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DERMATOGLYPHICS: A REVIEW & ITS ROLE IN DENTISTRY

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ABSTRACT
The scientific study of fingerprints and the dermal ridge configurations is known as Dermatoglyphics. Earlier, these were used for predicting the future and for criminal investigations. Today, these are mainly used in the medical and dental fields for the diagnosis of genetic abnormalities. These fingerprint patterns are unique and separate for each individual. These remain unaffected by genetic factors and other local/environmental factors. This new branch still needs some developmental research especially for using it in the dental field. However, the studies and research so far holds great promise and is here to stay. This article is a brief review on dermatoglyphics and mainly focuses on **the dermatoglyphic features and characteristics in some common clinical** dental conditions, along with the method of registering prints, advantages and limitations of dermatoglyphics.

KEYWORDS: Dentistry, Dermatoglyphics, Fingerprint, Fingertip pattern.

INTRODUCTION
Skin is the largest and most delicate organ of the human body. It serves various vital functions. The skin of hand and feet is covered by two distinct classifications of marks, one of them being the creases/folds of the skin (i.e. used in palmistry).[1] The scientific study of finger print patterns and the dermal ridge configurations is called as "Dermatoglyphics", which are mainly present on the hands (palms, fingers) and feet (toes and soles). The term "Dermatoglyphics" was coined by Cummins and Midlo (1926).[2-4] Although, Cummins is called as "The father of Dermatoglyphics".[5] Dermatoglyphics word is derived from 2 Greek words, i.e. Derma (skin) and Glyphae (carve).[4] These patterns are unique for each individual and not even duplicated in monozygotic twins. These patterns once formed, remains constant throughout the life, until the body decomposes.[6] The fingerprint configuration is determined by the multiple genes and their study points to vital genetic and medical information about an individual. Unusual ridge formation is suggestive of various chromosomal abnormalities in the individual. There are several factors that can influence the ridge patterns, like nerve pairs at the border between dermis and epidermis, insufficient oxygen supply, the abnormal distribution of sweat glands, or changes in epithelial growth.[7,8]

In the recent times, this technique is being used in various fields including dentistry. Various pathological conditions like - Dental caries, Periodontal diseases, Oral submucous fibrosis, Down's syndrome, Malocclusions, Klienfilter's syndrome etc. can be primarily investigated by dermatoglyphics.[9]

EMBRYOGENESIS OF DERMATOGLYPHICS
The development of dermatoglyphic patterns begins around the 6th week of gestation (time when fetal pads appears) and maximum size is reached around 12th and 13th weeks and ended around 24th week of gestation (with the appearance of finished patterns on the skin surface).[10] Dermal ridge configurations appear due to physical and topographic growth forces which affects volar skin. Mainly different genes regulate the ridge patterning and at the same time, total form of hand also determine these pattern, in their development stage.[9]

METHODS OF REGISTERING FINGER PRINTS
These methods are generally inexpensive, non- invasive and rapid.[11,12]

Some of the methods are:-

a) Ink method:- Most widely used method. The fingers are pressed on ink pad and recorded on a clean paper.
b) Faurot method:- Some solutions that are commercially available, are used and the prints are recorded on sensitized paper.
c) Transparent adhesive tape method:- In this method, dry coloring pigments (like chalk, ink, standard ink, india ink, carbon paper, crayons, graphite) are applied on hands. The prints are lifted with the help of clear transparent tapes and can be preserved.
d) Photographic method:- Principle used-"total internal reflection". A polaroid camera is used to capture the magnified image.
e) Numerical method
f) Rubber and pop casts
g) Scanning electron microscope:- It is an expensive method.
h) Integrated automated fingerprint identification system:- It is an expensive method. Automatic separate machines are used to scan palm and hands to record prints.
i) Specialized methods:- The correlation between the epidermal pattern and underlying bone structure is called as "Radiodermatography".

PATTERN CONFIGURATIONS

Pattern configuration is of 2 types: (i) Palmer pattern
(ii) Finger tip pattern

Palmer patterns configurations are:- [Fig.1]

