

The Dermatoglyphics: Deciphering Dental Diseases.

Abstract:

Dermatoglyphics is the study of pattern of ridges and configurations over the digits, palm and soles which can be used as preliminary method of diagnosis and investigation. In the existing literature, association between various dental diseases has been found with dermatoglyphics. These were initially used for the purpose of individual's identification but its association with different medical and dental diseases has been found. Health problems can be anticipated easily if the diseases are diagnosed or detected at an early stage. Dermatoglyphics not only plays an important role in finding the association or correlation between finger print patterns and dental diseases but it is also of great help in early detection of medical and dental conditions. The aim of this article is to discuss in detail about advantages, limitations and types of the dermatoglyphics pattern and also about the existing literature and investigations conducted by various authors.

Keywords: dermatoglyphics, finger print, dental diseases, derma.

Introduction:

Dermatoglyphics is the study of pattern and configurations of epidermal ridges on the volar aspect of hands and feet. [1] The term 'dermatoglyphics' is derived from two Greek words derma means skin; glyphe means carve. This term was coined by Harold Cummins in 1926 [2]. Due to the uniqueness and long-term reliability, these can be used as diagnostic tools and also to co-relate genetically inherited diseases with dermal configurations. This may further help in early diagnosis and prevention with respect to the quote 'prevention is better than cure'. The reliability of the dermatoglyphic technology for preliminary investigations of defects inherited genetically is also proved to be significant. Health problems can be anticipated easily if the diseases are diagnosed or detected at an early stage. Dermatoglyphics not only plays an important role in finding the association or correlation between finger print patterns and dental diseases but it is also of great help in early detection of medical and dental conditions.

Dermatoglyphics has been proved to be a useful tool, not only in identification of individuals but has also been co-related

with many of the medical and dental defects. Keeping in mind the above points, this paper reviews the existing literature on correlations between dermatoglyphic patterns and different dental conditions.

History :

Dermatoglyphics has come into account since ages, earlier Chinese folks used dermatoglyphics for the purpose of palm reading and fortune telling. In the prehistoric era, Indians believed that a person with presence of ten whorls was destined to be an 'emperor'(Chakravarti). [3]

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Galton was the first person to conduct first systematic study in 1892 over this whole concept of dermatoglyphics. He initiated his work with the thought that fingerprints are unique identification marks of each and every individual and moreover it persists throughout the life. Dermal patterns in families and racial groups were first studies by Galton. [4] Sir Edward Richard Henry further utilized this technique for identification of criminals. [5] In 1899, he established 'Henry System Of classification' which elaborated the method of cataloging fingerprints.

Since many years studies have suggested that heredity plays a significant role in fingerprint patterns. Though some data collected through qualitative analysis and other features of fingerprint patters led to less significant and inconclusive results.[6] In 1957, Walker published a paper titled “The use of Dermal Configurations in the Diagnosis of Mongolism”, this paper stated relevant findings of the relation between dermal configurations and mongolism. He also further quantified the dermal arrangements as an aid to diagnostic tool.[7]

In early 20th century, the Law Enforcement Agencies formally accepted fingerprints as 'personal valid' identification proofs and thereafter it became a standard universal procedure in forensics. [8] In India, first study on fingerprints was conducted by Herschel (1858). [9] Though there are numerous studies conducted in this context, a lot of research has still to be done in this field to determine the validity and reliability.

Advantages:

- This technique is simple and versatile as compared to other methods. The interpretation of findings is relatively easy and faster.
- These develop at the time of birth and are identified uniquely for each individual.
- This technology is cost effective, efficient and requires minimum apparatus. The data collected can be stored and preserved for long time.
- It is done rapidly in clinics or anywhere (doesn't require hospitalization or invasive procedures).

Limitations:

- In patients with malformations or disfigurements of limbs dermatoglyphic patterns are difficult to diagnose.
- It is necessary to record an accurate print as thick, thin or improper print can lead to misled information.
- Application of ink material should be in adequate amount and care must be taken while recording the prints. [10]

Methods of Printing:

Ink Method- It is the most commonly used method. The apparatus required to carry out the procedure includes: glazed surface good quality paper, a roller, a rubber sponge, ink (printer), inking slab (metal or glass). [11,12]

Faurot Inkless Method- This method requires minimum equipments. A specially treated sensitized paper and patented solution that is available commercially is used. [11]

Transparent Adhesive Tape Method- A coloring agent (India Ink, dusted colored chalk, common oil pastel crayon, graphite stick or powdered graphite etc.) is used to produce a colored smear onto the skin after which print is generated by with the help of transparent adhesive tape. This technique holds an advantage over other techniques that it can be preserved for longer period of time.

Photographic Method- The basic principal involved is total internal reflection. An object when pressed against a prism produces an internal reflection. A magnified image is obtained with the help of a Polaroid camera.

