sexes, ethnic groups and age categories. As dermatoglyphics and their components are genetically determined and the arrangement of the ridges remains constant through life, they have become of value as the supportive aid in diagnosis of hereditary disorders.[12]Dermatoglyphic patterns appear during thirdnever change in the life of an individual. Any abnormalities due to genetic or other factors express their effect before the end of fifth month of foetal development.[13] The Recent evidences have proved the basis for genetic contributions in diabetes mellitus and in various medical disorders. Hence dermatoglyphic variation is an essential investigation for its early diagnosis.[14]

Diabetes mellitus is non-communicable disease andsignificant public health problemthat occurs, when pancreas cannot yield enough insulin or when body cannot use the insulin effectively.[15] It is categorised by the high levels of glucose in blood, which might lead to the progressive damage in most tissues, and organs of body likeblood vessels, heart, eyes, skin, kidneys, and nerves.According to international Diabetes Federation, in year 2017 there were about 425 millionpeople having diabetes and expected to be more than 629million patients by 2045.[16] Symptoms of DM are generally less obvious, or absent. Therefore, disease might not be diagnosed for many years, until complications have already appeared.[16]DM has been shown to be associated with certain dermatoglyphic traits and Indians in particular been shown to be predisposed to DM.[17,18]It can be used for early and inexpensive screening of individuals at risk for DM.[19]Recently an Indian study indicated that dermatoglyphic abnormalities might be used as the diagnostic tool for predicting possibility of development of diabetes at a later date.[20]

Early diagnosis and appropriate treatment are very essential to inhibit long-term complications of disease (e.g. retinopathy, neuropathy, and nephropathy). The estimate of people with high-risk of emerging DM is valuable not only for the disease prevention but also to avert the disease complications. The aim of present study was to measure the atdangle in patient of Diabetics Mellitus as thereliable marker.

MATERIAL & METHOD

The present comparative case control study was performed to collect dermatoglyphic pattern in patients with diabetes and to compare same parameters in control group in Department of Medicine, Saraswati Medical CollegeandHospital, Unnao. A total 200 patients of clinically diagnosed diabetic (100) in study group patients were compared with same age group of 100 non- diabetic patients as control the group.

Inclusion Criteria:

Study group A (DM) include those patients having age above 25 years with fasting glucose level ≥7.0 mmol/l (≥126 mg/dl), symptoms of diabetics mellitus plus a random Blood glucose concentration ≥11.1 mmol/L(≥200mg/dl) or 2 – h plasma glucose ≥ 11.11 mmol/L (≥200mg/dl) during a 75g oral glucose tolerance examination. Control group include that case having age above 25 years having normal

blood pressure and normal blood sugar level.

Exclusion Criteria:
Patients with deformity of hand,Chromosomal abnormalities such asTurner's syndrome,Klinefelter's syndrome, etc. and diseases like congenital anomalies, neurological disorders, carcinomas and psychiatric diseases were excluded from the study.

Materials Used:
The materials used in present study were whitepaper, a clip board, printing ink, hand roller, a flatbottom container, optical grade hand lens with 4X &6X magnification, protractor, scale, spirit orturpentine oil and liquid soap. Dermatoglyphic printof palm was taken by "Ink and paper Method" asdescribed by "Cummin (1936)" and "Cummin andMidlo (1961)".

Measurement of atd Angle:
Position of "axial or t triradius" was identifiedfirst and then the "triradius a" and "triradius d" werelocated by the hand lens. Then the atd angle wasdrawn by joining lines from "triradius a" to "axial ort triradius" and from "triradius d" to "axial ort triradius". atd angle was measured with help ofa protractor in the palm. Atdangle was measured inright, and left hand separately. Then two values weresummed to get single value for an individual. Thenthe mean values were calculated for different group.[6] **[Figure No. 1]**

Statistical Analysis:
Data was analysed with SPSS (Statistical Package for Social Sciences) software version 23.0 (IBM, New York, USA). Data was summarized with descriptive measures like mean and standard deviation. Independent Sample t test was used to examine difference between adtangles in both groups. A p-value below 0.05 (P<0.05) was considered as statistically significant.

Observation
Table no 1 and figure no 2show the compression of male participants mean angle of study DM and control group, and it was noted thatmean atd angles in male paticipent was significantly lower in DM group in both hand and mean dat angles were higher significantly in DM than controls group; whereas adt angles in male participants were higher significantly in left and insignificantly lower in right of the DM group (p<0.05).

