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Dermatoglyphics: The Science of Palmar Configurations

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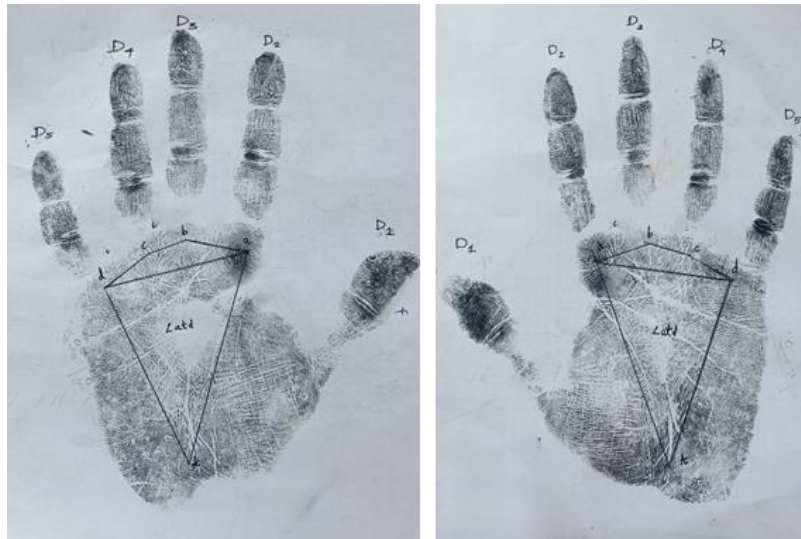
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ABSTRACT

Dermatoglyphic studies the dermal ridges found on the finger balls, palmar digital creases, thenar and hypothenar, interdigital area of palm. Fingerprint patterns congenitally engraved on the finger extremities are the major qualitative parameter in dermatoglyphic research. The 'atd' angle, finger ridge count, total finger ridge count, absolute finger ridge count, position of axial triradius are the ultimate parameters assessed and counted quantitatively in dermatoglyphic examinations. Fingerprint patterns were first proposed by Sir Francis Galton based on the opening and orientation of palmar rides, in his famous book *Fingerprints*. The fingerprints patterns he observed were the arch, the loop and the whorl. Researchers like Edward Henry improved the finger patterning by integrating the perception of 'core' and 'delta'. The 'atd' angle, finger ridge counts, total finger ridge count, absolute finger ridge count and palmar ridge count are other dermatoglyphic parameters currently investigated by the researchers. Many studies have scientifically and universally supported clinical significance of dermatoglyphics and widely approached dermatoglyphics as method of prognostication. Unusual dermatoglyphics reveals distorted genomic systems and abnormal intrauterine-embryonic developmental disarrays.

Main text

Dermatoglyphics is an area of interdisciplinary area of anthropological science, anthropometry science, genetics, forensic sciences and animal sciences. Dermatoglyphics depend on volar ridges configurations located on the finger balls, configural parameters on the palmar digital creases, thenar and hypothenar, interdigital area of palm. Fingerprint patterns engraved congenitally on the finger extremities, which are unalterable. Major qualitative parameter in dermatoglyphic research is the fingerprint patterns whereas the 'atd' angle, finger ridge count, total finger ridge count, absolute finger ridge count, position of axial triradius are the fundamental parameters examined and enumerated quantitatively in dermatoglyphic studies. Fingerprint patterns were initially suggested by Sir Francis Galton (1982) based on the opening and flow of rides, in his famous book *Fingerprints*, 1980, as the arch, the loop and the whorl. Edward Henry revised the finger patterning by incorporating the concept of 'core' and 'delta' in finger patterns, thus sub grouped Galton system (Yager & Amin, 2004). The 'atd' angle is yet another quantitative measure of dermatoglyphics; hypothetical geometry formed in the palm (Brunson et al., 2015). Finger ridge counts, total finger ridge count, absolute finger ridge count and palmar ridge count are being. Palmar and plantar friction ridges are parallelly aligned polygenic traits and follow polygenic inheritance. Genes and antenatal intrauterine ecosystem are the influencing factors in the instigation and differentiation of palmar and plantar volar configurations. Embryonic formation of the dermatoglyphic patterns happens during the first trimesters of intrauterine period ectodermally and established by 16th week of gestation (Kucken & Newell 2005). Process of formation of fingerprints commence with the formation of embryonic volar pads. Embryonic rudimentary volar pads through an array of genomically tailored processes transform into dermal configurations^{8,9,10}. The formation and differentiation of volar configurations controlled and regulated by well-defined genomic processes and monitored accurately driven by embryogenetic machinery, therefore the presence of any abnormal, irregular and atypical palmar patterns reflects defective genomic machinery, mutagenic intrauterine environment and embryonic progression. Strange and unusual dermatoglyphic palmar configurations reported several congenital diseases with significant evidence (Kucken & Newell 2005, Verbos 1970, Rignell 1985).



