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Clinical Dermatoglyphics

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Abstract: The human skin on the palmar and plantar surfaces of hand and foot is arranged in fine ridges and furrows, contrary to that covering the other parts of the body. The study of the configurations formed by the epidermal ridges on the finger balls and also on the palmar surfaces of the hands and plantar surfaces of the feet are collectively known as dermatoglyphics. Dermatoglyphic characters are highly variable not only between individuals of a population, but also between populations. These variations are heritable. The patterns are formed in the fetus during the first half of the fetal development. That is why no two individuals not even the identical twins have exactly the same patterns. All these properties have made dermatoglyphics a valuable research tool in the field of physical anthropology including human genetics, Forensic science and Medicine. In this article, a modest attempt has been made to show the correlation between clinical dermatoglyphics and human historical evolution through cultural evolution of human life.

Keywords: palmar, plantar, dermatoglyphics, twins, epidermal, ridges

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The human skin on the palmar and plantar surfaces of hand and foot is arranged in fine ridges and furrows, contrary to that covering the other parts of the body. The study of the configurations formed by the epidermal ridges on the finger balls and also on the palmar surfaces of the hands and plantar surfaces of the feet is collectively known as dermatoglyphics. Dermatoglyphic characters are highly variable not only between individuals of a population, but also between populations. These variations are heritable. The patterns are formed in the fetus during the first half of the fetal development. That is why no two individuals, not even the identical twins have exactly the same patterns. All these properties have made dermatoglyphics a valuable research tool in the field of physical anthropology including human genetics, Forensic science and Medicine.

Cave drawings and petroglyph diagrams dating back thousands of years provide a record of early man's interest in hands. It is clearly known that as early as 5000 BC, Babylon business transactions were recorded in clay tablets that include fingerprints and at the same time Chinese documents are found having clay seals imprinted with the fingerprint of the author. Perhaps the most bizarre use of the fingerprints in recorded history dates to 16th century in China where the sale of the children is concluded by placing their hand and feet prints on the bills of the sale.

The first scientific publications came out only in the later part of the 17th century (Grew, 1684, Bidloo, 1685, Malphigi 1686) despite that, in China, fingerprints have been used as personal marks, for thousands of years, having, however, no conception of the individuality of the dermatoglyphic features for a long time (Cummins and Midlo, 1961).

Sir Francis Galton (1892) is the inventor of first practical method of fingerprint identification, responsible for basic nomenclature (arch, loop and whorl). These three pattern types have widely been used in race study in the first half of 20th century and even later. Henry (1937) distinguished the four basic patterns of finger namely arch, loop, whorl and composite (under whorl category and accidental). Galton demonstrated scientifically the permanence of fingerprints, first twin research. Inez Whipple (1904) made first serious study on comparative survey which is the classic in the field. Kristine Bonnevie (1923) first introduced the concept quantitative approach through the method of ridge counting to understand the genetics of dermatoglyphics.

The use of dermatoglyphics in disease diagnosis and in medical genetics is not a new field of study. Harold studied all aspects of fingerprint analysis from anthropology to genetics from embryology to the study of malformed hand from two to seven fingers. His famous Down's syndrome studies predicted a genetic link to the disease based upon the presence of the Simian Crease. His willingness to stake his reputation on research that only became scientific fact two decades later cemented his place in history and brought national attention in dermatoglyphics.

Jurpin and Legenne (1953) were the first to report the peculiarities in dermatoglyphic features of Down syndrome patients. Penrose (1954, 1964), Priest (1969) and Lajaczkowska (1969) have observed the presence of abnormal dermatoglyphic features in the mothers of DSPS. Schmidtetal (1981) observed that younger parents with abnormal dermatoglyphic features might have a higher risk of DS child and these parents may be undetected mosaics for

Trisomy – 21. Thus, interesting findings may result if dermatoglyphic features and their changes in parents of DSPS are investigated.

