DOI: 10.14260/jemds/2015/1291

REVIEW ARTICLE

DERMATOGLYPHICS AND BLOOD GROUPS: A REVIEW

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HOW TO CITE THIS ARTICLE:
Abha Bharadwaja. "Dermatoglyphics and Blood Groups: A Review". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 51, June 25; Page: 8918-8923, DOI: 10.14260/jemds/2015/1291

ABSTRACT: Finger Print is known to be the best tool of identification. The term dermatoglyphic was coined by Harold Cummin in 1926 and was classified by Sir Francis Galton into loops, whorls and arches. Since then finger prints have been used for determining physical and mental health. Various studies have been carried out throughout the globe to prove its association with Down's syndrome, Schizophrenia, Rubella embryopathy, other genetic disorders and gender variations. Studies also suggest a correlation of finger prints and blood groups. Hence an effort was made to review the literature on this aspect.

KEYWORDS: Fingerprints, Dermatoglyphic, Blood groups, Review.

INTRODUCTION: Dermatoglyphics (Fingerprint) is a collective term for all the integumentary features, inclusive of dermal ridge and thick configurational arrangements on the digits, palms and sole excluding flexion creases and other secondary folds. They develop between 13th to 19th weeks of prenatal life. Cummins (1926) found that the configurations of ridge pattern are determined partly by heredity and partly by accidental or environmental influence, which produce stress and tension in their growth during foetal life.[1] Fingerprint is an impression of the curved lines of skin at the end of a finger that is left on a surface or made by pressing an inked finger onto paper. It has a unique characteristic, mark or pattern that can be used to identify somebody.

Forest reported that dermatoglyphics form a part of structural constitution.[2]

Blotegrel and Blotegrel expressed the correlation between the physical characters and blood groups. An association has been found between distribution of finger print (Dermatographic) pattern and blood groups. The correlation is more consistent for blood group A and loops, arches are more common in blood group AB.[3]

HISTORY: There are records of fingerprints being taken many centuries ago, although they weren't nearly as sophisticated as they are today. The ancient Babylonians pressed the tips of their fingertips into clay to record business transactions.

Malpighe (1686) briefly mentioned the existence of patterns of ridges and sweat glands on the fingertips. In 1684, Grew (1641–1712) published the first scientific paper to describe the ridge structure of the skin covering the fingers and palms.In 1685, the Dutch physician Bidloo (1649–1713) published a book on anatomy which also illustrated the ridge structure of the fingers. In 1788, the German anatomist Mayer (1747–1801) recognized that fingerprints are unique to each individual.[4]

The first attempt to systemically categorize fingerprints was found in works of Purkinge in 1823.[5]In 1858, Sir William Herschel in India, used fingerprints for personal identification.[6] In 1863, Paul-Jean Coulier (1824–1890), professor in Paris, discovered that iodine fumes can reveal fingerprints on paper.[4] A few years later, Scottish doctor Henry Faulds (1880) in Japan published his work on fingerprints.[7]

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Alphonse Bertillon in 1879, had created a system to identify individuals by anthropometric photographs and associated quantitative descriptions.[4]

Sir Francis Galton in 1892, published a book called "Fingerprints," in which he outlined a fingerprint classification system. The system was based on patterns of arches, loops and whorls.[8]

Juan Vucetich set up the world's first fingerprint bureau in 1892 after studying Galton's pattern types.[4]

Sir Edward Henry, added to Galton's technique and created his own classification system based on the direction, flow, pattern and other characteristics of the friction ridges in fingerprints. The Henry Classification Systemreplaced the Bertillon age system as the primary method of fingerprint classification throughout most of the world.[9]

Henry P de Forest (1902) had first prints officially recorded for personal identification in United States.[2]

Harold Cummins (1926) coined the word dermatoglyphics. He observed that the ridge configurations are determined partly by heredity, partly by accidental or environmental influence, which produce stress and tension in growth of part during fetal life.[1]

Since then, dermatoglyphics has become important for identification and determining physical and mental health.

THE ANATOMY OF FINGERPRINT: A fingerprint is the reproduction of the friction ridges present on the inner surface of a fingertip. They are composed of raised parallel ridge lines and furrows (Valleys). A fingerprint is composed of two layers, namely, epidermis (Outer layer) and dermis (Inner layer). The epidermis has five different cell layers and dermis has only one large layer consisting of connective tissue and blood vessels. The epidermis ridges are supported by double rows of papillae pegs on the dermis, which can plays a vital role during recovery of fingerprints from deteriorating bodies. Fingerprint contains unique and abnormal points or discontinuities on ridges and furrows and is called as Minutia.[10]

Fingerprints Pattern are Classified by Galton[8] into three Patterns as:

1. Loops (60-65%).
2. Whorls (30-35%).
3. Arches (5%).

Loops may be ulnar or radial loops. The typical whorl is a generalized pattern. It is distinguished by concentric design. The majority of ridges make circuits around the core, a pivotal feature in the interior of the pattern. The loop is simpler in construction than the whorl. It possesses only one triradius. Instead of coursing in complete circuits as in the whorl, the ridges curve around only one extremity of the pattern, forming the head of the loop. The arches are the simplest of the entire print configurations. There is no triradius.

