

Dermatoglyphics in Dentistry - An Overview

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Abstract

Dermatoglyphics is the study of various patterns and configurations of fingers, and palms, soles. This could be used as an adjunct in preliminary diagnosis. Many studies in literature have shown an association between these dermal configurations and dental diseases. Early detection is very important in controlling dental diseases. As dermatoglyphics appear at a very early stage of life and remain constant throughout, this could be a very important diagnostic tool if proved. This article aims to highlight the various types of dermatoglyphic patterns, advantages, limitations and its associations with various dental diseases.

Keywords: dermatoglyphics; fingerprint; dentistry

Introduction

Dermatoglyphics is defined as the study of configurations and patterns of the epidermal ridges [1]. The term dermatoglyphics was given Cummins and Midlo in 1961 [2]. It is a derivation from two Greek words where 'derma' means skin and 'glyphe' means carve [3]. Harold Cummins is the father of dermatoglyphics [4]. It is said that these epidermal configurations appear during the 12th week of intrauterine life and are established by the 24th week of intrauterine life. They remain constant throughout life once established. They only increase in size [2]. A rule called 'proof of no change' was put forward by Galton which stated that dermatoglyphic configurations of an individual remains constant or unchanged throughout that person's lifetime [5]. Due to this unique nature dermatoglyphics could be a useful tool in diagnosing and treatment of examined individuals [6, 7].

Dermal ridge configurations are said to be unique for an individual and hence it could be a useful tool to assess the genetic trait of an individual, evaluation of children with any suspected genetic diseases and in forensics [7, 8]. It has been said that genetics and environmental factors influence the development of fingerprint configurations [9]. The ridged skin is considered as a sensitive indicator of intrauterine dental abnormalities since it develops from the fetal volar pads same as that of the teeth, which also originates from the same ectodermal layer during the 6th-7th week of embryonic life [10]. Hence, it can be inferred that any intrauterine dermal damage occurs, anomaly of the tooth also can be expected. This can be considered as the basis for comparison of dental disorders with dermatoglyphics [11].

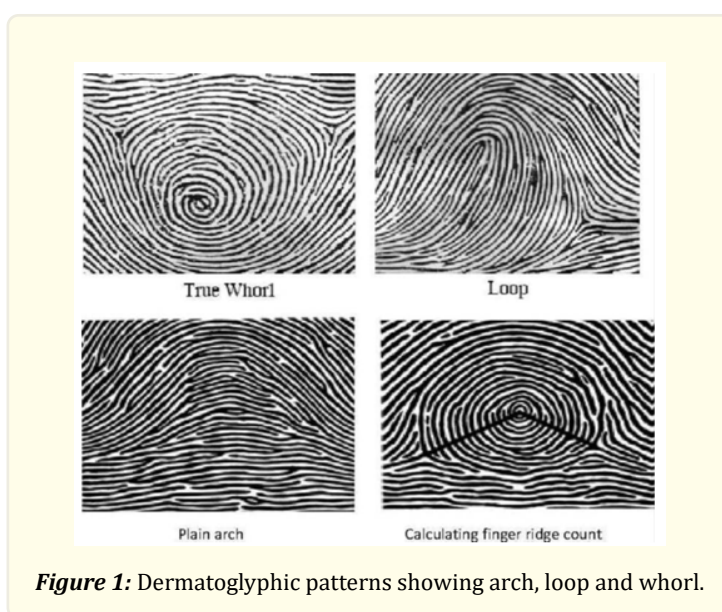
Dermatoglyphic Patterns

In 1892, Galton has classified fingerprint patterns into 3 types: arches, loops, and whorls. Basis for this classification was the degree of curvature of the ridges [12, 13].

In arch pattern, the dermal ridges run from one side of the pattern to the other with a slight rise at the center of the pattern. Here, these ridges do not make a backward turn or twist. Arches can be either simple or tented type [12, 14].

In loop pattern, dermal ridges run from one side of the pattern continue till the center and then at least one ridge tends to make a backward turn around the core. Loops can be either ulnar or radial depending upon the direction [12, 14].

In whorl pattern, the dermal ridges start from one side of the pattern and complete a circle. Whorls can be either spirals or double loop (Figure 1) [12, 14].



Core is the approximate center of the pattern and triradius is the landmark formed due to the confluence of three ridge systems [14, 15]. Arch has no triradius, loop has one triradius and whorl may have two or more triradii [12].

Total finger ridge count: ridge count is calculated by drawing a straight line from the core to the triradius of the pattern and counting the number of ridges that is touched or crossed by the line (Figure 1) [12].

The whole palm print show certain other patterns/features like the atd angle (the angle formed by joining the lines drawn from the digital triradius 'a' to axial triradius 't' and from this to digital triradius 'd'), H-loop, IV loop, a-b ridge and others [16].