In Indian context, S. Rajangam et al in the early 90's made an attempt to compare the dermatoglyphic features of DSPS, their parents and the controls and to ascertain whether there is any correlation between the dermatoglyphic features of DSPS and their parents. It was observed that the results of their study, for the first time in India, confirm the findings from other countries on the nature of dermatoglyphic features of the DS patients in comparison to their parents and control group. It strongly supports the theory of possibility of identifying parents with an increased risk of having children with Down's Syndrome, thus facilitating genetic counseling. Banerjee et al in late 60's have reported some studies on the natural significance of DSP variability in Bengali population. Their result confirms the earlier observations in this regard. But not a single work has been done from this part of India and this should be a fruitful area for research.

Palmar creases are genetically control morphological variable and stand a chance of being greatly enriched by future researchers. Besides this, the variable can also be employed as an aid for human variation and several medical disorders. The three pulmonary creases of the palm i.e. radial longitudinal crease, distal transverse crease and proximal transverse crease bears a genetic unity (Bali and Chanbe, 1971). It is worth mentioning to investigate the relative length formula of the three types of crease. A number of scholars made their observations between the mentally retarded children and control group, the crease length formula have been found useful for interpreting behavioral attributes.

The use of dermatoglyphic characteristics to understand the socio cultural and psychological abnormalities have not received adequate attention there is an association between certain dermatoglyphic traits and with certain psychological disorders. The field provides a lot of scope for quantification and modeling but has not been explored enough to with different pattern types of dermatoglyphic with psychological, occupational and economic conditions of the population under study.

Manic Depressive Psychosic (MDP) (Mood disorder) or common psychiatric disease has a genetic element in its etiology. Recent linkage studies with DNA markers indicate linkage between mood disorder and chromosome II (Egel and et al 1987). Linkage between MDP and x chromosome markers have also been reported by Baron et al 1990,1987, Mendlewiez et al 1987. Mukherjee et al 1990 made an attempt to find out the association of specific dermatoglyphic traits with MDP. The study suggests that a combination of dermatoglyphic traits on finger and palms may, in course of further research,

turn out to be useful in screening of non-patient genotypes for mood disorder and thereby, helps in further genetic analysis of the disease itself.

Mitral Valve Prolapse, a form of heart disease, is associated with an abnormality high member of arches. Breast cancer, in recent studies, has been linked to high number of whorl patterns. Genetic oriented diseases have received the most scrutiny (Trisomy, Tay Sachs) but correlation have been found to Alzhemeir's, Tuberculosis, Diabetes, Cancer, Heart disease and many more medical conditions.

Concurrent with the study of fingerprints patterns, the study of the line formations of the palm is also a part of the field of dermatoglyphics. However, unlike the fingerprints patterns, the line formations keep altering throughout a person's life and have also shown themselves to be much more difficult to categorize. Because there has never been an argued upon system for line classification, the study of lines has lagged behind the rest of dermatoglyphic research. Nonetheless, numerous studies have found correlation between line patterns and different diseases and psychological conditions.

By the early 1980's, the DNA testing had replaced the dermatoglyphic test as the standard in twin studies, issues of paternity, and chromosome disorder research. The Genome project that intends to fully map human DNA with the next several years has gobbled up the funding that used to sustain dermatoglyphic research.

At a conference on the state of dermatoglyphic (1991), various researches laid out their vision of the future. The good news is that several possible applications of dermatoglyphics are seen quite promising. For instance:

1. Dermatoglyphics may be in position to become the primary means of assessing complex genetic traits.
2. Because fingerprints and line formations form during vital stages of fetal developmental, dermatoglyphic studies are in a unique position to evaluate the effect of toxins on the intrauterine environment.
3. Dermatoglyphics are still useful for the evaluation of children with suspected genetic disorders and diseases with long latency, slow progression and late onset.

However, there are some obvious problems above the funding problems related to dermatoglyphic studies:

i. Small sample size.
ii. Incomplete diagnosis.
iii. Limited number of variables studies per research paper.
iv. Control group inadequacy.

v. Statistical methodology errors.

It is interesting to note, that all these difficulties linked together with one another. In recent years the scanner technology and software capabilities have advanced rapidly, that can be used easily to clinical dermatoglyphic research. That should be a fruitful area for future research.

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