Table no 2 and figure no 3 show the compression of female participants mean angle of study DM and control group, and it was found thatmean atd angles in female participants was significantly lower in DM group in both hand and mean dat angles in female participants were higher significantly in DM than controls group; whereas adt angles in female participants were higher significantly in left side and insignificantly lower in right side of the DM group (p<0.05)

Table no 3 and figure no 4 shows the association of angles of right and left among DM and control groups where it was observed that mean atd angles was significantly lower in DM group and mean dat angles were higher significantly in DM group than controls whereas adt angles were significantly higher in left and significantly lower in right of the DM group (p<0.05)

DISCUSSION
Medical interest in dermatoglyphics developed only in the last few decades and knowledge of the type of deviations associated with various medical disorders can add appreciably to the diagnostic armamentarium of the clinician. Diabetes, Congenital heart disease, Mongolism, Down's Syndrome, Schizophrenia, Leukaemia, Thalassemia, are a few conditions to mention which utilized dermatoglyphics for its easy applicability, reproducibility, reliability, for early detection and management of high risk population.

In the present comparative case control study; we have aimed to measure the atdangle in Diabetics Mellitus patientand compare it with control. Dermatoglyphics parameters can be used not only for an early detection of these diseases but also in suggesting various control measures to prevent the ill effects of the diseases. The parameters studied will help to use in setting the dermatoglyphic markers for these diseases.

Table No 4 Different Studies Comparing Left, And Right Hand atd Angle Between DM And Controls With Our Findings

Authors (Year)	Side	DM Cases	Control	P value
Sharma MK &Sharma H[20] (2012)	Left	42.22 + 7.01	40.28 + 8.00	> 0.05 (S)
	Right	43.66 + 7.81	40.00 + 6.40	< 0.01 (S)
Trivedi PN et al[21] (2014)	Left	41.58±5.99	40.27±5.12	0.009(S)
	Right	43.87±8.43	40.81±5.16	0.002(S)
Ghosh JR et al[22] (2016)	Left	48.37±13.22	42.98±5.41	<0.05 (S)
	Right	49.23±15.49	43.12±7.17	< 0.05 (S)
Satabdi S et al[23] (2021)	Left	42.62 ± 2.91	42.1±3 2.8	0.043 (S)
	Right	42.81±2.86	42.43±2.58	0.109 (NS)
Present Study	Left	46.16±5.25	72.56±11.57	<0.001 (S)
	Right	46.72±6.89	51.38±7.24	<0.001 (S)

The present study noted the mean atd angles was significantly lower in DM group and mean dat angles were higher significantly in DM group than controls whereas adt angles were higher significantly in left and significantly lower in right of the DM group (p<0.05). In a similar study **Ojha P & Gupta G**[24]alsoreported thestatistical difference in tad angle, atd angle, tda angle in their prospective study. **Lekshmi AP et al**[25] **reported** thefrequency of triradius is more in diabetics.While **SudagarM et al**[26]reportedmean value of atd angle is slightly decreased in diabetic patients (P >0.05). The frequency of t and t' are increased (P >0.05, P >0.05) and the frequency of t" is decreased (P >0.05) in diabetic patients but they are not statistically significant.

Our study quoted 'atd' angles in hands of both the sides in patients (DM) were increased in all groups, except 'adt' angles in both males and female (right side) but they significantly differed on left side (overall, p<0.01). In a similar study **Sharma MK & Sharma H**[20]reported 'atd' angles in hands of both the sides in DM were increased in all groups except in males (on left side) but they significantly differed on right side (overall, p<0.01) and on left side (female; p<0.001). The 'tad' and 'tda' angles on both the sides of hands in all groups were lower in DM patients except in the males (left 'tda') but they only significantlydiffered in females (left 'tad' p<0.01). **Bichitrananda R et al**[27]concluded theaxial triradius t also proved to be most reliable and significant parameter in case of the DM patients irrespective of sex. Both females and males diagnosed as the cases of DM possessed t' or t" on their palms irrespective of side of hands.

Although a few researches have been embark on to establish an association between DM with dermatoglyphics (adt angle), the results obtained so far have been ambiguous. Contradictory results have been observed mostly from different populations due to a vast difference among the patterns in various populations.

Limitation And Recommendation:
Our study was done at single centre with small sample size; it is not a representative of entire population group. More extensive research is required for the establishment of dermatoglyphics as screening tool. Findings of the our study indicated that there is the need for study with larger sample size, and with more diverse population to observe role of fingerprint pattern expression as help to screening strategies for DM.

CONCLUSION:
The mean atd angles were significantly decrease in DM group, angle 'adt' showed significant increase in left hands and mean dat angles were significantly increase in both hands of cases as compared to controls.The dermatoglyphic study is completely cost-effective and no need of hospitalization and it might help in identifying the phenotype of a promising future illness. Our study would be supportive to frame counselling messages behalf on dermatoglyphic pattern predominant (adt angle) among young generation and their probable stimulation to regulate the young people's likelihood to grow diabetes in their later age. It may be used for mass screening program for stoppage of DM.