Advantages [17]

- The method to collect dermatoglyphics is simple with interpretation of findings being easy and fast.
- These dermatoglyphic patterns are unique for each individual.
- The technique is cost effective, efficient, and requires minimum equipment.
- Storage of data is easier and not cumbersome.
- It is faster and can be done anywhere and does not require hospitalization.

Disadvantages/Limitations [17]

- It is difficult to check in individuals with malformations of fingers/hands or disfigurements.
- Appropriate amount of ink should be placed or else the print will not be readable.
- Accurate print has to be recorded for obtaining readable prints or else it will lead to misleading information.

Recording Dermatoglyphics

Ink method

This is the oldest and most widely used method. The equipments required are simple i.e. printer's ink, a roller, glass/metal inking slab, sponge rubber and good quality paper for recording [18, 19].

Transparent adhesive tape method

Here, a dry colouring pigment is applied to the skin surface and then lifted off with a transparent adhesive tape. The prints obtained are very clear in this method [18, 19].

Faurot inkless method

In this method a specially sensitized paper and a commercially available patented solution is required [18, 19].

Photographic method

This method is based on total internal reflection. This occurs when an object is pressed against a prism. The magnified image is photographed using a polaroid camera [18, 19].

Numerical method

Algorithm of synthesis of images of fingerprints is used and minutiae are created. The model allows looking at digital coding of a fingerprint and also enables mathematical cataloging of minutiae and types of patterns [18, 19].

Special methods

Special methods allows study of dermatoglyphics and underlying bony structures (radiodermatography), study of sweat pores (hygrography) or study of the spatial shape of the ridged skin areas, for example in primates (plastic mold method) [18, 19].

Digital method

In recent times, fingerprints are being recorded digitally with various softwares to identify the type of fingerprints [20].

Dermatoglyphics and Dentistry

In the recent past, dermatoglyphics has been gaining attention in the field of dentistry. There are studies showing correlation between dermatoglyphics and various dental diseases like dental caries, oral cancer, malocclusion, cleft lip and palate, periodontal diseases and also in forensic odontology [21].

Oral potentially malignant disorders

A study was conducted by Venkatesh et al where among all the participants with leukoplakia 30.70% had whorls and 6.30% had loop pattern. Among the participants who had oral submucous fibrosis, 60.70% had loop pattern, 30.32% had whorl pattern and arch pattern was present in 7% of the subjects [22].

Dental caries

There have been many studies showing a correlation between dental caries and dermatoglyphics. Increased frequency of whorls was seen in individuals with dental caries. Also, increase in ulnar and radial loop pattern was associated with a decreased susceptibility to dental caries [23-28].

Periodontal diseases

A study conducted by Atasu et al stated that dermal configurations along with clinical and radiographic investigations can be used to categorize patients according to different periodontal disease classification [29].

A study by Kochhar et al reported a decreased frequency of loops with increase in periodontal disease and there was no significant relationship with whorls [28].

Malocclusion

Many studies in literature have been done to correlate malocclusion with dermatoglyphics. Most of the studies are where Angle's molar relation has been considered to correlate with dermatoglyphics. Study done by Reddy et al stated that particular predictive occurrence of patterns was not found to be associated with any class of malocclusion but an increased frequency of twinned loops was seen in Class II malocclusion and radial loops were absent in Class III malocclusion [2].

In a study done by Tikare et al found a statistically significant correlation between whorl pattern and Class I and Class II malocclusion groups. But, overall there was no significant correlation between both [30].

Fewer studies have been done to correlate skeletal malocclusion with dermatoglyphics. Study done by Divyashree et al showed an increased frequency of whorls in skeletal class I pattern group and ulnar loops in skeletal class II pattern group [31].

Cleft lip and palate

Balvir conducted a study where an increased frequency of radial and ulnar loops was seen patients with cleft lip and palate [32].

Forensic odontology

A comparative study was done among 100 children where 50 were healthy children and 50 were mentally challenged children. Mentally challenged children group showed an increased frequency of loop pattern and transverse palmar crease line [33].

Conclusion

Dermatoglyphics are unique to an individual. They remain constant once established. Hence, can serve as an important diagnostic tool for various dental conditions. It can serve as an adjunct for preliminary diagnosis. The use of dermatoglyphics in dentistry has been evolving with newer digital methods for collection and identification. Use of these dermal configurations in various studies involving oral cavity should be made more common in order to establish its authenticity. In future, studies involving genetics and dermatoglyphics are required for more confirmatory results.

