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Cheiloscopy and Dermatoglyphics as Screening Tools for Type 2 Diabetes Mellitus in Lucknow Population – A Preliminary Study

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Abstract

Aim: The aim of this study is to assess the efficiency of Cheiloscopy and dermatoglyphics in patients with type II diabetes mellitus with non-diabetic as control group.

Materials and Methods: The study sample comprised 30 individuals in the age group of 30–60 years, of which fifteen were diabetics and fifteen controls who reported to the Department of Oral Medicine, Babu Banarasi Das college of Dental Sciences, Lucknow, Uttar Pradesh. Lip prints were collected and categorized based on the Suzuki and Tsuchihashi system. Fingerprint patterns were obtained and classified according to the Henry's system of classification.

Results: Type II and IV lip print patterns were predominant in Type II diabetic patients and Type I lip print patterns in controls. Increase in number of whorls type of fingerprint pattern in type II diabetes mellitus patients.

Conclusion: This inference may be widely applied clinically for the early diagnosis of type II diabetes mellitus mainly in a mass screening of a population. Application of Cheiloscopy as a potential biomarker in the early diagnosis of T2DM which can be used in mass screening. Further studies are needed to confirm the findings.

Keywords: Cheiloscopy, dermatoglyphics patterns, lip prints, fingerprints, type II diabetes mellitus

Introduction

Diabetes mellitus (DM) is a global disease, and the prevalence is increasing particularly in developing countries. It represents a major threat of the public health condition worldwide. Recent estimates indicate that there were 171 million people in the world with diabetes in the year 2000 and this is projected to increase to 366 million by 2030.[1] The vast majority of cases of diabetes fall into two broad etiopathogenetic categories – type I DM (T1DM) and T2DM. Clearly, T2DM has become an epidemic in the 21st century where India leads the world with the largest number of diabetic patients.[2] Indians are apparently genetically more prone to diabetes and insulin resistance.[3] T2DM is a complex disorder of general metabolism and is currently thought to occur in genetically predisposed individuals who are exposed to a series of environmental influences that precipitates the onset of disease. It accounts for approximately 90%–95% of all diabetes. The clinical symptoms of T2DM are varied, and there are fewer efforts among individuals to assess their biochemical levels of blood or urine for glucose. Furthermore, the cost involved in these assessments is high. It is estimated that in about 50% of affected people the disease is undiagnosed. [6] Individuals with undiagnosed T2DM are at increased risk of developing coronary artery disease, stroke and peripheral vascular disease. Untreated diabetes results in a series of complications. Hence, diagnosis at an early stage is key in modifying lifestyle and in early treatment

Dermatoglyphics is a Greek word which is derived from “derma” meaning skin and “glyphae” meaning carving.[4] It is the science and art of the study of surface markings/patterns of ridges on the skin of the fingers, palm, toes, and soles. Abnormalities in the ridge patterns may occur due to genetic alteration during organogenesis period, i.e., between 13th–60th day after fertilization of the ovum.[2] During development, once the epidermal ridges are formed, they are age and environment stable becoming a reliable indicator of genetic composition of the individual. Since many genes take part in the formation of dermatoglyphic characters, it is possible that genes which predispose to familial disease may, by pleiotropy, also influence the ridge pattern so that constellation of dermatoglyphic features may be characteristic of a particular disease.[5] Abnormal dermatoglyphic patterns have been observed in several non-chromosomal genetic disorders and other diseases whose etiology may be influenced directly or indirectly, by genetic inheritance. Dermatoglyphics as a diagnostic aid and supportive evidence in the diagnosis of several diseases such as diabetes, mongolism, schizophrenia, and leprosy has been reported in recent literature.[6]

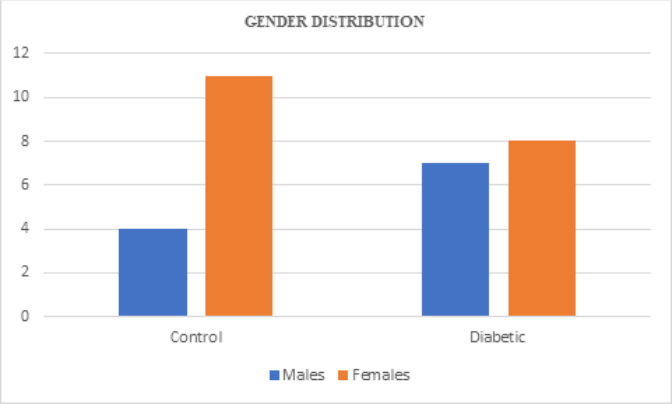
Cheiloscopy {Greek word: Cheilo-lips; skopien-to see) is the study of lip prints.[7] There are many well-known implanted methods of human identification based on these characteristics, and one of the most interesting emerging methods of human identification is human lips recognition. Lip print refers to imprint produced from lines and fissures in the form of wrinkles and grooves present in the zone of transition of the human lip between the inner labial mucosa and outer skin.[8] Importance of lip print patterns has been accentuated upon by Edmond Locard along with Le Moyne Snyder pertaining to their stable and permanent nature and ability to resist climatic change. Lip prints are analogous to fingerprints and can be used for personal identification since they are unique for individuals and do not change during the life of a person.[9] It has been verified that lip prints recover after undergoing alterations such as minor trauma, inflammation, and

