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DERMATOGLYPHICS AND PERIODONTAL DISEASES-A POSSIBLE RELATION FOR EARLY PREDICTION?

Periodontology

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ABSTRACT

Periodontitis is a disease affecting the oral cavity resulting in loss of teeth and it is the second major cause after dental caries resulting in edentulism, the diagnosis of this disease at the earliest possible stage is key for its successful treatment. The diagnostic aids currently available are depending on evaluation of clinical signs and symptoms and the advanced diagnostics aid aim at evaluating microbial profile of the affected sites which are very expensive and cannot be used as a chair side aid. The prediction of a disease by any means may be really an indispensible tool when it comes to minimizing the morbidity of this disease, recent trails which were carried out to evaluate any possible link with the dermatoglyphics (finger print pattern) and susceptibility of an individual to a particular disease has yielded some valuable information in case of some medical conditions. This study deals with the search of any possible link between dermatoglyphics and periodontitis and evaluation of the applicability of previous study results in the participants of this study.

KEYWORDS

Dermatoglyphics, Diagnosis, Periodontitis, Prediction, Susceptibility

INTRODUCTION

Dermatoglyphics,according to Harold Cummins and Midlo in 1926 refers to the branch of science which studies the patterns of skins (dermal) ridges present on the fingers, toes and the soles of human[1]. The uniqueness of finger prints present on the individual was considered to be a an important identification mark of thet individual as it cannot be reproduced or matched with any other individual, this uniqueness has provoked a thought process of correlating the same with the medical, physical and psychological behavior of the particular person, there are some ancient civilizations in the human history which have used these same parameter for various other purposes such as utilizing them in the agreement copies of financial or land delaing as done in the ancient Chinese civilizations, ancient Indian civilizations have evolved a science known as palmistry which is known believed to predict the past and future of the individuals life and prospects of his health and wellbeing Fingerprints are formed between 13th to 19th weeks in the womb when the fetus is developing. These are developed in tandem with brain cells development.

There have been many efforts worldwide in the past and at present in the field of science and health to investigate this unique identification characteristic of an individual to assess his susceptibility/probability to identify and detect its value in diagnosis of various developmental and/or acquired disease at present or in due course of his life.

History of dermatoglyphics

history of dermatoglyphics dates bachk to 17th Century BC, where historians have discovered impressions recorded in clay frames as a record for legal matters.[2] Johann Christoph Andreas Mayer 1788 may the the first person who can be credited with the discovery of unique and individualized pattern of every individuals finger print, the next landmark study can be credited to Purkinje 1823.[3] Jan Evangelist Purkyn described nine distinct fingerprint patterns including loops, spirals, circles and double whorls.[4] Sir William Herschel began the collection of fingerprints in 1856. He noted the patterns to be unique to each person and not altered by age.[2] The first systematic study of the whole subject, however, was carried-out by Francis Galton around the year 1892. He divided the ridge patterns on the distal phalanges of the fingertips into three groups namely, arches, loops and whorls.[5,6]Lauter (1912) provided the history of the fingerprint system. Hersched (1916) traced the origin of the fingerprints. Cummins (1927) found the impression of a thumb print on clay. Cummins (1930) exhibited the first fingerprint carving of the stone age. De Forest (1930) traced dactyloscopy in the United States of America. Wilton (1938) published a book, Finger Prints History, Law and Romance. Myers (1939) provided the history of identification of fingerprints. Developmental process of dermatoglyphics

The patterns of elevations which appear as lines or ridges and linear or curved depressions starts forming in the early stages of intrauterine development and they are formed according to the genetic information which is shared by many genes spread over different chromosomes and few environmental factors may also play a role in this process, all these patterns develop in relation to Volar pads, which are elevations caused by mesenchymal tissues present over the proximal ends of metacarpals on each finger along with inter phallengal area,Thenar , hypothenar areas of palms and soles.