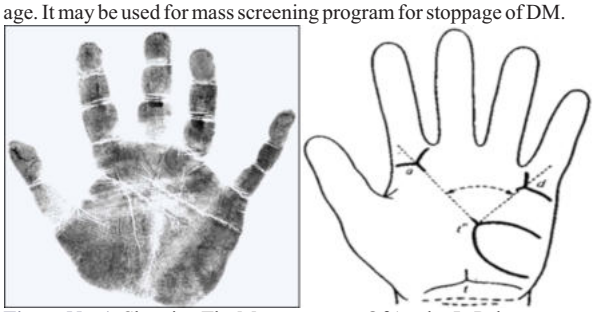

Figure No. 1: Showing The Measurements Of Angles In Palm

Table No. 1: Compression Of Male Participants Mean Angle & SD Of Study Group DM And Control

		DM (N=100)	Normal (N=100)	P value
Angles Right	atd Angles	46.40±7.36	51.68±7.76	<0.001 (S)
	adt Angles	71.88±10.57	73.62±9.27	0.384 (NS)
	dat Angles	59.80±7.23	56.70±7.11	0.033 (S)
Angles Left	atd Angles	47.04±5.41	72.46±11.61	<0.001 (S)
	adt Angles	70.00±11.34	58.84±4.95	<0.001 (S)
	dat Angles	62.72±10.63	30.82±9.14	<0.001 (S)

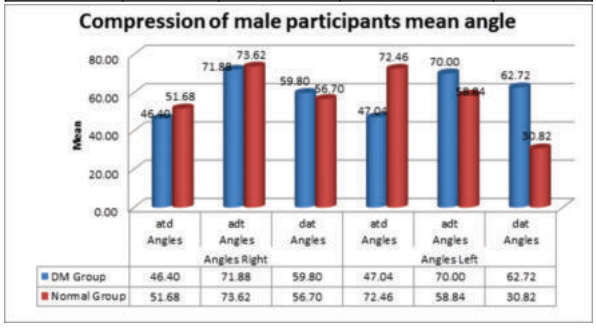

Figure No 2: Bar Chart Shows The Male Participants Mean Angle In Group DM And Control

Table No. 2: Compression Of Female Participants Mean Angle & SD of Study Group DM And Control

		DM (N=100)	Normal (N=100)	P value
Angles Right	atd Angles	47.04±6.44	51.08±6.75	0.003 (S)
	adt Angles	71.60±11.49	74.76±9.05	0.130 (NS)
	dat Angles	62.72±8.00	56.00±6.70	<0.001 (S)
Angles Left	atd Angles	45.28±4.98	72.66±11.65	<0.001 (S)
	adt Angles	75.28±7.43	58.80±4.94	<0.001 (S)
	dat Angles	61.68±6.34	32.68±12.21	<0.001 (S)

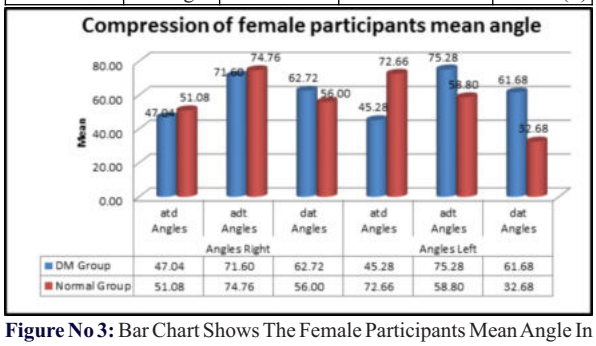

Figure No 3: Bar Chart Shows The Female Participants Mean Angle In Group DM And Control

Table No. 3: Compression Of Total Participants Mean Angle Of Study Group DM And Control

		DM (N=100)	Normal (N=100)	P value
Angles Right	atdAngles	46.72±6.89	51.38±7.24	<0.001 (S)
	adtAngles	71.74±10.99	74.19±9.13	<0.001 (S)
	datAngles	61.26±7.73	56.35±6.88	<0.001 (S)
Angles Left	atdAngles	46.16±5.25	72.56±11.57	<0.001 (S)
	adtAngles	72.64±9.90	58.82±4.92	<0.001 (S)
	datAngles	62.20±8.72	31.75±10.77	<0.001 (S)

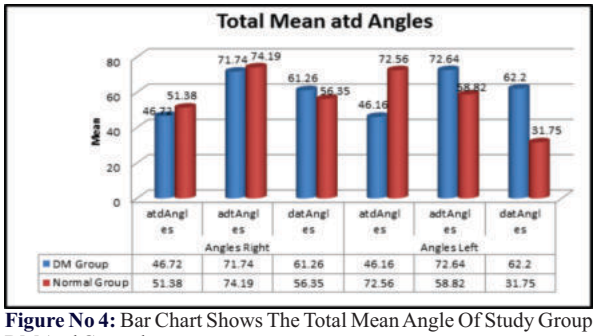

Figure No 4: Bar Chart Shows The Total Mean Angle Of Study Group DM And Control

Conflict Of Interest - No conflict of interest was declared.

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Ethical Clearance – Taken

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