herpes and that the disposition and form of furrows does not vary with environmental factors.[8] The biological phenomenon of system of furrows on the red part of human lips was first noted by anthropologist, R. Fischer in 1902. However, it was only in 1932 that Edmond Locard, one of France's greatest criminologists, recommended the use of lip prints in personal identification and criminalization.[10] Since then several studies have established the uniqueness of cheiloscopy.

With the increase in the prevalence of diabetes in recent times, there is a keen search in medicine for potential early biomarkers of the disease. Lip prints and fingerprints being genetically determined may serve as one of such biomarkers. Both Cheiloscopy and dermatoglyphic pattern analysis are closely related to genetics, biology, medicine, forensic sciences, and evolutionary history. Also, genetically determined traits, fingerprints, and lip prints may serve as a biomarker in screening diabetes. The analysis of lip prints and fingerprints are noninvasive and straightforward methods when compared with biochemical tests for T2DM. Many authors have studied the alliance between fingerprints and diabetes. However, studies on the association between lip prints and diabetes mellitus are inadequate. The present study attempts to evaluate the efficiency of Cheiloscopy and dermatoglyphics in patients with type II diabetes mellitus with non-diabetic as the control group.

Materials and Methods

Study Sample: The study sample comprised 30 individuals in the age group of 23–60 years, of which fifteen were diabetics (6 males and 9 females) and fifteen controls (4 males and 11 females) (Graph I) who reported to the Department of Oral Medicine and Radiology, Babu Banarasi Das college of Dental Sciences, Lucknow, Uttar Pradesh. Fifteen clinically diagnosed Type II Diabetic patients and fifteen healthy individuals without diabetes and without any family history of diabetes were taken as controls. Exclusion criteria: Eliminated co-morbid patients with associated cardiac, renal, and other life threatening diseases. Patients with inflammation, trauma, congenital deformity, or any other diseases of the lips and fingers, those with known hypersensitivity to lipstick and stamp ink and those with other systemic diseases were excluded from the study. The procedure of taking lip prints and fingerprints was explained to the patient. Informed consent was obtained from the participants prior to this study.



Graph 1: Gender Distribution in Control Group and Diabetic Group

Lip print Analysis

Procedure: The lips were first cleaned thoroughly. Lipstick was applied uniformly, starting from one end of the upper lip, and then moving laterally using an earbud. The same procedure was repeated for the lower lip. The earbud was discarded, maintaining strict aseptic conditions. The individuals were asked to gently rub his/her lips together to spread the lipstick evenly. The lipstick was allowed to dry for half a minute. The individuals were asked to retain a relaxed lip position, and the impression was taken on the glued portion of the cellophane tape. The tape was carefully removed without smudging, and the impression was stuck on plain paper.

[Figure 1] Cotton and Vaseline were used to remove the lipstick. After acquiring the pattern of the individuals, each of them was assigned a definite number and studied with a magnifying lens.

Figure 1: (a) lipstick application using ear bud; (b) obtaining lip print using cellophane sheet; (c) final lip print.

The classification of patterns of the lines on the lips proposed by Suzuki and Tsuchihashi[11] was followed, [Table 1] since it gives a clear description of nearly all the commonly encountered lip patterns.

Suzuki And suchihashi Classification

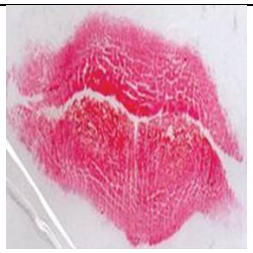
Type I Type I'	Clear-cut vertical grooves that run across the entire lips Similar to type I, but do not cover the entire lip	
Type II	Branched grooves	
Type III	Intersected grooves	
Type IV	Reticular grooves	
Type V	Grooves do not fall into any of type I–IV and cannot be differentiated morphologically (undetermined).	