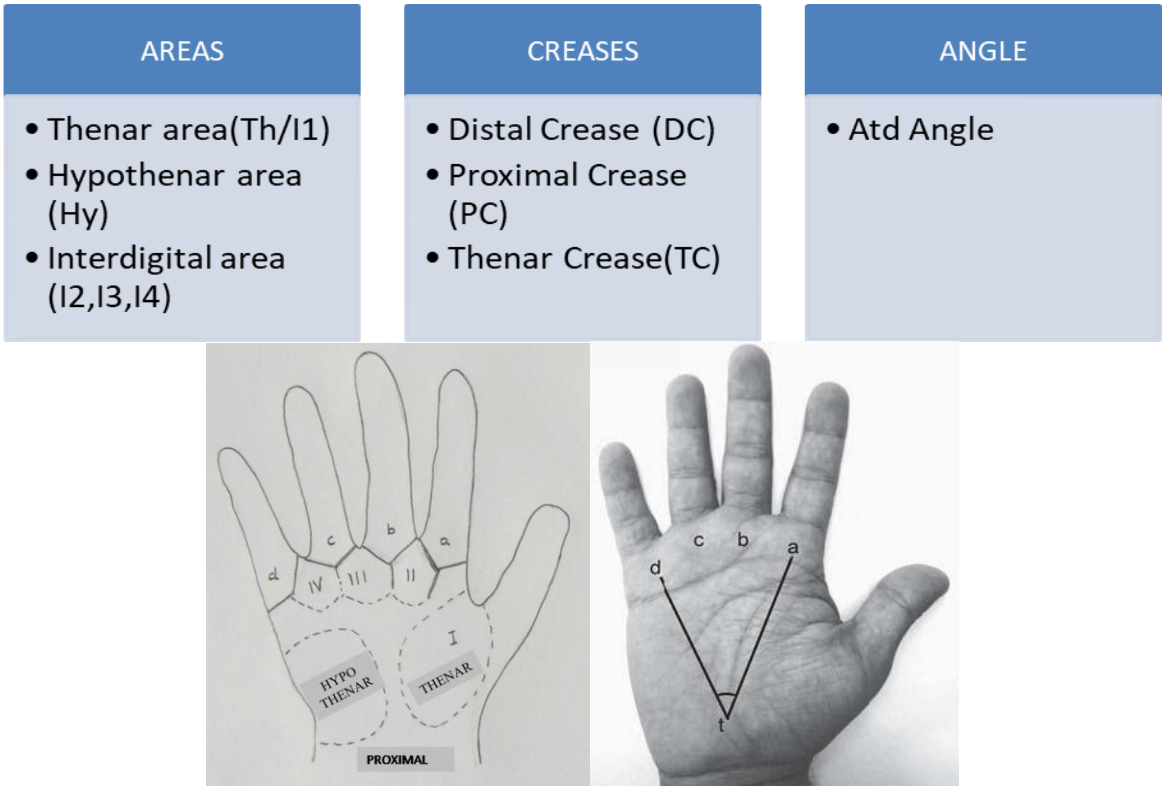

Figure 1

DERMATOGLYPHICS LANDMARKS

Ridge- formed by curved lines in a fingerprint.
Core- centre of a pattern.
Triradial point/Delta- the meeting point of three ridges, which form angles of approximately 120 degrees with one another.
Radiants- numerous ridges which constitute the skeletal framework of the pattern.

FINGER TIP PATTERN CONFIGURATIONS

Distal phalanges finger tip patterns are divided into 3 broad types (by Sir Francis Galton, 1892).[13] They are:-

➢ Arch: It is the simplest of all types. [Fig.2] Approximately 5% people have ridges that enter from one side and exit from another side with a distally bowed step makes these arches. A wave like pattern is formed in the centre. These are called as the plain arches. [Fig.2A]

When the ridges rise in the centre like a spike and are not smooth. These are called as the tented arches. [Fig.2B]

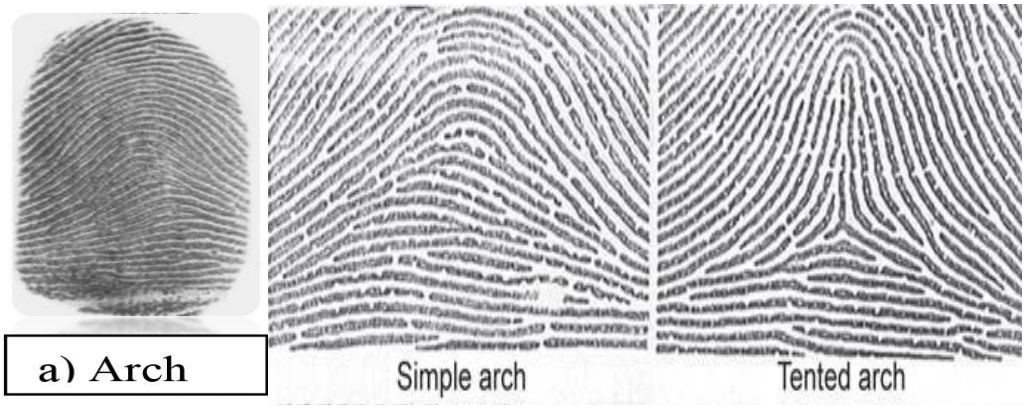

Figure 2: 2A- Plain arch, 2B- Tented arch.

- Loops: One of the commonest pattern configuration on finger tips[14] seen on almost 65% of the population.[15] [Fig.3]
- The ridges curve around only one extremity of the pattern and flow to the margin of the digit.

One delta/ tri-radial point is seen in these types of patterns.

Loop opening towards the ulnar side is known as ulnar loop and is 60% of the loops.

Loop opening towards the radial side is known as radial loop and is 5% of the loops.

Figure 3

- Whorls: Any ridge configuration that encircles the core as concentric circles are called as whorls.

