

Dermatoglyphics and Periodontitis

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Running Title: Dermatoglyphics and Periodontitis - A Mystery of Hand Prints Unveiled: A Cross - Sectional Study!!
Dermatoglyphics and Periodontitis - A Mystery of Hand Prints Unveiled: A Cross - Sectional Study!!

Abstract: ***Objectives:** This study aims to assess the relationship between the finger prints and severity of periodontitis. **Materials and Methodology:** A total of 45 patients with the mean age group of 18 - 45 years were equally divided into three groups comprising 15 patients in each group as follows: Group 1: Healthy group, Group 2: Gingivitis and Group 3: Periodontitis. The fingerprint patterns of each participant were recorded with an impression technique using duplicating ink. **Statistical Analysis:** The descriptive analysis of the data was presented as percentage frequency. The percentage frequencies of each pattern on each individual finger were calculated and statistical test were applied. Data was analyzed using the statistical package SPSS 22.0 and level of significance was set at $p < 0.05$. **Results:** There were increased frequency of ulnar loops, whorls and fewer arches in both hands in patients with chronic periodontitis. **Conclusion:** Dermatoglyphics may serve as an early predictor for many genetic disorders of the oral cavity and other diseases whose etiology may be influenced directly or indirectly by genetic inheritance.*

Keywords: Dermatoglyphics, Gingivitis, Periodontitis, Fingerprint

1. Introduction

Dermatoglyphics (from Greek ancient derma = “skin”, glyph = “carving”) is a branch of science in the study of pattern of skin (dermal) ridges present on the fingers, toes and the soles of human. Characteristically, hair does not grow from this area¹.

Dermatoglyphs consists of alignment of sweat gland pores and they are shaped in the first trimester of gestation, thus forming during the 6th - 7th week of the embryonic period and completing after 10 - 20 weeks of gestation². Seven genes are at least thought to be involved in finger ridge formation. The patterns of nervous system, the genes encoding for the layers of skin, the amount of buckling, instability and other factors determine an individual's specific unique set of fingerprints³.

Dermatoglyphics have a strong inheritable genetic connection and can be used as diagnostic tool for oral disease and other disease whose etiology may be influenced directly or indirectly by genetic inheritance⁴. A study by *Atasu et al⁵ (2015)* concluded strong correlation between dermatoglyphics and aggressive periodontitis.

2. Literature Review

Dr. Harold Cummins 1926: he is known as Father of Dermatoglyphics coined the term dermatoglyphics and first established the direct relationship between patterns formation and development on the palm and of the brain³. 1943 published “Finger Prints, Palms and Soles” Bible in field of dermatoglyphics mentioned about his research on embryogenesis of skin ridge patterns in detail.

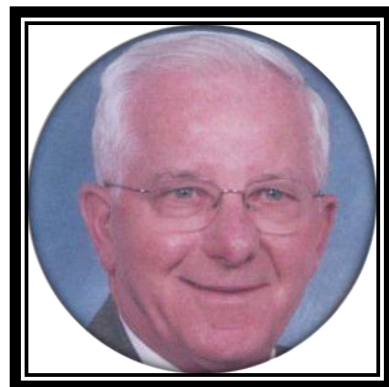


Figure 1: Dr. Harold Cummins

1788 *JC Mayer* was the first to write out basic tenets of finger print analysis and theorized that finger prints were unique. 1823 *Joannes Evangelista Purkinji*, found that the patterns on one's finger tips and the ridges and lines on one's prints begins to form at around the thirteenth week in the womb and published his research thesis on finger prints pattern classification.

1969 *John J. Mulvihill, MD and David W. Smith, MD* published *The Genesis of Dermatoglyphics* that provide the most up to date version of how finger prints form.