References

1. Gupta RK and Gupta AK. "New, easy and effective method to take dermatoglyphic prints". National Journal of Medical Research 3 (2013): 45-47.
2. Reddy BR., et al. "A comparative study of dermatoglyphics in individuals with normal occlusions and malocclusions". J Clin Diagn Res 7 (2013): 3060-5.
3. Bhat GM., et al. "Dermatoglyphics: in health and disease - A review". International Journal of Research in Medical Sciences 2

- (2014): 31-37.
4. Madan N, Rathnam A and Bajaj N. "Palmistry: A tool for dental caries predilection". *IJDR* 22.2 (2011): 213-218.
 5. Kimura S. "Embryologic development of flexion creases". *Birth Defects Orig Artic Ser* 27 (1991): 113-29.
 6. Stosljevic M and Adamovic M. "Dermatoglyphic characteristics of digito-palmar complex in autistic boys in Serbia". *Vojnosanit Pregl* 70 (2013): 386-90.
 7. Kamboj M. "Dermatoglyphics". *Br Dent J* 204 (2008): 51.
 8. Namouchi I. "Anthropological significance of dermatoglyphic trait variation: An intra-Tunisian population analysis". *Int J Mod Anthropol* 4 (2011): 12-27.
 9. Kobylansky E., et al. "Relationship between genetic anomalies of different levels and deviations in dermatoglyphic traits". *Stud Hist Anthropol* 4 (2004): 61-121.
 10. Atasu M and Akyuz S. "Congenital hypodontia: A pedigree and dermatoglyphic study". *J Clin Pediatr Dent* 19 (1995): 215-24.
 11. Bhat PK., et al. "Dermatoglyphics: A new diagnostic tool in detection of dental caries among deaf and mute children". *Int J Clin Dent Sci* 2 (2011): 80-4.
 12. Verbov J. "Clinical significance and genetics of epidermal ridges - A review of dermatoglyphics". *J Invest Dermatol* 54 (1970): 261-71.
 13. Galton F. "Finger Prints". London: McMillan (1982).
 14. Nabar BS. "Forensic Science in Crime Investigation". Hyderabad: Lowhouse (2006).
 15. Prabhu N., et al. "Dermatoglyphics in health and diseases - A review". *J Res Adv Dent* 3 (2014): 20-6.
 16. Gupta V, et al. "Dermatoglyphics and dental caries: A review". *Indian Journal of Forensic Odontology* 4.3-4 (2011): 33-37.
 17. Babu DBG and Asif SM. "Dermatoglyphics in dentistry: A review". *Int J Contemp Dent Med Rev* (2015): 1-3.
 18. Miller JR and Giroux J. "Dermatoglyphics in pediatric practice". *J Pediatr* 69 (1966): 302-12.
 19. Jurgensen AP and Kosz D. "Fingerprint Verification for Use in Identity Verification System". Aalborg University (1993): 257-80.
 20. Shashidhar K., et al. "Association between dermatoglyphic patterns and growth patterns of subjects with skeletal class I relation: A cross sectional study". *F1000Research* 11 (2022): 597.
 21. Prabhu N., et al. "Dermatoglyphics in Health and Oral Diseases-A Review". *JSM Dent* 2.4 (2014): 1044.
 22. Venkatesh E., et al. "Palmar dermatoglyphics in oral leukoplakia and oral squamous cell carcinoma patients". *J Indian Acad Oral Med Radiol* 20 (2008): 94-9.
 23. Atasu M. "Dermatoglyphic findings in dental caries: a preliminary report". *J Clin Pediatr Dent* 22 (1998): 147-9.
 24. Madan N, Rathnam A and Bajaj N. "Palmistry: A tool for dental caries prediction". *Indian J Dent Res* 22 (2011): 213-8.
 25. Abhilash PR., et al. "Dermatoglyphics in Patients with Dental Caries: A Study on 1250 Individuals". *J Contemp Dent Pract* 13 (2012): 266-274.
 26. Bazmi BA., et al. "A cross sectional study of dermatoglyphics and dental caries in Bengalee children". *J Indian Soc Pedod Prev Dent* 31 (2013): 245-248.
 27. Agravat D, Agarwal N and Patel P. "Dermatoglyphics: A Tool for Dental Caries Prediction". *J Adv Med Dent Sci Res* 2 (2014): 66-69.
 28. Kochhar GK., et al. "Dermatoglyphics of Dental Caries and Periodontal Diseases in Children of North India". *J Pharm Biomed Sci* 04 (2014): 658-663.
 29. Atasu M., et al. "Dermatoglyphic findings in periodontal diseases". *International Journal of Anthropology* 20 (2005): 63-75.
 30. Tikare S., et al. "Dermatoglyphics--a marker for malocclusion?". *Int Dent J* 60 (2010): 300-304.
 31. Divyashree., et al. "Dermatoglyphic patterns and their co-relation with skeletal malocclusions". *IOSR-JDMS* 15 (2016): 101-104.
 32. Balgir RS. "Dermatoglyphics in cleft lip and cleft palate anomalies". *Indian Pediatr* 30 (1993): 341-6.
 33. Kiran K, Rai K and Hegde AM. "Dermatoglyphics as a non-invasive diagnostic tool in predicting mental retardation". *J Int Oral Health* 2 (2010): 95-100.

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