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Study of dermatoglyphics in type 2 diabetic individuals in a teaching hospital, Telangana

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ABSTRACT

Background: Dermatoglyphic pattern, epidermal ridges found in the fingertips of the palm exhibits in various pattern like whorl, arch and loop. This pattern of arrangement develops by 22nd weeks of intrauterine life and persists all through the life without any change. Among the metabolic disorders available globally, Dermatoglyphics as a diagnostic aid is now well established in number of diseases which have strong hereditary basis and is employed as a method for screening for abnormalities.
Aim of the study: To study dermatoglyphics in type 2 diabetic individuals.
Materials and Methods: Prospective observational study for duration of one year from March 2019 to February 2020 at the Department of Forensic Medicine at Maheshwara Medical College and Hospital, Patancheru, Telangana. Dematoglyphics were studied in 50 known cases of type 2 diabetes mellitus and compared with normal, healthy, non diabetic age matched control individuals. The patterns on both palms were recorded by the Modified Ink Method and studied for finger tip pattern configuration, palmar pattern configuration, palmar a-b ridge counts and palmar atd angle.
Results: The patients were from 30 to 70 years age groups. There was increase in the frequency of whorls and decrease in loops in both the hands in diabetic individuals as compared to controls.
Conclusion: Dermatoglyphics is a noninvasive simple technique and can be used as an initial screening method to identify diabetic population.

1. Introduction

Dermatoglyphics (Fingerprints) refers to the study of all features of ridged skin.[1]

Cummins and Midlo first formulated this term in 1943, derived from the Greek words "dermato" which means skin and "glyphics" means carvings.[2]

The ridged skin (also known as the friction ridges skin) is located on the digit and palmar surface of the hands (known as fingerprints and palm prints) and on the plantar surface and the toe of the feet. It is believed that the mechanical function of these ridges conveys a firmer grip and prevents slippage[3] and is also believed to enhance the sense of touch.[4]

Diabetes is a serious and chronic disease that occurs, either when the pancreas cannot produce enough insulin, or when the body cannot use insulin effectively.[5]

It is characterized by high levels of glucose in the blood, which may lead to progressive damage in most tissues and organs of the body such as heart, blood vessels, eyes, kidneys, skin, and nerves. According to the international Diabetes Federation, in 2017 there were 425 million people with diabetes, and there are expected to be more than 629 million patients by 2045.[6]

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There are two types of diabetes mellitus; type 1 and type 2 (formerly known as insulin and non-insulin diabetes mellitus). The most common type of diabetes is type 2 diabetes (T2 DM) whcih accounts for almost 90% of diabetics. It was previously called non-insulin-dependent or adult-onset diabetes. Symptoms of T2 DM are often less obvious or absent. Therefore, the disease may not be diagnosed for several years, until the complications appear.[6]

Early diagnosis and treatment are very important to prevent long-term complications of the disease like retinopathy, neuropathy, and nephropathy. The prediction of people with high risk of developing T2 DM is useful not only for disease prevention, but also to prevent the disease complications.

Dermatoglyphics as a diagnostic aid is now well established in number of diseases which have strong hereditary basis and is employed as a method for screening for abnormalities.[7]

Apart from its use in predicting the diagnosis of genetic disease; dermatoglyphics is also used in forensic medicine in individual identification, physical anthropology, human genetics and medicine. Sir Galton Francis (1892) published a book "finger prints", which included the first classification of finger prints. He used ridge characteristics called 'minutea', still called Galton's details.[8]

2. Aim of the study

To study Dermatoglyphics in type 2 diabetic individuals.

3. Materials and Methods

This was a prospective observational study carried out over a period of one year from March 2019 to February 2020 in the department of Forensic Medicine and Toxicology at Maheshwara Medical College, Patancheru, Hyderabad, Telangana.

A total of hundred known cases of type 2 diabetes mellitus were selected by simple random sampling who visited the OPDs. Also hundred normal healthy non diabetic individuals were taken as control cases. There were no ethical issues involved in the study. Informed consent was obtained from all the participants included in the study.

3.1. Inclusion criteria for cases

1. Patients willing to participate in the study.
2. Patients aged 30-70 years of age.
3. Both genders.
4. Blood sugar level– Fasting >126mg% and postprandial 180mg%.
5. Absence of any other genetic disorders.

3.2. Inclusion criteria for controls

1. Patients willing to participate in the study.
2. Peoples with an age above 30 years.
3. Both genders.
4. Normal blood sugar levels.
5. No family history of diabetes mellitus.