Principles of Dermatoglyphics:

Fingerprint has three important principles:

- a) It is an individual characteristic
- b) It will remain unchanged during individual's lifetime
- c) It have general ridge patterns which help to classify systematically⁶

Features of Dermatoglyphics:

The 3 main features are as under:

- 1) Uniqueness
- 2) Invariance
- 3) Hereditary

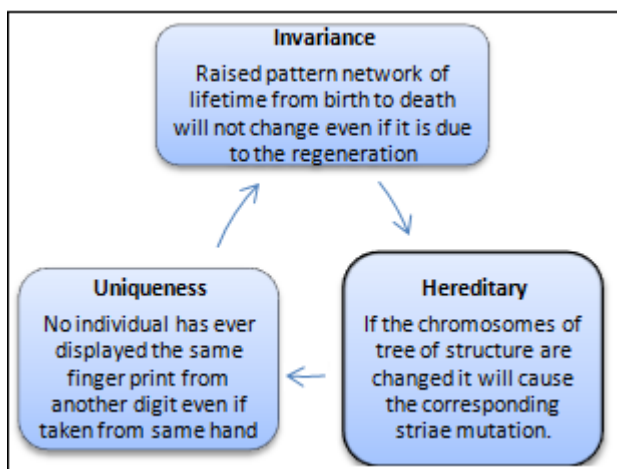


Figure 2: Features of Dermatoglyphics

LANDMARKS

- a) Triradii - Atriradius is formed by the confluence of three ridge systems and forms an angle of 120 degree. Geometric center of triradius is called as tridial point.
- b) Core - It is approximate center of the palm and turn back themselves at 180 degree. In ridge counting the point of core (not the whole core) is used.
- c) Radiants - These are ridges that emanate fromtriradius and enclose the pattern area⁶.
- d) Delta -It is the point on a ridge, at or in front of and nearest the center of divergence of the type lines. Delta area is a triangular area from where the ridges radiate outwards⁷.

Classification

There are three basic finger print patterns

- 1) Arches
- 2) Loops
- 3) Whorls²

1) **Arches:** These are simplest pattern found in five percent of finger trips. The ridges run from one side to another of patterns, making no backward turns. These are parallel ridges that usually traverse the pattern are and form a curve that is concave proximally. They are classified as:

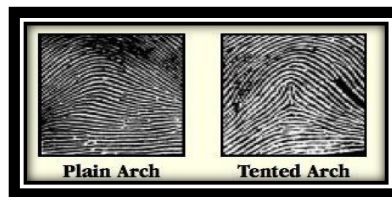


Figure 3: Arches Pattern

- a) Plain arches – with little elevation at the center and consistency of flow can be observed in this pattern
- b) Tented arches - with a tent like elevation at the center^{3, 8}

2) **Loops:** Loops are the most common pattern on fingertips and occurs in about 60 to 70% of population. One or more ridges enters on either side of impression, recurves abruptly, touches or crosses the line running from the delta to the core and terminates on or in the direction of the side where the ridge or ridges entered. The loop pattern is subdivided into two types:

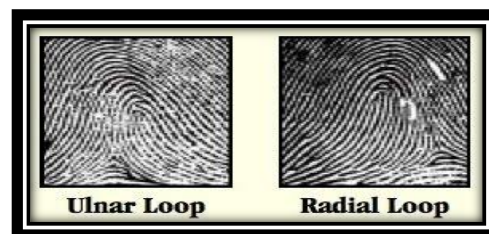


Figure 4: Loops Pattern

- 1) In ulnar loop – the pattern area curves and exit from thumb side
- 2) In radial loops - the pattern area recurves and exit from the little finger side^{3, 8}

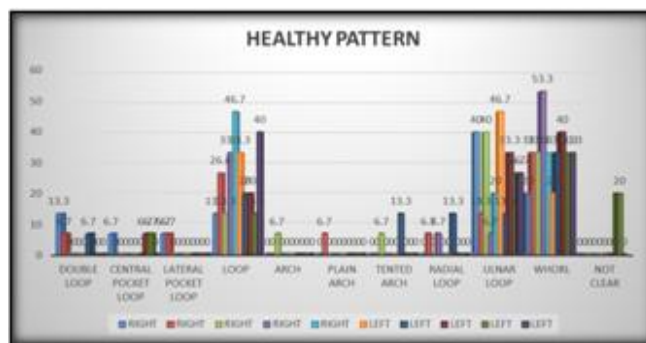
3) **Whorls:** Whorls accounts for 25 to 35 % of finger print patterns. In a whorlpattern some of the ridges make a turn through at least one circuit. Any finger print pattern which contains two or more deltas will be of a whorl pattern. There are six types of whorls:



Figure 5: Whorls Patterns

- a) Concentric whorl - the ridges are unusually arranged as succession of concentric rings around the core.
- b) Spiral whorl - the ridges are formed by the spiral pattern around the core in clockwise or anticlockwise direction.
- c) Mixed whorl - it contains circles and spirals in same pattern.
- d) Central pocket whorl - it is formed by a smaller pocket within a loop.
- e) Twin whorl - in these ridges arising from each core open towards the opposite margin of the finger.
- f) Accidental whorls - these represent the characteristic of particular whorl subgrouping^{3, 8}

4. Results



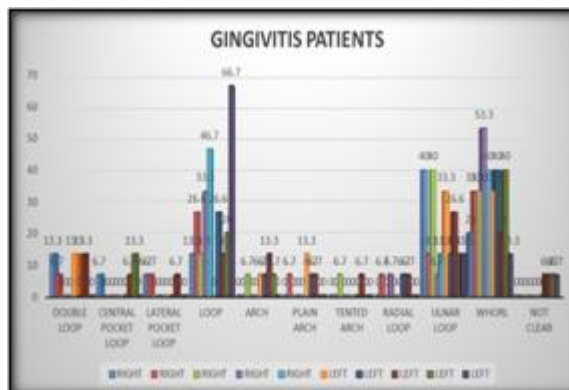
Graph 1: Healthy Patients (Whorl Pattern predominant)

Dermatoglyphic Pattern Recording:

Standard ink method was used to determine fingerprint patterns. All the participants were requested to clean their hands to remove impurities. Spirit was used to remove remaining oil and other dirt and keep the hand clean and dry. With the help of Kores duplicating ink, the fingers print was recorded and studied with the help of magnifying lens. Patterns were classified as arches, loops, whorls, and periodontal status were recorded using Russell periodontal index²³.

3. Material and Methodology

The present study was conducted in the out - patient Department of Periodontics and Oral Implantology in Swami Devi Dyal Hospital and Dental College. A total of 45 patients divided into three groups with 15 patients in each group were included in the study. The participants were explained about the details of the study and informed consent was taken from all the patients regarding the use of their fingerprints for research purpose. The study protocol was approved by the Institutional Ethics Committee.



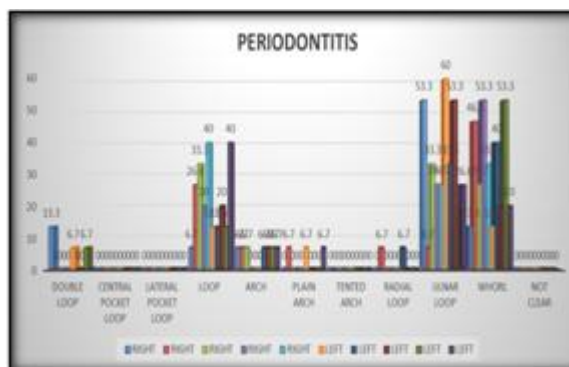
Graph 2: Gingivitis Patients (Loop Pattern Predominant)

The inclusion criteria were as follows:

- 1) Mean age group 18 - 45 years
- 2) Periodontitis was assessed using probing pocket depth ≥ 5 mm and clinical attachment level ≥ 5 mm.

The exclusion criteria were as follows:

- 1) Absence of a digit/figures
- 2) Patient with conditions or abnormalities that does not allow accurate recording of finger prints
- 3) Patients who are current \past smokers
- 4) Pregnant \ lactating females
- 5) Patients on antibiotics or any other medications for any debilitating conditions
- 6) Patients who have got oral prophylaxis done in past 6 months



Graph 3: Periodontitis Patients (Ulnar Loop Predominant)

Statistical Analysis: Data was analyzed using the statistical package SPSS 22.0 (SPSS Inc., Chicago, IL) and level of significance was set at $p < 0.05$. **Descriptive statistics** was performed to assess the mean and standard deviation of the respective groups. **Inferential statistics** was done using **CHI SQUARE TEST** was used for checking the association between the groups.

5. Discussion

Dermatoglyphics in Health & Disease:

Dermatoglyphic features are inherited through a polygenic system with individual genes contributing an additive genetic component⁹. The type of finger print pattern is unique based on the genetic characteristics of each individual. In addition of predictive value of finger prints in various diseases dermatoglyphics is used in identification of an individual. Due to uniqueness of finger prints, these can be used to identify the criminals at crime scene, dead or unconscious person in blast injuries or mass disaster injuries, accidental exchange of new born babies. Dermatoglyphics can be used to determine or exclude parentage under circumstances of uncertainty of paternity of child^{10, 11}.