These consists of 2 or more deltas and can be in the form of spiral, shell, circle, eye etc.

Complex configurations under whorls are known as 'composites'.

There are different types of whorls like- [Fig.4]

- ❖ Plain/ simple whorl:- Ridges are in the form of homocentric coaxial rings/ ellipses.
- ❖ Double/ spiral whorl:- These are spirally arranged around a core; and can be in clockwise/ anti-clockwise direction.
- ❖ Central pocket loop/ whorl:- It is the simples of all. The pattern consists of a loop and a whorl and the small whorl is enclosed by a loop.[13]
- ❖ Accidental whorls:- Patterns which do not fall under any of the given types, fall under this category of accidental whorls.

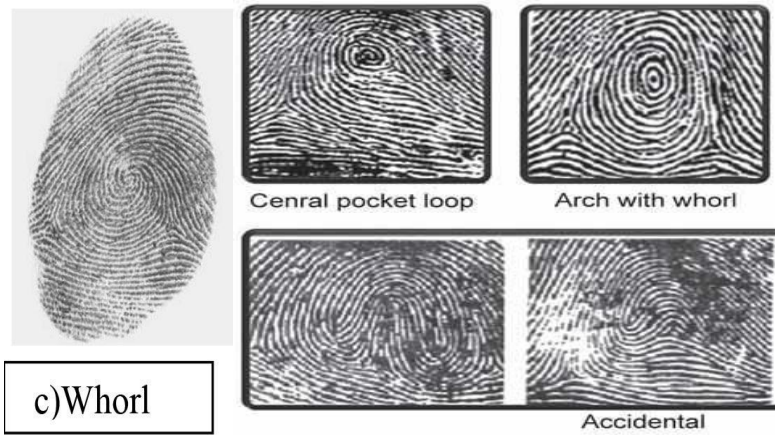

Figure 4

DERMATOGLYPHICS IN DENTISTRY

Dermatoglyphics is used to reveal several oral diseases as well as genetic abnormalities. These are genetically controlled characters and any deviation from normal, indicates an abnormal condition.

Dermatoglyphics are being widely used in forensic odontology.

1) Cleft lip and palate[4] - On the right hand the following are seen:
   (↑) frequency of loops and arches,
   (↑) tri-radii count,
   (↓) frequency of whorls,
   (↓) Atd angle (more than 30°),
   (↓) mean total ridge count.

2) Down's Syndrome[16]- Bilateral ulnar loops on fingers,
   High frequency of simian creases,
   Radial loops on digits 4 and 5

3) Oral Submucous Fibrosis-(↑) in frequency of arches,
   (↓) in frequency of simple wholrs,
   (↓) Atd angle.[17]
   (↓) in pattern frequency of Thenar/ I1 areas.[17]

4) Periodontal disease

(i) In Aggressive Periodontitis: (↓) twinning,
   (↓) transverses loop patters,
   (↑) concentric whorls,
   (↑) transverse ulnar loops

(ii) In Rapidly Progressive Periodontitis: (↓)double loops,
   (↑) frequency of radial loops

5) Dental Caries[28] - (↑)in pattern of whorls,
   Ulnar and radial loops frequency (↑),
   (↑)in total count of ridges

6) Bruxism[19] –Polat reported that (↑) in whorls frequency,
   Ulnar loops frequency(↓),
   Frequency of Atd Angle(↓)

7) Forensic Odontology- an increase in frequency of transverse palmer crease line is observed in mentally challenged children.[20]

ADVANTAGES OF DERMATOGLYPHICS

- Scanning as well as recording is cheap and rapid.
- It is a non- invasive technique that does not requires hospitalization and can be performed in clinics also.
- Requires minimum instruments or equipments.
- Lifelong preservation of data is possible in this technique.

DISADVANTAGES/ LIMITATIONS OF DERMATOGLYPHICS

- In cases of gross malformations in the limbs, it becomes difficult to use these dermatoglyphics to be used for clinical diagnosis.[16]
- Careful application of ink must be done while recording the prints. The ink must be applied in sufficient quantity so that a proper impression is made. Too thick / thin ink may result in improper prints.
- Using Atd angle as a parameter has several disadvantages. Spreading of fingers and the pressure exerted can affect the Atd angle.[13]

CONCLUSION

Dermatoglyphics is an integral part of science and medical field these days. As, the Fingerprints are unique and unalterable; hence, act as an excellent tools for personal identification, morphological, and genetic research. The correlation of dental problems is still in its initial stages, and presently, it can be said that the various fingerprint patterns can be considered as an indicator for the occurrence of congenital orofacial abnormalities and dental diseases. Dermatoglyphics has moved from obscurity to acceptability as a diagnostic tool. Extensive study and research in this field are required to determine its validity. In the future, it may serve as an important tool that can predict the future health of a person. This should be concluded that, the fingerprint pattern can be considered as a non- invasive diagnostic tool for prediction, early diagnosis and management of dental diseases.

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