Special Methods- It permits the existing relationship between the epidermal ridges and the underlying boney structures (radiodermatography), estimation of the sweat pores (hygrophotography), or study of the spatial shape of the ridged skin areas, as done in mammals (plastic mold method).

Numerical Method- Algorithm of synthesis of images of fingerprints is used and minutiae are created. Digital coding of a fingerprint are estimated and also enables mathematical cataloging of minutiae and types of patterns.

Dermatoglyphics Pattern Layout:

Dermatoglyphic Landmarks

Fingerprint pattern has basically three dermatoglyphic landmark- tri-radii, cores and radiants.[13]

Tri-radius – it is formed by three- ridges junction, approximately forming an angle of 120° with one another.

Core – the central part of the pattern.

Radiant – they emerge from the tri-radius and encircle the pattern area.

Finger- Tip Design Pattern:

In 1892, Galton categorized the patterns of ridge on the distal phalanges of the finger-tips as follows[14,15]:

Arches- This is the most simplest method found on the finger tips. This pattern does not show tri-radii landmark. Parallel ridges are arranged sequentially bisecting the pattern area to produce a curve that is concave proximally. The curvature follows a gentle, distally bowed configuration. This design pattern is subdivided into two types: Simple Arch or Plain Arch and Tented Arch. Simple or plain arch represents the ridge traversing from one side of the digit to the other without re-curving. Tented arch represents the ridges that meet at a point to form a 'tent' shaped arch.

Loops – This is the most commonly found pattern on the fingertip. There is recurvation of the ridges i.e. the ridges enter from one side of the finger and leaves from the same side after re-curving abruptly. Loops have one tri-radius and are further divided into two types- Ulnar loops and Radial loops. Loops with opening on the ulnar side are considered as ulnar loops and on the radial sides are considered as radial loops.

Whorls – If the configuration of ridges has two or more tri-radii it is considered as whorls pattern. There are different types of whorl pattern. The ridges in plain/concentric whorl pattern present with concentric rings arranged in accession. The ridges follow a spiral pattern in clockwise or anti-clockwise pattern around the core is considered as Spiral Whorl. The pattern showing a ring inside which a whorl pattern can be seen is considered as central pocket whorl. The pattern where the loops interlock is considered as Lateral

pocket/twinned loop whorl. When the pattern cannot be classified under any of the above mentioned categories, they are known as Accidentals/complex pattern.

According to Cummins and Midlo, Composites is the new pattern of ridge added to this classification.

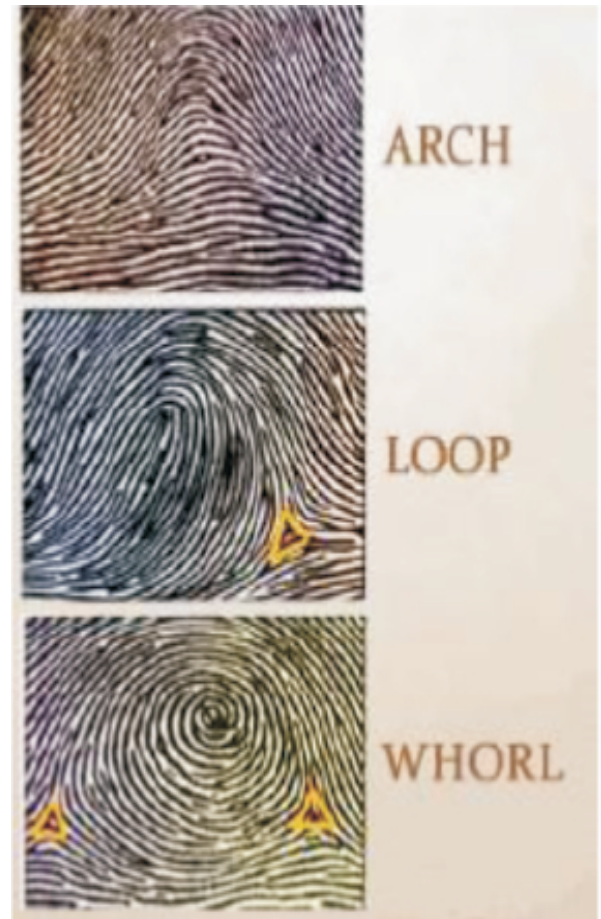


Figure I: Arches, Loops And Whorls pattern

Dermatoglyphics and Dentistry:

Dermatoglyphics has captivated a lot of attention in the field of dentistry. In numerous studies, it's correlation has been shown with different dental diseases such as caries, oral cancer, developmental defects of tooth, malocclusion, different congenital anomalies like cleft lips, cleft palate, periodontal diseases, dental fluorosis and also plays a major role in forensic odontology.[16] Table 1 shows the description and comparison of various studies showing the association between dermatoglyphics and dental diseases.