Dermatoglyphics is like a map that allows one to analyses his own potential and talent.

Whorl signifies stubbornness. Loop signifies lack of perservance. Arch denotes the merciless crude behavior.

A person with ulnar loop on all fingers is clear spirited, strong - willed person (melancholic), cool in judgment and ruthless in business.

A person having whorls on all fingers is mostly restless, doubting, sensitive, clever, eager for action and inclined to do crime.

A mixture of whorls and loops signifies a neutral character, kind, obedient, truthful but often undecided and impatient.

Arches and radial loops occur in person who is ambitious, cool, stubborn, disobedient, defiant and rebellious¹².

Dermatoglyphics in Disease

Dermatoglyphics as a diagnostic tool is now well established in a number of diseases which have strong hereditary basis. Dermatoglyphics are of considerable importance in anthropology, criminology, medicine, chromosome abnormalities and also plays a significant role in disease affecting the oral cavity³.

A) Dermatoglyphics in diseases which are purely genetic disorders

- 1) **Down's syndrome (trisomy 21):** These patients have mainly ulnar loop pattern, single transverse palmer crease (simian line) and lower ridge count along digital midlines¹³.
- 2) **Turner's syndrome:** There is predominance of whorls pattern, although the pattern of frequency depends on the particular chromosomal abnormality¹⁴.
- 3) **Klinefelter's syndrome:** There is excess of arches on digit 1, more frequent ulnar loops on digit 2, over all fewer whorls pattern, lower ridge count for loops pattern and whorls pattern and total reduction of finger ridge count¹⁵.

B) Dermatoglyphics in other diseases which have some genetic background

- 1) **Neurological diseases:** Since brain and skin develop from same ectoderm during embryogenesis, dermatoglyphic variations are informative for early developmental brain disturbances¹⁶.
- 2) **Rheumatic heart disease:** There is decreased frequency of arches in males and increased frequency of whorls pattern in females. There is increased frequency of patterns in 3rd interdigital area in males and decreased 'td' ridge count, increased multiple axial triradius in females¹⁷.
- 3) **Diabetes mellitus:** In type 1 Diabetes mellitus there is increased frequency in whorls pattern and decreased ulnar loop and increased incidences of arches in females¹⁸.
- 4) **Malocclusion:** Malalignment of teeth in both the arches showed a significant variation in these patterns³. **Reddy et al**¹⁹ concluded that arches were found at a higher frequency percentage in class I and class II div I malocclusions, but no significant increase in whorls was noted in class III malocclusions.

5) **Dental caries:** Dental caries is a global problem. Many studies have reported a significant association between dermatoglyphics and early stages of dental caries³. **Chinmaya et al**²⁰ reported that central pocket whorl and twinned loops have an association with an increase in dental caries experience.

6) **Bruxism:** Bruxism is the involuntary gnashing, grinding or clenching of teeth³. **Polat et al**²¹ reported an increase in frequency of whorls and a decrease in frequency of ulnar loops in bruxism patients.

7) **Application in Periodontal Disease:** Dermatoglyphics serve as an early forecasting tool in periodontal disease, as genetics play a key role in the onset of periodontitis³.

A Comparative study done by **M. Atasu et al**⁵, among periodontal healthy subjects and patients with periodontitis, observed that patients with juvenile periodontitis, has decreased frequency of twinned and transversal ulnar loops on all fingers, 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 progressing periodontitis (RPP) and the increased frequencies of concentric whorls and transversal ulnar loops on all fingers of the patients with adult periodontitis (AP). **Soumya et al**²², reported significant increase in the whorl pattern in chronic periodontitis patients. Among the whorl pattern, central pocket whorl pattern was significantly increased. And the second most common pattern found in the chronic periodontitis patients was the loop pattern.

6. Conclusion

In Periodontology, Dermatoglyphics can be used as a potent bio - indicator for predicting the susceptibility of various diseases like chronic periodontitis as due to its genetic nature and a strong hereditary background. It also provides a window of hope in establishing more non - invasive techniques and procedures in early diagnosis and treatment of the periodontal diseases. This dermatoglyphics research only adds a cornerstone to the existing research work.

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