A triradius is located at the meeting point of three opposing ridge systems. Whereas, absolute finger ridge count (AFRC) is the counting of all the ridges on the tip of all digits of both hands from all the triradii to the core. Since the whorl has two triradii there will be two ridge counts from the two triradii to the core.[11]

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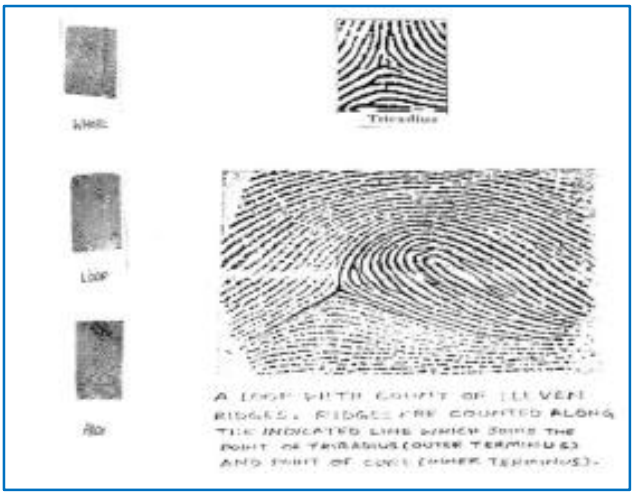

A very rare medical condition adermatoglyphia is characterized by the absence of fingerprints. It is thought to be caused by the improper expression of the protein SMARCAD1. Loss of fingerprints can be seen in ectodermal dysplasia, patients on anticancer treatment, leprosy and in old age. Damage can also occur due to excessive exposure to X-rays, burns, caustic agents and wounds.[12,13]

FINGERPRINT AND BLOOD GROUPS ASSOCIATION: Blood group system was discovered way back in 1901 by Karl Landsteiner. Till now 19 groups are known which vary in their frequency of distribution amongst various races of mankind. 'ABO' and 'Rhesus' groups are of major importance. 'ABO' system is further classified as A, B, AB, O blood group types according to presence of corresponding antigen in plasma. 'Rhesus' system is classified into 'Rh positive and 'Rh negative according to the presence or absence of 'D' antigen.[14] The knowledge of distribution of ABO blood group is most important as certain diseases/malignancies have predilection for certain blood groups, like it was found that carcinoma of cervix had higher frequency in blood group A. A significant association was identified for cholera in which cholera patients were twice as likely to have blood group O and one ninth as likely to have blood group AB as community controls.[15,16] Some interesting facts are also related to blood groups. An association has been found between distribution of finger print (Dermatographic) pattern and blood groups.[3]

Hahne KW (1929) in his study asserted that blood group O is associated with more loops and sless whorls than blood group A.[17] Herch M (1932) found high frequency of loops in blood group A.[18] Bloterogel H and Bloterogel W (1934) expressed a correlation between physical characters and blood groups.[3]

Geipel (1935)[19] showed in a series of 381 Germans, the absence of significant correlation between dermatoglyphics and blood groups.[18]

Gowda and Rao (1996) in their study on Gowdasaraswat Brahmin community of South Kanda district (Karnataka) reported a high frequency of loops with moderate whorls and low arches in the individuals of A, B, O blood group. They also found significantly greater number of loops in Rh - positive and whorls in Rh – negative subject. The total finger ridge count (TFRC) was higher in blood group A.[20]

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Kshirsagar et al (2001) also reported high frequency of loops, moderate of whorls and low of arches in individuals with ABO, Rh blood groups. Frequency of whorls was higher in O blood group and low in AB blood group. Whereas percentage of arches was high in AB blood group and low in B blood group.[21]

Bharadwaja and colleagues (2004) found high frequency (51.8%) of loops, followed by whorls (35.8%) and arches (12.3%). Blood group A showed more loops (Rh positive 54.26%, Rh negative 60%) while, blood group AB had more whorls (Rh positive 43.34%, Rh negative 60%) . The suggested an association between finger print pattern and blood group. The total finger ridge count (TFRC) was significantly greater in blood group B.[22]

Prateek and Keerath (2010) have reported high frequency of arches and low frequency of whorls in A - negatives.[23]

Mehta and Mehta (2011) conducted a study on 200 MBBS students on palmar dermatoglyphics in ABO, Rh blood groups. Whorls were highest in B blood group and difference was significant with O blood group. Whereas, Loops were highest in O blood group and were significant with A, B, AB blood groups. Arches were highest in AB blood group and were statistically significant with B and O blood groups. Mean of absolute finger ridge count was highest in B blood group and the difference was statistically significant with O blood group. Arches were higher in Rh – negative.[24]

In another study from Guntur, India (2011) 506 students of known blood group were selected. They found an association between distribution of finger print pattern and blood groups. In all blood groups, the frequency of finger print pattern observed is loops were highest followed by whorls and arches respectively. But loops were associated more with O group, whorls with AB group and arches with B group. Thumbs presented high frequency of whorls in $A^{+ves.}$ Index and ring fingers were associated with high frequency of whorls in A^{-ves} and AB positives.[25]

Desai et al concluded in their study that Loops were the most common fingerprint patterns and Arches were the least common. Loops dominated in all the Blood groups of both Rh positive and Rh negative individuals but Whorls were found to be dominating in O negative blood group. The only association between gender and finger print patterns in their study was that Loops and Arches were found in higher frequency in Females as compared to Males and whorls were found to be high in males as compared to females.[26]

A recent study from Nigeria too have found that there is an association between distribution of fingerprint patterns, blood group and gender and thus prediction of gender and blood group of a person was possibly based on the fingerprint patterns.[27]

So, all these studies suggests an association between dermatoglyphic pattern and blood groups.

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FINANCIAL OR OTHER COMPETING INTERESTS: None

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Date of Submission: 01/06/2015.
Date of Peer Review: 02/06/2015.
Date of Acceptance: 17/06/2015.
Date of Publishing: 24/06/2015.