TABLE 1: Description And Comparison Of Various Studies Showing The Association Between Dermatoglyphics And Dental Diseases

S.No	Authors	Study Description
ORAL SUBMUCOUS FIBROSIS		
1.	Venkatesh et al. (2008)	According to study conducted by Venkatesh et al. in 2008, among all the participants with leukoplakia, whorls was found in 30.70% of the population, loops was found in 6.30% where as in patients with oral submucous fibrosis, loop fingerprint pattern was found in 60.70% of the population, whorls was found in 30.32% and arch pattern was seen in 7% of the participants. [17]
CLEFT LIP AND PALATE		
2.	Scott et al. (2005)	As reported in study by Scott et al. studied 460 nonsyndromic cleft lip and palate patients along with their 254 relatives not affected with the same were studied for their dermatoglyphic patterns. They observed that patients with cleft lip and palate showed increased number of ulnar and radial loops. [18]
3.	Mathew et al.(2005)	In a study conducted by Mathew et al. 100 children aged 5 to 15 years were studied, among which 50 were nonsyndromic children with cleft lip and palate while rest 50 children had no anomalies (control group). They found that children with cleft palate and lip had increased frequency of ulnar loops as compared to the control group. [19]
4.	Saxena et al. (2013)	294 subjects were studied by Saxena et al. among which 48 subjects were selected with cleft lip and palate and 50 subjects were selected with no anomalies along with both their parents. Cleft participants were found with increased frequency of loops and arches and low mean total ridge count. [20]
DENTAL CARIES		
5.	Atasu et al. (1998)	In a study conducted by Atasu et al. dermatoglyphic patterns of students with extensive caries were compared to that of students with no caries. They found that a significant difference was found between dermatoglyphics pattern of the two groups. The participants with extensive caries were found with more whorls pattern while the caries free participants showed more of ulnar loops configuration. [21]
6.	Sharma et al. (2009)	In a study conducted by Sharma et al. on 90 participants to find if there exists any significant association between dental caries, bacterial interactions in saliva and dermatoglyphics. There was significant correlation found in the subject group among all three factors but no significant association was seen in the control group. [22]
PERIODONTAL DISEASE		
7.	Atasu M et al. (2005)	In a study conducted by Atasu M et al correlation of dermatoglyphics was found with different groups of periodontal diseases. They also concluded that dermatoglyphics can be used with other clinical and radiographical investigations to categorize patients according to different groups of periodontal disease classification. [23]
8.	Atasu and Akyuz (1995)	In 2005, a study conducted by Atasu and Akyuz, patients with juvenile periodontitis presented with decreased twinned and transversal loops while patients with rapidly progressing periodontitis showed frequentness of radial loops on second finger of the right hand where as double loops were decreased on all fingers. [24]
FORENSIC ODONTOLOGY		
9.	Kiran K. et al. (2010)	In a study conducted by KiranK. et al (2010) 100 children were selected, out of which 50 patients were mentally challenged while the rest healthy 50 patients were selected. Mentally challenged people presented with increased frequency of loops and transverse creases on palm. [25]
MALOCCLUSION		
10.	Reddy et al. (1997)	In a study conducted by Reddy et al. 96 participants were divided into three different malocclusion groups. Class I group was considered control group and the other two groups, that is, Class II (div. 1 and div. 2) and Class III groups were considered as experimental group. The study participants aged between 12 -14 years were included in the study. They deduced that pattern of arch and ulnar loops were found most frequently in patients with craniofacial Class II div.1 and div.2 defects. In addition to this the whorls pattern was found with least frequency in these patients. In contrary to this, Class III patients presented with increased frequentness of arch and radial loop pattern. The prediction of patients with class I - II malocclusion according to the frequency of arches showed more sensitivity values as compared to using the same criteria in prediction of patients with Class II (div. 1 and div.2) malocclusion defects. [26]
11.	Tikare et al. (2010)	Tikare et al. studied 69 - 6 high school going children aged between 12 to 16 years to find correlation between finger print patterns and malocclusion. They found a statistically significant correlation between whorls fingerprint pattern and Class I and II malocclusion. Though, no overall statistically significant results were found in correlation between both. [27]
OTHER DENTAL DISORDERS		
12.	Genc A et al. (1999) & Singh S et al. (2012)	Few studies showed statistically significant association between finger print patterns and taurodontism and dental fluorosis. [28, 29]

Conclusion:

The dermatoglyphics plays a major vital role in forensic sciences and technology due to the fact that fingerprints remains the same since birth till death and these are uniquely identified for each and every individual. Use of dermatoglyphics for studies related to oral cavity among dental professionals and researchers should be made common. This will further help in early diagnosis, prompt treatment and better prevention of disorders of oral cavity and other diseases inherited genetically.

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