

REVIEW ARTICLE

Dermatoglyphics- An Overview

Aesha¹, Sreeja.C², Shahela Tanveer³**ABSTRACT**

Dermatoglyphics refers to the branch of science in the study of patterns of skins (dermal) ridges present on the fingers, toes and the soles of human. The link between our fingers and intrinsic qualities, talents emphasize the congenital link. They begin to develop in 10th week of gestation and are completed by 24th week. This article highlights dermatoglyphics and its importance in congenital abnormalities, psychiatric disorders and various disorders.

Keywords: Dermatoglyphics, fingers, toes, congenital abnormalities

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Senior Lecturer, Department of Oral Pathology, ¹Chettinad Dental College and Research Institute, Kelambakam, Chennai, ²Adiparashakthi dental college and hospital, Melmalvathur, Chennai, ³Senior Lecturer, Department of Oral Medicine and Radiology, Sri Sai Dental College and Hospital, Vikarabad, Hyderabad

Corresponding author: Dr. Aesha, Senior Lecturer, Department of Oral Pathology, Chettinad Dental College and Research Institute, Kelambakam, Chennai

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INTRODUCTION

Dermatoglyphics deals with the study of the epidermal ridges and their configuration on the fingers, palms and soles. The word "Dermatoglyphics" is originated from two greek words "Dermato" means skin and "Glyphics" meaning carving.¹ 1926 was the year when Harold Cummin proposed the term 'dermatoglyphics' When we look back in our

ancient India there was a study known as 'Samudra Shashtra' defined as a study of ridges. These ridges were further classified into 3 groups which was named as Chakra, Shankya, padma, the same in our current modern classification is given as Whorl, Loop and Arch system. IN 1684, the study of dermatoglyphics was first started By Grew. Subsequently, in 1923, Epidermal ridges were classified into 9 types by Parkinjee.

William Herschel (1880) used fingerprints for personal identification purpose in India. In early stages of foetal development the dermal ridges start differentiating. These ridges were always genetically determined and were also changed depending on the environmental factors.¹ Therefore the study of dermatoglyphics has evolved for the research field to help and detect the medical problems such as congenital anomaly and helps us to detect the inutero dental anomalies.²

Embryogenesis: 10 week of gestation was the time when the fetal pads start the development process and continues until the end of 24th week of inutero development. From 11- 14 week the development is unaffected by any environmental factors and thus highlights on the importance of studying the ridges in its unique way. This shows as a marker for each ones identification as well as to know the developmental anomalies or the defects inutero during early stages of pregnancy itself. Therefore both genetic and environment are to considered as an important fact in this aspect.

The use of Dermatoglyphics in medical and dental fraternity is the most upcoming for detection of potential cases such as Schizophrenia etc. And in cases like oral clefts, dental caries for early detection and prevention; submucous fibrosis-a precancerous disease affecting the oral mucosa caused mainly by genetic predisposition.⁵ It is caused by inflammation and progressive deposition of collagen fibers in lamina propria and deep connective tissue^{3,7}. These result in the thickening of the oral mucosa and thereby restricting mouth opening. Most probably gutkha

chewers are affected but it may also affect the others; Malocclusion- Both development of dentition and palate occurs in the same time as that of the development of dermal ridges. Though both develop at same time but are not always associated with genetic structures.⁴⁴

Main advantage of the knowledge of dermatoglyphics is a) They remain unchanged throughout individuals life span b) The convenience and inexpensive methodology of recording⁶

Methods of recording Dermatoglyphics include

1. Ink method – described by Cummins and Midlow(1943)
2. ‘Scotch-tape India-ink’ method - which is an inkless method using sensitizing fluid, adhesive tape, powder, and carbon paper.
3. Recent "hi-tech" methods are generally computer based and begin by scanning prints with a video camera followed by digitizing the print features which are then subjected to analysis.
4. Okajima (1975) developed a method to study ridges on the dermal surface instead of the epidermal surface using chemical treatment and staining with toluidine blue that can be done even in fetuses from the 14th gestational week.
5. Misumi et al. (1984)³ used scanning electron microscope.
6. Rubber and Plaster of Paris casts
7. Integrated Automated Fingerprint Identification System (IAFIS)
8. The lipstick method -is easy, harmless, cheap, subject and user friendly and a single person can do the procedure alone too. The chemical composition of lipstick varies greatly from brand to brand. A typical lipstick has the following composition: dye, 5%; titanium dioxide 10%; oil 40%; wax 20%; emollient 25%, with traces of other components to impart a pleasant odor, a preservative to kill microbes, vitamin E, sunscreens and sometimes even a flavoring agent. Commonly used dyes are 4', 5'-dibromo-fluorescein and 2', 4', 5', 7'- tetrabromo-fluorescein, which is also known as eosin.