The presence of the volar pads as well as their size and position are to a large extent responsible for the configuration of papillary ridge patterns. For example, small pads would result in a simple pattern (arch) whereas more prominent pads would tend to lead to the development of larger and more complex systems of ridge configurations including loops and whorls.[7,8]

Dermatoglyphic pattern configurations in fingers

The ridge patterns on the distal phalanges of the fingertips are divided into three groups: Arches, loops and whorls [Figure 1].[5,7]

Arches are formed by a succession of more or, less parallel ridges which traverse the pattern area and form a curve that is concave proximally [Fig 1]a. The arch patterns are sub-divided into two types: The simple (or, plain) arch (A) pattern which is composed of ridges that cross the fingertips from one side to the other without recurring and the more intricate type, wherein, the ridges meet at a point, so that, their smooth sweep is interrupted and a tented arch (T) is formed.[5,7] The most common pattern on the fingertip is the so-recognized loop pattern [Fig 1]b. In this configuration, a series of ridges enter the pattern area on the same side. If the ridges open-up on the ulnar side, the resulting loop is termed as ulnar loop while if they open-up towards the radial margin, it is termed as a radial loop. A loop has a single triradius which is located laterally on the fingertip and always on the side, where the loop is closed.[5,7] The ridges in a simple whorl are commonly arranged as a succession of concentric rings. Such patterns are described as concentric whorls [Fig 1]c. Also, they might be seen in a different configuration with spirals around the core in either a clockwise or, a counter clockwise direction and this type of pattern is called as a spiral whorl.[5]

Figure: 1a,1b,1c

Dermatoglyphic landmarks

The basic dermatoglyphic landmarks found on the fingertip patterns are the triradii and cores. Triradii are formed by the confluence of three ridge systems [Fig 2]. The geometric center of a triradius is designated as the triradial point. The triradial point forms one terminus of the line along which ridges are counted. These are commonly observed in the HY areas of the palms.[5] Another important landmark employed in ridge counting is the core which is in the approximate center of the pattern. The cores may be of different shapes. In a loop pattern, the core is usually represented by a straight, rod-like ridge or, a series of two or, more such parallel ridges over which other recurring ridges pass. If a straight ridge is absent in the center of the loop, the innermost recurring ridge is designated as a core. In a whorl, the core can appear as a dot or, a short ridge (either straight or, bent) or, it can be shaped as a circle or, an ellipse in the center of the patterns. In ridge counting, not the whole core, but the point of core only is used. The point of core is at the distal tip of the straight line forming the core. When the innermost recurring ridge contains no ending ridge, the point of core is placed on the shoulder of the loop farther from the triradial point. The shoulders of a loop are the points at which the recurring ridge definitely curves. When an even number of rod-like ridges is present, the point of core is placed on the end of one of the two center ridges farther from the digital triradius. If there are two straight ridges within the innermost recurring ridge, one of which does not rise as high as the shoulder of the loop, the tip of the other ridge is chosen as the point of core. When an uneven number of rods make up the middle of the pattern, the point of core is the tip of the central rod-like ridge. The recurring ridges representing the core must have no appendage connected perpendicularly to their tip on the outside. In presence of such an appendage, the loop is considered spoiled and the next loop outside is considered in locating the point of core. Also, two recurring ridges side by side at the center of the pattern are treated as one loop with two rods within the re-curve. The rod, farther, from the triradius, in such a case, is chosen as carrying the point of core.[5]

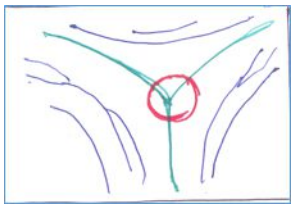

Figure 2: Triradial point

Methods of recording: Three methods of recording have been used for taking prints: Inkless methods (Walker 1957)

- The Holister system for the young and new born infants
- The Indian ink method (Cumins and Midlow, 1961).

Inkless methods (Walker 1957)

MacArthur and Ford (1937) described a procedure for making prints in the latent form from face cream which was spread on a kymograph paper. The latter was fixed in shellac after developing an impression with lamp black fine powder. This saved the subject from the inconvenience of the staining or, the discoloration of the hands.[9] The X-ray (Roentgen's method) has scored its useful value over other unsuccessful techniques for finger prints in the advanced states of decomposed bodies. X-ray records are used for the indirect correlation of the position of the triradii and the hand skeleton by fastening lead pallets with adhesives at the point of the triradii.[10] Castellanos (1939) mentioned Beclare's procedure which consisted of smearing the skin with lanolin and bismuth carbonate and taking shadow graphs by the usual X-ray method.[9]