Table 1: Lip print patterns in the study - Suzuki and Tsuchihashi system

Fingerprint Analysis

Procedure: Patients' hands were cleaned and dried before printing. The patients' fingerprint was collected by using a stamp pad, and the prints were made onto a plain paper. Prints were dried and studied using a magnifying lens to identify the fingerprints. The fingerprint patterns were classified according to the Henry's system of classification which categorizes fingertip patterns into loops, whorls, and arches.[12] [Figure 2]

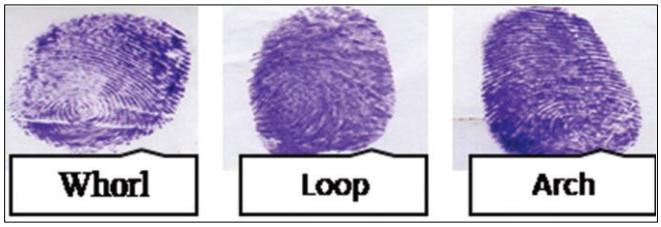


Figure 2: Fingerprint patterns in our study - Henry's system

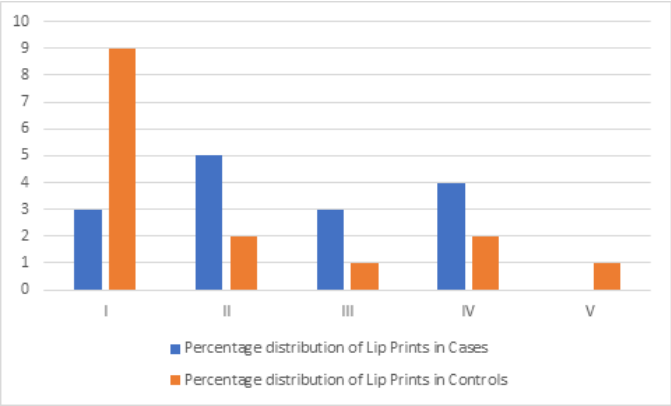
Results

Cheiloscopy patterns: Lip print patterns in diabetics and controls were classified into Type I, II, III, IV, and V. The percent distribution of each lip print pattern in people with T2DM were 20% Type I, 33% Type II, 20%

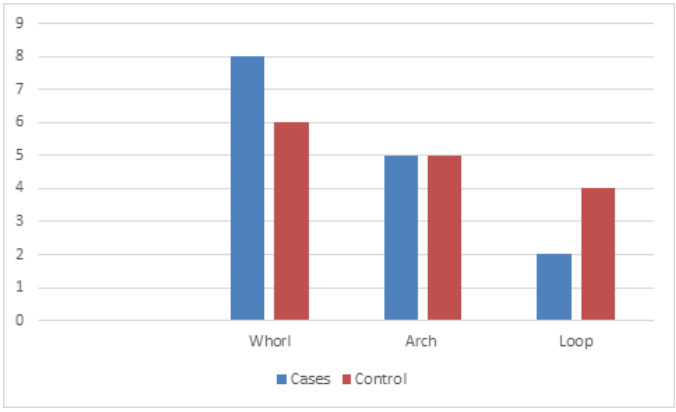
Type III, 27% Type IV and 0% Type V. In controls, 60% Type I, 13% Type II, 7% Type III, 13% Type IV, and 7% Type V. Type II and IV lip print pattern were predominant in T2DM patients and Type I lip print pattern in controls. The reticular, branched, vertical, followed by intersected patterns were observed in decreasing frequency among male subjects while among female subjects, branched, vertical, intersected, and reticular patterns were observed. However, no undifferentiated pattern was observed in male and female for the Diabetic subjects. Gender-wise analysis for lip print and fingerprint patterns did not yield significant results. [Graph II].

Dermatoglyphic patterns

The whorl loop pattern was found to be frequently present among both male and female subjects in both T2DM and control groups. [Graph III] This was followed by the arch type of pattern and loop pattern.



Graph II: Comparison of lip print patterns in cases and controls



Graph III: Distribution of fingerprint patterns in T2DM Group and Control Group

Discussion

Several authors have studied the Dermatoglyphic patterns in type II Diabetes Mellitus patients and their findings were matching with the observations of the present study. Sant et al[13] reported an increased number of Whorls and decreased number of ulnar loops in type II Diabetic mellitus patients. The prevalence of DM is rising at a deplorable rate worldwide. Diabetes was once considered to be a mild malaise of the elderly, howbeit presently, it is one of the prime causes of morbidity and mortality affecting the youth also. The WHO projects that diabetes will be the 7th leading cause of death in 2030.[14] Although diabetes confirmation by blood test is the most widely accepted and validated method, this provides a stressful situation for the patient and requires more time and resources. Hence, the situation warrants a reliable early biomarker which can be used for mass screening of a genetically vulnerable population like that in our country, while imposing lesser financial liability and providing greater patient comfort.