Dactylography OR Fingerprint system was suggested by Galton which was based on the claims of Henry Faulds and Sir William Herschel in nature, 1880. It is a study of the epidermal ridges and configurations in the palms of the hands. The method can also include the soles of the feet.

Anatomy of the Fingerprint

The individual characteristic is none other than Fingerprint. Studies have also shown that none have same ridge pattern. Dermal ridges are those raised surfaces found on hands, feet, palms and soles. These ridges are known for the performance in firm finger grasp.

Classification of Fingerprints Two International Systems:

- Henry System – Used in North America and Europe
- Vucetich System – Used in Central and South America Identification is based on class and ridge patterns (minutiae) found on each individual print.

Principles

- A fingerprint is an individual characteristic
- No two fingers have the same fingerprint
- Identical twins are similar but not identical
- Fingerprints remain unchanged during a lifetime
- Fingerprints have general ridge patterns that permit them to be classified

Types of Fingerprints

Plastic Impressions: Made in soft material like butter, soap, etc.

Visible Prints: Prints made when fingers have been covered in blood, dirt, oil, paint, etc.

Latent Prints: Prints not visible to the human eye, hidden, unseen until treated.

Galton classified fingerprints into three types:

- Loop
- Whorl
- Arch
- Delta

Loop: 60% of the world's population has them. Loops have one or more ridges entering from one side of the print, recurring and exiting from the

same side.

If loop flows towards the little finger = ulnar loop/pinkie

If loop flows towards the thumb = radial loop /thumb

All loops have one delta, which is triangular in shape.

Whorls: 35% of the world's population has them. They have some ridges that form circles or spirals and have 2 deltas and four types of whorls: 1. Plain whorl 2. Central Pocket whorl 3. Double Loop 4. Accidental whorl.

Arches: 5% of population has them.

Start on one side and rise towards the centre, then leave on other side. No deltas. Two types of arches plain and tented.

Ridge Characteristics : A finger print has many number or identification points they are named as ridge characteristics. The following are the types of ridge characteristics.

- a. Ridge dots- A single ridge unit which is equal to the size of its width.
- b. Bifurcation: One friction ridge divides into two. They can also be opposite ridges.
- c. Trifurcation: One friction ridge divides into three ridges.
- d. Ending: A structure which terminates within the friction ridge
- e. Ridge crossing- Two ridge units intersect
- f. Enclosure: Single ridge bifurcates and rejoins after short course and continues as a single one ridge
- g. Spur: A bifurcation one with short the other with long ridge
- h. Bridge: Parallel running ridges

Identification of Minutiae

12 points of minutiae should match a print from the crime scene to a person's print. Identification is based on class and ridge pattern found in each of these prints. This technique is performed by a latest technique of Automated fingerprint identification system.

Using these methodology and techniques we can read the dermatoglyphics.

Poroscopy

The method was first introduced by Edmund

Locard, a study of the pores through which sweat exudes out. The number, size, shape, and site in given papillary ridge of epidermis vary from one individual to another. They are more reliable when only partial fingerprints are available.

Footprints

Impressions of human feet on various substrates are found to be unique to each individual. The foot measurement, morphology and the ridge pattern or dermatoglyphics are important character of an individual that can be obtained from ones foot impression. An analysis of the footprints can be done in the same way as the fingerprints. Apart from the ridge patterns the various measurement s such as the length and width of the foot, length and width of the toes, toe pads, the angles of declination from each toe, and from the ball to its juncture with the arch, etc helps in differencing the footprints of one individual from another. In forensic science the analysis of the foot may aid in estimating the stature, weight, and gait of an individual. The footprints are recorded by photography or impression casts. Barefoot inked impression of airforce personnel are maintained as friction ridge of the foot have a high chance to persist following the crash.

Studies performed

In an issue of National journal of medical research by Andani Rashida H et al published their work in specific syndromes of genetic origins. 100 diagnosed thalassaemia patients were studied. On result there was correlation between dermatoglyphics and inherited disorders like thalassaemia.

Other studies also includes Down's syndrome: A marked increase of the ulnar loops on the fingertips is virtually a constant feature of the dermatoglyphics in Down's syndrome.

Clefts: Balgir RS in 2006 studied on both palatal and cleft lip have shown increased radial and ulnar loops with wider atd angle.

Dental caries: In a study performed by A Sharma and R Somani in the year 2005 found a great difference in loops between both caries group as well as noncaries individuals. The difference in growth pattern of microorganisms were also significant.

Cancer studies: One of the study has found significantly fewer ($P < 0.05$) radial loop patterns on the first, second, third and fourth digits on left hand, and second digit of the right hand in squamous cell carcinoma of head and neck cases.

CONCLUSION

Dermatoglyphics is an interesting field by giving the importance in both medical and dental fields, by various techniques mentioned above. Most important it is a sensitive indicator for anomalies in intrauterine dental anomalies.

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