The Holister system for the young and new born infants

In infants, prints have been developed on photographic paper from a moistened blotter which is pressed against the fingers and passed through a developing mixture which is prepared from a stock solution which consists of sodium sulphide, NaoH, starch and distilled water. This is made permanent by fixation in hypo solutions.[9] Inkmethods

One of the best known and most widely used methods utilizes printer's ink and a good quality paper along with a roller, a glass and/or, metal inking slab and a sponge rubber pad. A small amount of ink is spread over the slab with the roller into a thin, even film. The area to be printed is pressed against the slab and then, pressed against the paper placed over the rubber pad.[9,10]

Studies based on Dermatoglyphics to identify various systemic disorders

Neiswanger *et al*. conducted a case control study in Chinese individuals with non-syndromic cleft lip with or, without cleft palate (CL/P) and the control groups. Increased radial and ulnar loops were observed in cleft lip and palate patients.[11] Sugerman *et al*. observed wider atd angles.[12] Mathew *et al*. found an increased frequency of ulnar and radial loops than the arches and whorls in cleft lip with or, without cleft palate patients compared to controls.[11] ImeneNamouchi conducted a study on Tunisian population to analyze eventual differences between men and women and between individuals according to their geographical distribution.

The Chi-square test revealed highly significant differences between the sexes for the frequencies of arches in case of fifth finger and for the frequencies of loops in case of fourth left finger and the first left finger. The difference of distribution of the whorl pattern between men and women was statistically significant for the fourth left finger while no significant difference was found between sexes in regards of finger ridge counts.[13] Luna and Pons *et al*. conducted a study and described an Eastern Andalusia population by more of the whorls and radial loops in males while arches and ulnar loops in females.[13] Igbigbi and Msamati *et al*. investigated the South African populations with regards to the digital patterns. In Zimbabwean subjects, ulnar loops were the most predominant pattern type in both sexes followed by whorls in males and arches in females; however the sex differences between the digital pattern types were not found to be statistically significant.[13] Sontakke *et al*. found significant reduction of loops in Klinefelter's syndrome patients (31.7%) as compared to that of controls. A significant increase of whorls in Klinefelter's syndrome patients (66.7%) as compared to that of controls (35.0%) was also observed. A similar finding was reported by a study on Japanese patients with Klinefelter's syndrome.[14]

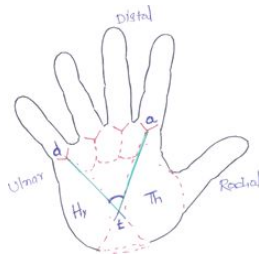

Figure 3: ATD angle

Ramesh *et al*. observed TFRC (Total Finger Ridge Count)and ATD angles (ATD angle is formed by lines drawn from the digital triradius (a) to the axial triradius (t) and from this triradius to the digital triradius (d) [Fig 3])with a significant increase in sickle cell anemia patients concluding sickle cell anemia to have dermatoglyphic correlation and that the same could be considered as marker for male as well as female patients as the diagnostic tool in linking sickle cell anemia to dermatoglyphics.[16] PadminiPramila *et al*. observed an increased incidence of atd angle in male diabetics than the controls although no significant difference was observed for the same in female patients as against the controls.[17] InamdarVaishali *et al*. (1995), in his study with 158 Insulin Dependent Diabetes Mellitus (IDDM) children with limited joint mobility, found a higher frequency in the number of arches in the patients than in the controls.[17] Igbigbi and Msamati *et al*., in their study in 2002 on sub-Saharan Africans, also showed the values of TFRC found among the Zimbabweans to be higher in the men than