3.3. Exclusion criteria

1. Patients not willing to participate in the study
2. Patients above 70 years of age

3.4. Methodology

A questionnaire was prepared for collection of data such as patient demographics which included age, history of present illness, past history, family history, personal history, any addictions such as smoking and alcohol.

3.4.1. Total of 100 participants were selected randomly as per above criteria

They were divided into n=50cases (with diabetes) and n=50 controls (with normal blood sugar levels) out of which half were males and half were females, their age distribution ranges from 31 to 70 years. All participants were explained about the procedure in detail. The patterns on both palms were recorded by the Modified Ink Method elucidated by Purvis Smith (1969).

Participants were asked to cleaned the hands with soap and water and then dried. Ink was placed on the ink slab and spread. The whole of the palm and fingers were smeared with ink by using the roller with light uniform strokes starting from the distal wrist crease to the finger tips, making sure the flexion creases, the ulnar margin, the central hollow of the palm and the finger tips are not devoid of ink. After inking, the palm was brought to the paper kept on the cylinder. The hand was rolled starting from the wrist and moving to the fingers with gentle pressure applied from the dorsal side by the operator. The individual fingertips were rolled from ulnar to radial side to obtain rolled finger prints. The procedure was repeated for the other hand.

Soon after the print was taken, it was examined for clarity in the different fingers and the palmar areas. The ink from hands was easily removed with water.

The data was entered and the printed sheets had name, age and gender for cases and controls. The prints were then subjected for detailed dermatoglyphic analysis with the help of magnifying hand lens and ridge counting was done with the help of a sharp needle. The details were noted on the same paper with pencil pen. The palmar prints were analyzed qualitatively and quantitatively.

The impressions were analyzed for finger and palmar qualitative and quantitative features. Quantitative dermatoglyphic parameters studied were individual finger ridge count for ten fingers, pattern intensity, total finger ridge count (TFRC), absolute finger ridge count (AFRC), in the fingertips, and a-b count, Atd angle.

3.4.2. a-b ridge count

The ridge count most frequently obtained is the a-b ridge count. Counting was carried out along a straight connecting the triradii 'a' and 'b'. The count excluded the ridges forming the triradii.

4. Observations and Results

In the present study it was observed that there was an increase in the frequency of whorls in both the hands in the cases when compared to controls. Whorls constituted 28 (56%) in the cases and 21 (42%) in controls of right hand. Whorls constituted 29 (58%) in the cases and 14 (28%) in the controls of left hand.

There was decrease in the loops in both hands in the cases when compared to controls.

In females, there was an increase in the frequency of whorls in both the hands in the cases when compared to controls. Whorls constituted 23 (46%) in the cases and 19 (38%) in controls of right hand. Whorls constituted 26 (52%) in the cases and 16 (32%) in the controls of left hand.

There was decrease in loops in both the hands in the cases when compared to controls. Loops constituted 21 (42%) in the cases and 23 (46%) in controls of right hand. Loops constituted 17 (34%) in the cases and 26 (52%) in the controls of left hand.

Males had significant reduction in arches in the right hand in comparison to females.

4.1. Palmar pattern configuration and Finger ridge count and Atd angle in diabetic population and non diabetic population

In the present study average of total finger ridge count measured in males was 72.6 in right hand, 73.6 in left hand and was increased when compared to male non-diabetics, where the average total finger ridge count was 66.0 on right hand and 68.1 on left hand. In the present study, average of total finger ridge count in females was 71.7 in right hand, 74.5 in left hand which was more as compared to non-diabetics females, which showed an average total finger ridge count of 65.0 on right hand and 66.1 on left hand.

4.2. Palmar a-b Ridge Counts

In the present study, the average a-b ridge count of diabetic patients in males was 35 on right hand, 36 on left hand in males and compared to non-diabetic males counted 33 on right hand and 36 on left hand. The average a-b ridge count of diabetic patients in females was 35 on right hand, 36 on left hand which was decreased when compared to females 36 on right hand, 37 on left hand.