Lip prints and fingerprints are genetically determined and form a unique pattern for each individual. T2DM, having a strong genetic background, can be influenced by these dermatoglyphic features. Furthermore, lip print and fingerprint analysis are simple and non-invasive methods compared with biochemical tests for T2DM.

Record on the comparative study of lip print and fingerprint analysis with T2DM is exiguous in literature.

In the present study, it was found that the percent distribution of each lip print pattern in people with T2DM were 33% Type II followed by 27% Type IV, 20% Type I and 20% Type III. However, in controls, the maximum percentage was found for 60% Type I followed by 13% Type II, 13% Type IV, and 7% Type III and 7% Type V. Branched and Reticular type of lip pattern was significant in the diabetic group than healthy controls. In normal controls, clear-cut vertical groves (60%) and branched pattern (13%) were significantly higher than diabetics. These findings indicate the people with branched and reticular type of lip pattern are at higher risk of developing T2DM, however, the group of people with clear-cut vertical groves are less likely to develop this disease. There was no significant difference in fingerprint patterns between the study groups. In a study by Nadeem J. and T. Radhika[15] they found that Type II and IV lip print patterns were predominant in diabetic patients and Type I lip print patterns in controls. They also found no such significant difference in fingerprint patterns between the study groups, which corroborates with our study. Manjusha et al.[16] reported that Type IV pattern of lip prints was significantly more in the diabetic patients when compared to the normal controls, the study was conducted to assess the predictive role of Cheiloscopy on type II diabetes mellitus (T2DM) and showed a ray of hope for application of Cheiloscopy as a potential biomarker in the early diagnosis of T2DM.

Sant et al. reported an increased number of whorls and decreased the number of loops of fingerprint patterns in diabetic patients.[13] Study by Akshailekshmi and Anandarani showed the frequency of whorls was significantly more in diabetics, and the frequency of ulnar loops and arches were significantly less in both hands of male and female cases.[17] The present study also showed similar results with the higher number of whorls compared to loop and arch patterns. Srivastava and Rajasekhar found that there was an increased frequency of whorl pattern in both sexes which correlates with the present study.[18] Our study showed an increased frequency of whorl followed by arches and loop pattern. In contrast to our study, Burute et al. reported significantly higher frequency of arches in fingerprints of Type 2 diabetic females.[19] Manjusha et al. reported an increased frequency of loop pattern in a study in Kerala,[16] this contrasts with our study which showed whorl being more common among cases and controls.

We speculate that these variations may be attributed to several factors. The first factor could be the inclusion of insufficient subjects in the study. Abhilash et al. in a sample size of 1250 found that an individual's susceptibility to dental caries significantly increases with an increase in the whorl type of pattern.[20] They concluded that the dermatoglyphic patterns might be utilized to study the genetic basis of dental caries. Akin to dental caries, DM is a multifactorial disease in which genetic and environmental factors play in unison. Thus, there is still scope for further study on larger sample size. Other factors include the difference in the genetic make-up of individuals belonging to different geographical areas and variegated methodology used in various studies. Thus, there is still scope for further study on larger sample size. Other factors include the difference in the genetic make-up of individuals belonging to different geographical areas and variegated methodology used in various studies. The significant results of lip print pattern in the present study show a ray of hope for the application of Cheiloscopy as a potential

biomarker in the early diagnosis of T2DM which can be used in mass screening. The insignificant results of dermatoglyphics in T2DM call for further research on larger sample size.

Connotations for Clinical Practice

Dermatoglyphics and Cheiloscopy have proven to be handy, non-invasive, and economical tools for the preliminary diagnosis of suspected genetic origin diseases. Since Type 2 diabetes mellitus has a robust genetic consideration, and these could be influenced by dermatoglyphics and lip print patterns. An individual's dermatoglyphics and lip print patterns may be genetic markers. Personal identification is of utmost importance for unknown deceased persons in homicide, suicide, accidents, and most disasters. Their identification is also necessary for missing persons due to amnesia and culprits hiding identity. Thus, fingerprints and lip patterns can be used as a potential mass screening tool for Type 2 diabetes mellitus.

Conclusion

Type 2 and Type 4 lip print patterns were predominant in patients with Type 2 diabetes mellitus. Hence, Cheiloscopy can be used as a potential mass screening tool for Type 2 diabetes mellitus. Fingerprint patterns cannot be used as a screening tool for diabetes as there was no significant difference in fingerprint patterns between diabetics and controls. Lip print patterns are unique and are genetically determined. Just like dermatoglyphic patterns, lip prints also, do not undergo any alterations since birth till death of a person. They are permanent structures and do not undergo any change. They maintain their form along with dexterity. This study did not show that there is a definitive correlation between a specific fingerprint pattern along with lip print pattern in genetically type 2 diabetes.

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