in women. These results were also comparable to those obtained in the Zulus of South Africa.[13] Arunpongpaisal and Nanakorn, in their study, showed that only male schizophrenics had a significantly less proportion of whorl pattern than the controls, the findings which were consistent with the Paez's study.[18] Schauman and Mayersdorf *et al*. found an increase in radial loops in white adults with idiopathic epilepsy.[19] AndaniRashida and *et al*., in their study, showed 'atd' angle to be wide in Thalassemia patients in comparison to the controls.[20] SinghalManju D and Gandotra A showed a significant difference of atd angle in the right hand in leprosy patients as compared to the control group. [21] Bukelo *et al*. reported an increase of arches and a decrease of ulnar loops in the fingertips of a group of patients with an acute blast cell leukemia.[22] Ramesh *et al*. observed a significant increase in TFRC and ATD angle sickle cell anemia patients as against the controls.[18] Reddy *et al*. also reported an increase in TFRC ($P < 0.001$) in carcinoma cervix patients as compared to controls.[18] InamdarVaishali *et al*. conducted a study on ninety histopathologically established females of cancer cervix and ninety normal healthy females (control group). In both patients and controls, the age-range was between 25 and 65 years. The results of the study showed a significant increase in the frequency of whorls and TFRC in both hands and an increase in the frequency of arches in left hand with a significant decrease in atd angle and ridge count and frequency of ulnar loops in both hands of females having carcinoma of cervix as compared to the controls. There was no significant difference although that could be observed in relation to other parameters like a-b, b-c, c-d ridge counts and radial loop frequency between the patients and controls.[18] AndaniRashida and *et al*., in their study, showed 'atd' angle to be wide in Thalassemia patients in comparison to the controls.[20] Bukelo Mario Joseph *et al*. conducted a study on patients with acute lymphoblastic leukemia and controls. The results of the study showed the mean ab ridge count and the mean ATD angle to be higher in cases than the controls.[22]

Since the disease identification or detection and diagnosis is carried out in the past and at present depending upon the dermatoglyphics in medical and scientific researches , there have been few efforts made to correlate the occurrence of different forms of periodontitis and their correlation with the dermatoglyphics, the studies of Yilmaz S, Atasu M et al [23,24]studies have indicated a possible relation with the pattern of finger print and type of periodontitis, we have conducted this study to investigate the relevance of the previous studies in interlinking the dermatoglypic findings with the type of periodontitis to test the application of this principle in the patients visiting the postgraduate department of periodontics in Meghana institute of dental sciences,Nizamabad.India.

METHODOLOGY

A total of 25 patients with chronic generalized periodontitis and 25 patients with generalized aggressive periodontitis were included in the study.Fingerprint patterns of the study subjects were obtained by ink – stamp method given by Cummins and Midlo.The 3 basic types of ridge patterns found in the distal phalanges of the digits – whorls, loops and arches were calculated.

RESULTS

The data obtained were stastistically analysed using Chi square test. (Table 1).

The following table highlights the fact that there is increased frequency of ulnar loops in patients presenting with aggressive periodontitis, where as whorls and loops were found more frequently on all fingers of patients presenting with chronic periodontitis

Table 1

	Chronic Periodontitis		Aggressive Periodontitis	
	No.	%	No.	%
ARCHES	22	8.80%	34	13.60%
ULNAR LOOPS	89	35.60%	109	43.60%
RADIAL LOOPS	22	8.80%	15	6.0%
WHORLS	117	46.80%	92	36.80%

Discussion

Many researchers have acknowledged the fact that there is a evidence that the finger prints are reflection of the genetic makeup of an individual , the fact that the genes spread over many chromosomes act in tandem in creating these unique patterns over the fingers palms and soles[26], inheritance studies carried on monozygotic twins and a high incidence of occurrence of a particular abnormality or a disease in siblings and parents paved a strong foundation for searching for a possible link between the fingerprint pattern and various conditions affecting the periodontal health.

Yilmas S et al[24]Atasu M et al,[25] reported decreased frequencies of twinned and transversal ulnarloops on all fingers of the patients with juvenile Periodontitis, a decreased frequency of double loops on all fingers and an increased frequency of radial loops on the right second digits of the patients with Rapidly progressing Periodontitis (RPP), and the increased frequencies of concentric whorls and transversal ulnar loops on all fingers of the patients with Adult periodontitis, an increased frequency of t″ triradii on the palms of the patients with JP, the increased frequencies of IV and H loops and tbtriradii on the palms of the patients with RPP and an increased frequency of e triradii on the soles of the patients with JP. [25]

Conclusion

Within the limitations of the study, it was found that certain finger tip patterns were in greater frequency in aggressive periodontitis patients. However, further studies with larger sample size are required to arrive at a conclusive report linking dermatoglyphic patterns in aggressive periodontitis.

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