Table 1: Age and gender distribution of cases and controls

Age distribution (in years)	**Males**	**Females**
30-40	08	08
41-50	10	10
51-60	**20**	**20**
61-70	12	12
Total	50	50

Table 2: Fingertip pattern configurations in males

Fingertip pattern in males	Right hand		Left hand	
	Cases	Control	Cases	Control
Whorls	**28 (56%)**	**21 (42%)**	**29 (58%)**	**14 (28%)**
Loop	**20 (40%)**	**25 (50%)**	**17 (34%)**	**29 (58%)**
Arch	02 (4%)	04 (8%)	04 (8%)	7% (14%)
Total	50 (100%)	50 (100%)	50 (100%)	50 (100%)

Table 3: Fingertip pattern in females

Fingertip pattern in Females	Right hand		Left hand	
	Cases	Control	Cases	Control
Whorls	23 (46%)	19 (38%)	26 (52%)	16 (32%)
Loops	21 (42%)	23 (46%)	**17** (34%)	26 (52%)
Arch	06 (12%)	08 (16%)	07 (14%)	08 (16%)
Total	50 (100%)	50 (100%)	50 (100%)	50 (100%)

4.3. Palmar Atd angle

In the present study, atd angle was wider in male diabetic patients ie, 37.8° on right hand, 37.5° on left hand and and when compared to non-diabetic males it was 36.6° on right hand, 36.5°on left hand. The atd angle in females had 36.4° on right hand, 36.9° on left hand when compared to non-diabetic (control) females, where it was 37.4° on right hand and 37.5° on left hand.

5. Discussion

5.1. Comparative studies related to Finger Pattern configuration

In the present study, there was an increase in the frequency of whorls and decrease in loops when compared to controls. Srivastava et al[9] observed similar findings in their study where they noted higher incidence of spiral whorls in both hands of male and female cases and a higher frequency of loops in both hands of controls. In a similar study done by Rakate NS et al[10] they too observed an increase in the number of whorls of both hands in males and females as compared with control group, while the frequency of ulnar loop was more in control group than diabetic patients. In the study by Sumangaladevi et al[11] ulnar loops showed maximum percentage frequency in both right and left hands of female patients and controls. Ulnar loops showed maximum percentage frequency in both right and left hands of male normal controls, whereas, whorls showed maximum percentage frequency in right and left hands of male patients.

5.2. Comparative studies related to the Total Finger Ridge Counts (TFRC)

In the present study, average of total finger ridge count measured in diabetic males was increased when compared to male non-diabetics and it correlates well with the studies of Rakate NS et al[10] and Srivatsava et al. While Rakate NS et al[10] study showed average of total finger ridge count measured in males more when compared to non-diabetic population and Srivatsava et al[9] observed the fingertip ridge counts to be higher in cases as compared to controls and Sumangaladevi et al study[11] observed the TFRC was high in normal females and decreased in patients. Panda et al (2004); Ravindranath et al (1995) showed increase in ulnar loop patterns in both sexes in diabetics but Sant et al (1983) showed decrease in ulnar loop in both sexes. Nayak et al (2015) showed no significant difference in the diabetics and control.

5.3. Comparative studies related to a-b ridge count

In the present study, the average a-b ridge count of diabetic patients in males was 35 on right hand, 36 on left hand in males and compared to non-diabetic males counted 33 on right hand and 36 on left hand. The average a-b ridge count of diabetic patients in females was 35 on right hand, 36 on left hand which was decreased when compared to control females 36 on right hand and 37 on left hand. In the study by Sudagar M et al[12] the maximum percentage of a-b ridge count was seen between 31-35 (34.6%) in diabetic males as compared to control males where it was seen between 36-40 (34.6%). The maximum percentage of a-b ridge count was seen between 31-35 (36%) in diabetic females as compared to control females where it was seen between 36-40 (35.3%).

Bala et al[13] showed higher mean a b ridge count in diabetics than control and highly significant in females. Similar findings were recorded by Oladipo and Ogunnowo.[14] A study done by Perumal and Manjunath[15] showed statistically significant decreased levels of mean right a-b and left a-b ridge count were observed in male Type 2 diabetes mellitus patients compared to normal male subjects and also decreased levels of mean right b-c, left c-d ridge counts in male Type 2 diabetes mellitus patients compared to normal male subjects but these values were statistically insignificant.

Sumangaladevi et al[11] also noted a-b ridge count to be decreased in female patients when compared to normal controls.

Rakate NS et al[10] reported the average a-b ridge count of diabetic patients as 36.00 on right hand, 37.00 on left hand in males and in females it was 34.66 on right hand and 35.33 on left hand which was more as compared to non-diabetic males which counted 34.42 on right hand and 35.44 on left hand; and in females it was 35.85 on right hand and 36.78 on leftt hand. Srivatsava et al[9] did not observe any significant difference in the scores between the cases and controls for these parameters for male and female subjects.

5.4. Comparative studies related to Atd angle

In the present study, the Atd angle was wider in male diabetic patients ie, 37.8° on right hand, 37.5° on left hand and when compared to non-diabetic males it was 36.6° on right hand, 36.5°on left hand. The Atd angle in females had 36.4° on right hand and 36.9° on left hand when compared to non diabetic (control) females where it was 37.4° on right hand and 37.5° on left hand.

