

The Mystery of Handprints-Dermatoglyphics

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Abstract

Dermatoglyphics refers to epidermal ridges present on the palm, sole, fingers, and toes. Over the past 150 years, Dermatoglyphics has been a powerful tool in understanding the basic questions in biology and genetics. It's analysis is now beginning to prove itself useful in the field of dentistry. Each and every individual has unique fingerprints, even in twins. These fingerprints remain the same lifelong from their development unless they are damaged by dermal injuries.

Keywords: Dermatoglyphics; Dermatoglyphics and dentistry; Fingerprints

Abbreviations: IAFIS: Integrated Automated Fingerprint Identification System; CP: Cleft Palate; PH: Periodontally Healthy; JP: Juvenile Periodontitis; RPP: Rapidly Progressive Periodontitis; AP: Adult Periodontitis.

Introduction

For centuries the carvings on the hand and feet have always been fascinating, not only to the anthropologists but also psychologists, sages, theologians, doctors and layman [1]. Palmistry in scientific terms is called as "dermatoglyphics" and refers to the friction ridge formations which appear on the palms of the hands and soles [2]. It is a specialization of science that deals with the study of such patterns.

The term was coined by Cummins and Midlo in 1926, although Cummins is regarded as the "father of dermatoglyphics". The main thrust of their research was on Down's syndrome and their characteristic hand formations. As from the cradle to the grave until the body decomposes finger prints remain unchanged. Their

variable characteristics are not duplicated in other people, even in monozygotic twins [3]. Thus the study of dermatoglyphics is considered as a window of congenital abnormalities and is a sensitive indicator of intrauterine anomalies and complex genetic traits.³ The ridges are influenced by blood vessels- nerve pairs at the border between the dermis and epidermis during the prenatal development and factors like inadequate oxygen, unusual distribution of sweat glands and alteration of epithelial growth [4]. Abnormal dermatoglyphics patterns may be observed in several non chromosomal genetic disorders and could be a useful diagnostic tool in diagnosis of lesions and conditions of the oral cavity like dental caries, periodontitis, cleft lip and palate, malocclusion etc [5].

History

The scientific study of papillary ridges of the hands and feet began with the publication of the thesis of Joannes Evangelista Purkinje in 1823. While William Herschel (1858) was the first to experiment it in India. Sir Francis Galton (1892) demonstrated the hereditary significance of fingerprints and biological variations of

different racial group in his book called "fingerprints. Sir Edward Henry in 1893 published the book: the classification and uses of fingerprints" commencing a modern era of fingerprint identification. Charles Midlo along with others put forward one of the most referred book "fingerprints, palms and soles", a bible in the field of dermatoglyphics. Penrose (1945) conducted investigations on Down's syndrome and other congenital disorders. Schaumann and Alter in 1976 documented "dermatoglyphics in medical disorders" that gave the details of dermatoglyphic patterns in different medical disorders [6].

Methods of Recording Dermatoglyphics

- a) Reviewing the literature one can find a number of methods for recording dermatoglyphics. Most of these methods are inexpensive, non-invasive and rapid. These methods are:
 - b) Ink method
 - c) Faurot inkless method
 - d) Transparent adhesive tape method
 - e) Photographic method
 - f) Special method
 - g) Numerical method
 - h) Lipstick method
 - i) Rubber And Plaster Of Paris casts
 - j) Scanning electron microscopy (Misumi, et al. in 1984)
 - k) Integrated Automated Fingerprint Identification System (IAFIS)

Classification of Fingerprints

Galton classified the fingerprints into 3 main types: Figure 1

- 1) Loop
- 2) Whorl
- 3) Arch

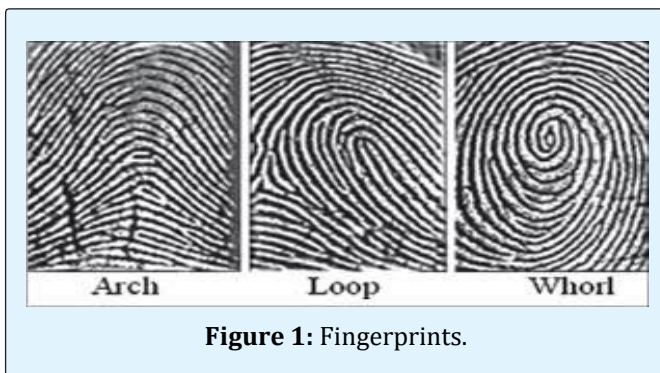


Figure 1: Fingerprints.

Loops: It is the most common pattern on the fingertip. 65% of the population possess loops. A series of ridges

enter the pattern area on one side of the digit, recurve abruptly, and leave the pattern area on the same side.

Types of loop: Depending on the side where the loop opens it is classified as:

- a) **Ulnar loop:** when the loop opens on the ulnar side and account for 60% of the loops.
- b) **Radial loop:** when the loop opens towards the radial margin and account for 5%.

Whorls: It is any ridge configuration with two or more triradii. One triradius is on radial and the other on the ulnar side of the pattern. Henry (1937) limited the designation of the term 'Whorl' to those configurations having ridges that actually encircle a core.