(Palmprints, Right and Left)

Dermatoglyphic investigations the fingers counted from thumb to little finger as D1, D2, D3, D4, and D5. Area of the palm classified as thenar, hypothenar, interdigital areas. The regional projections of palm near the thumb are called as thenar area whereas the prominence ulnar side is designated as hypothenar. Interdigital areas of the palm are significant where no patterns found however the simple ridges are seen. Area between the index and middle finger called as second interdigital area possess ridges and patterns. Interdigital area three found in between the base of the middle and ring finger with distinct palmar configurations. Fourth interdigital palmar area is designated at the base of the ring and little finger has friction ridges. Interdigital areas are important in measuring the palmar ride count. Classical ink method suggested by researchers Cumins & Mildo has been the most common and economical practice of taking prints in dermatoglyphic researches

Dermatoglyphic Parameters

Classification of the fingerprints was first made by Purkinje in 1923, where he suggested a nine-type fingerprint patterns system, however the fingerprint categorization was revised scientifically by Sir Francis Galton in 1829. The Galton founded the fingerprint grouping order and documented it in his famous book *Fingerprints*, 1980. According to Galton the arch, the loop and the whorl (Galton 1982). Later researcher Henry subclassified fingerprints based on concepts like core and delta categorized the fingerprints into composites models (Yager & Amin, 2004, Henry, 1928). Fingerprint patterns (FPP) is the fundamental qualitative parameter of dermatoglyphics. Characteristics of singularities, the core and delta (triradius) are fundamental in assessing the finger ridge count, a principle quantitative measure of dermatoglyphics. Points of links known as triradius, a triangular spot, are established when ridge bifurcate and two arms of the bifurcation separate, when two adjacent ridges run side by side. Finger ridge count is quantitative measure of counting ridges intervening between the delta and core. Core and delta are characteristically found in loops and whorls; however, due to the structural specificity the either core or delta present in arch patterns. In whorl pattern the core forms ring or elliptical, whereas the loops it centered in the middle of curving's. Finger ridge count (FRC) implies the quantitative measure of dermatoglyphics, count of number of ridges between the triradius and core of a fingerprint pattern. FRC calculated by counting the ridges that interfere a line drawn between core and triradius of an individual fingerprint pattern. Total finger ridge count (TFRC) and Absolute finger ridge count (AFRC) are quantitative measure of dermatoglyphics. Angle 'atd' is a principal quantitative palmar measure of dermatoglyphics, which is an angle formed by the lines by linking three palmar triradii correspondingly the distal triradii located at base of index finger (a), little finger (d) and axial triradii. PRC count is the quantitative parameter of palmar dermatoglyphics, which is the count of ridges between palmar digital triradii (a, b, c, d), located in the at base of the index finger (a), base of the middle finger (b), base of the ring finger (c) and base of the little finger (d). For the dermatoglyphic studies print of the palm is necessary requirement. .

Applied Dermatoglyphics

Forensic dermatoglyphics; a interdisciplinary department, relies on the dermatoglyphic configurations for criminal investigation and personal identification. Dermatoglyphic application of forensics remains inevitable due to economical and practical feasibility. Biometric dermatoglyphic is the part of applied dermatoglyphics where the fingerprints and palmar configurations are being utilized for the personal identifications. Psychometric dermatoglyphics is a collaborative domain of psychometrics and dermatoglyphics, which rely on the palmar configurations to assess the degree of intelligence, personality, skills, emotions and behaviour. Anthropological dermatoglyphics integrates the palmar configurations in anthropology, which studies the dermatoglyphics and its distinctiveness among the ethnic and tribal groups, their volar variation

Conclusion

From classical outlook of “science of fingerprint” the dermatoglyphics has been transfiguring into a multidisciplinary academic pursuit relies on the palmar and plantar configurations confined to the finger extremities, palms, and soles. Dermatoglyphics evolve into an integrative transdisciplinary scientific approach of anthropology, dermatology, genetics, forensics, computer science, and medicine.

Acknowledgements

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