Sudagar M et al[12] observed maximum percentage of Atd angle to be between 360-400 (49.3% and 46%) in both diabetic and control males but percentage-wise it differed. The maximum percentage of Atd angle was seen between 360-400 (42%) in diabetic females as compared to control females where it was seen between 410-450 (39%). In Rakate NS et al[10] study, the Atd angle was wider in diabetic male patients and was 37.98° on right hand and 38.34° on left hand. In females, it was 36.41° on right hand and 36.95° on left hand compared with non-diabetic where it was 37.98° on right hand, 39°on left hand and in females

it was 36.41° on right hand and 36.95° on left hand. Srivatsava et al[9] observed no significant difference in the scores between the cases and controls for these parameters for male and female subjects regarding Atd angle. Zieglar et al[1616]reported that there appear to be little agreement between the findings of various authors. Possible reasons are due to the small sample sizes chosen, incomplete diagnoses, control group inadequacy, statistical errors, and lack of open- mindedness in subjects.

6. Conclusion

Dermatoglyphics is a noninvasive simple technique and can be used as an initial screening method to identify diabetic population. In the present study there is increased number of whorl, decreased number of loops and arches in type 2 diabetes mellitus patients.

Dermatoglyphic investigation is absolutely cost effective and requires no hospitalization and it can help in predicting the phenotype of possible future illness. It can be used as a screening tool for early identification of at-risk individuals and prevent the further complications. Several studies done in different population have identified significant correlation between different fingerprint patterns and diabetes. However the type of pattern identified varies from one region to another. This may be because of racial dermatoglyphic differences from one population to the other.

7. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

8. Source of Funding

None.

References

1. Miller JR. Dermatoglyphics. *J Invest Dermatol*. 1973;60(6):435–42.
2. Newman HH. inger prints, palms and soles: An introduction to dermatoglyphics. In: By Harold Cummins and Charles Midlo. The Blakiston Co., Phila., xi + 309; 1943.
3. Bhat G, Mukhdoomi M, Shah B, Ittoo M. Dermatoglyphics: in health and disease - a review. *Int J Res Med Sci*. 2014;2(1):31–7.
4. Verbov J. Clinical significance and genetics of epidermal ridges-a review of dermatoglyphics. *J Invest Dermatol*. 1970;54(4):261–71.
5. World Health Organization. Global report on diabetes. 2016;.
6. Cho NH, Shaw JE, Karuranga S, Huang Y, Fernandes JDR, Ohlrogge AW, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res Clin Pract*. 2018;138:271–81.
7. Commins H, Midlo C. Finger prints of palms and soles. An Introduction to dermatoglyphics. New York: Dover pub; 1961.
8. Galton F. Finger prints. In: and others, editor. Facsimile Ed. vol. 1892. New York and London: Mac Millon;.
9. Srivatsava S, Burli S. A study of palmar dermatoglyphics in type 2 diabetes mellitus in a Bangalore based population. *Indian J Clin Anat Physiol*. 2019;6(1):118–25.
10. Rakate NS, Zambare BR. Comparative study of the dermatoglyphic patterns in type II diabetes mellitus patients with non diabetics. *Int J Med Res Health Sci*. 2013;2(4):955–9.
11. Devi KS, Ahmed MM. A Study of Dermatoglyphics in Insulin Dependent Diabetes Mellitus. *IOSR-J Dent Med Sci*. 2016;15(8):22–9.
12. Sudagar M, Radha K, Duraipandian K, KVKSundaravadhanam. Study of palmar patterns in diabetic patients. *Int J Adv Med*. 2014;1(2):117–22.
13. Bala A, Deswal A, Sarmah PC, Khandalwal B, Tamang BK. Palmar dermatoglyphic patterns in diabetes mellitus and diabetic with hypertension patients in Gangtok region. *Int J Adv Res*. 2015;3(4):1117–25.
14. Oladipo G, Ogunnowo BM. Dermatoglyphic patterns in diabetes mellitus in a south eastern Nigerian population. *Afr J Applied Zool Environ Bio*. 2004;6:6–8.
15. Perumal A, Manjunath KY. A study on inter digital area ridge count in type 2 diabetes mellitus. *Int J Res Rev*. 2016;3(3):21–4.
16. Ziegler AG, Mathies R, Mayer GZ, Baumgarti HJ, Rodewald A, Chopra V, et al. Dermatoglyphics in type 1 diabetes mellitus. *Diabet Med*. 1993;10(8):720–4.

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