Arches: 5% of population has them. It is the simplest pattern found on the fingertips. It is formed by succession of more or less parallel ridges, which transverse the pattern area and form a curve that is concave proximally. Sometimes the curve is gentle while at other times it swings sharply so that it may be designated as low or high arch respectively [6].

Dermatoglyphics in Dentistry

Over the past 150 years, Dermatoglyphics has been a powerful tool in understanding the basic questions in biology and genetics. Its analysis is now beginning to prove itself useful in the field of dentistry. Recognition of irregular fingerprints among the patients of periodontitis, dental caries and other genetic anomalies like cleft lip and palate has been the recent interest of authors and academicians [6].

Dermatoglyphics and Cleft Lip and Palate

Disturbances at any stage during palate development, e.g., defective palatal shelf growth, failed or delayed elevation and blocked fusion can result in cleft palate (CP) with or without cleft lip (CP ± L). Scott NM, et al. studied dermatoglyphic prints from individuals with non-syndromic CL/P (n = 460) and their unaffected relatives (n = 254) from the Philippines and China. An increased radial and ulnar loop were observed in Cleft lip and palate patients [7].

Dermatoglyphics and Periodontics

Periodontitis is a set of inflammatory diseases affecting the periodontium, i.e., the tissues that surround and support the teeth. Periodontitis involves progressive loss of the alveolar bone around the teeth, and if left untreated, can lead to the loosening and subsequent loss of teeth. Periodontitis is caused by microorganisms that adhere to and grow on the tooth's surfaces, along with an

over-aggressive immune response against these microorganisms.

Atasu, et al. conducted a study with the aim of finding a finger-tip pattern type that would identify the patients with periodontal diseases. When the finger-tip patterns of the patients were compared with those of Periodontally Healthy (PH) individuals, the decreased frequencies of twinned and transversal ulnar loops on all fingers of the patients with Juvenile Periodontitis (JP), 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 Progressive Periodontitis (RPP), and the increased frequencies of concentric whorls and transversal ulnar loops on all fingers of the patients with Adult Periodontitis (AP), an increased frequency of the tri-radial on the palms and soles of the patients with JP were found. The authors concluded that in the light of these findings dermatoglyphics could be used together with the other diagnostic methods such as clinical and radiologic investigations and in the identifying of the patients from distinct groups of PD's [8].

Dermatoglyphics and Malocclusion

Tikare, et al. revealed a statistical association between whorl patterns among Class 1 and 2 malocclusion children [9]. Reddy, et al. conducted a study using dermatoglyphics to predict and compare Class I, Class II, div. 1, div.2 and Class III malocclusions. A total of 96 subjects were divided into 3 malocclusion groups, i.e. Class I (control group), Class II, div.1, div.2 and Class III (experimental group) in the ages of 12-14 years. The dermatoglyphic findings revealed that the craniofacial Class II, div.1, div.2 pattern was associated with increased frequency of arches and ulnar loops and decreased frequency of whorls, whereas in Class III, there was an increased frequency of arches and radial loops with decreased frequency of ulnar loops. In predicting Class III malocclusion, based on frequency of arches, the sensitivity values were found to be higher and more reliable than the sensitivity values of Class II, div.1 and div.2 malocclusion. From their study, the authors of the present study observed that dermatoglyphics might be an appropriate marker for malocclusion [10].

Dermatoglyphics and Dental Caries

Dental caries is one of the most chronically infecting diseases in the humans since time immemorial. It is a multifactorial disease with its aetiology revolving around the host, microbes, time and substrate. But genetic susceptibility also plays an important role. Bhat, et al. in 2011 conducted a study to evaluate dermatoglyphic peculiarities and caries experience of deaf and mute

children. They observed that the frequency of whorls was more in caries group and the frequency of the loop was more in caries-free group [11]. Madan, et al. in 2011 conducted a study to determine the genetic aspect involved in the occurrence of dental caries through a cost-effective means. They observed that Handprints of caries-free children, especially females showed maximum ulnar loops. The caries group showed maximum occurrence of whorls which were more prevalent in females on the left hand 3rd digit than in males where the whorls were found on the right-hand 3rd digit, and also low total ridge count, especially in males [12].

Dermatoglyphics and Oral Carcinomas

Elluru Venkatesh carried out a study to determine whether specific dermatoglyphic patterns exist which help in predicting the occurrence of oral squamous cell carcinoma and oral leukoplakia. Arches and loops were more frequent in cases than in controls whereas whorls were more frequent in the control group ($p < 0.01$). Loops were at higher frequency in the inter-digital areas in cases than in control ($p < 0.05$). This study concluded that dermatoglyphic patterns may have a role in identifying individuals either with or at risk for developing oral leukoplakia and oral squamous cell carcinoma [13].

Conclusion

Fingerprints are known to be unique and unalterable and hence an excellent tool for population studies, personalized identification, morphological and genetical research. As the dermatoglyphics are genetically controlled characteristics, any deviation in it might indicate a deviation from the controlled population. They were considered as an inexact signs from which it has moved to acceptable diagnostic tool. Hence the future lies in these non invasive techniques of diagnosis in all fields of medicine and dentistry. Dermatoglyphics have been in history since time immemorial and has not been much implicated in dentistry; more research will definitely help create a brighter future for application of relationship of dermatoglyphics to abnormalities and diseases of the oral cavity.

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