

Review Article

Dermatoglyphics in Health and Oral Diseases-A Review

Namdeo Prabhu¹, Rakhi Issrani^{2*}, Saurabh Mathur², Gaurav Mishra³, Shruti Sinha²

¹Department of Oral and Maxillofacial Surgery, Saraswati Medical and Dental College, India

²Department of Oral Medicine and Radiology, Saraswati Medical and Dental College, India

³Department of Public Health Dentistry, Saraswati Medical and Dental College, India

***Corresponding author**

Dr. Rakhi Issrani, Department of Oral Medicine and Radiology, Saraswati Medical and Dental College, 233, Tiwariganj, Faizabad road, Lucknow-227105, Uttar Pradesh, India, E-mail: dr.rakhi.issrani00@gmail.com

Submitted: 27 June 2014

Accepted: 30 June 2014

Published: 11 July 2014

ISSN: 2333-7133

Copyright

© 2014 Issrani et al.

OPEN ACCESS**Abstract**

Dermatoglyphics refers to study of the intricate dermal ridge configurations on the skin covering the palmar and plantar surfaces of hand and feet. It is a branch of physical anthropology, medicine and genetics. Dermatoglyphic patterns are assumed to be genetically controlled although the exact mechanism of inheritance is still unknown. After their complete formation, they are unaffected by the environment, and this explains their unique role, as an ideal marker for individual identification and the study of populations, as well as detection of defects due to intra-uterine irregularities in the early weeks of pregnancy. However it is still at infancy in the world of dentistry where the co-relation of dental conditions with that of dermatoglyphic patterns is done. Hence the present paper reviews the work conducted by various authors on application of dermatoglyphics in dentistry along with the advantages and patterns of dermatoglyphics.

Keywords

- Dermatoglyphics
- Dermal patterns
- Fingerprints
- Palmar prints

INTRODUCTION

The modern study of the hand is thus far removed from the popular image of the soothsaying hand reader uttering mysterious incantations in an arcane language. Rather, through decades of scientific research, the hand has come to be recognised as a powerful tool in the diagnosis of psychological, medical and genetic conditions. For dermatoglyphic research and the discoveries of medical science have corroborated many of the traditional claims of hand analysts and has provided a firm empirical basis for the modern study of chiromancy.

The word 'dermatoglyphics' comes from two Greek words (*derma*, skin and *glyphe*, carve) and refers to the epidermal skin ridge formations which appear on the fingers, palms of the hands and soles of the feet [1]. This term was coined by Harold Cummins in 1926 [2]. It is known that finger and palm prints are formed during the 6-7th week of the embryonic period and are completed after 10-20 weeks of gestation [2]. Genetic process of dermatoglyphic traits is complex and is not perfectly known [3]. Their variable characteristics are not duplicated in other people, even in monozygotic twins or even in the same person, from location to location [4]. Abnormalities in these areas are influenced by a combination of hereditary and environmental factors, but only when the combined factors exceed a certain level, can these abnormalities be expected to appear [5].

Widespread interest in epidermal ridges developed only in the last several decades when it became apparent that many patients with chromosomal aberrations had unusual ridge formations [6]. Thus the study of dermatoglyphics is considered

as a window of congenital abnormalities and is a sensitive indicator of intrauterine anomalies as abnormal dermatoglyphic patterns have been observed in several non-chromosomal genetic disorders and other diseases whose aetiology may be influenced directly or indirectly by genetic inheritance [7]. Early detection can aid the clinician to anticipate health problems in children and initiate preventive and protective health measures at a very young age.

Over the past 150 years, dermatoglyphics has been a useful tool in understanding basic questions in biology, medicine, genetics and evolution, in addition to being the best and most widely used method for personal identification [8]. However it is still at infancy in the world of dentistry where the co-relation of dental conditions with that of dermatoglyphic patterns is done. Hence the present paper reviews the work conducted by various authors on application of dermatoglyphics in dentistry along with the advantages and patterns of dermatoglyphics [7].

ADVANTAGES

The major advantages of the dermatoglyphics are:

- i) They are fully developed at birth and thereafter remain unchanged for life.
- ii) Scanning or recording of their permanent impressions can be accomplished rapidly, inexpensively, conveniently and without causing any trauma to the patient or hospitalization.

METHODS OF RECORDING DERMATOGLYPHICS

Reviewing the literature one can find number of methods for recording dermatoglyphics. Variability lies in their requirements for equipment, time and experience, and in the quality of the prints produced.

The various methods that can be employed are: [9]

- i) Ink method,
- ii) Inkless method,
- iii) Transparent adhesive tape method, and
- iv) Photographic method.

DERMATOGLYPHIC PATTERN CONFIGURATION

Dermatoglyphic landmarks

The three basic dermatoglyphic landmarks found on the fingertip patterns are tri-radii, cores and radiants [8].

i) Tri-radius: It is formed by the confluence of three ridge systems that form angles of approximately 120° with one another.

ii) Core: It is in the approximate centre of the pattern.

iii) Radiant: They emanate from the tri-radius and enclose the pattern area.

Fingertip patterns

The ridge patterns on the distal phalanges of the fingertips are divided into the three groups: arches, loops, and whorls.

i) Arches: It is the simplest pattern found on fingertips. It is formed by succession of more or less parallel ridges, which traverse the pattern area and form a curve that is concave proximally (Figure 1). Sometimes, the curve is gentle; at other times it swings more sharply so that it may also be designated as a low or high arch respectively. The arch pattern is subdivided into two types:

a) Simple or plain arch composed of ridges that cross the fingertip from one side to the other without recurving.

b) Tented arch composed of ridges that meet at a point so that their smooth sweep is interrupted.

ii) Loops: It is the most common pattern on the fingertip. A series of ridges enter the pattern area on one side of the digit, recurve abruptly, and leave the pattern area on the same side (Figure 2). The loop pattern is subdivided into two types:

a) *Ulnar loop* composed of ridges that open on the ulnar side.

b) *Radial loop* composed of ridges that open on the radial side.

Loops may vary considerably in shape and size. They may be large or small, tall or short, vertically or horizontally oriented, *plain loop* or *double loop*. Occasionally, *transitional loops* can be found which resemble whorls or complex patterns.

iii) Whorls: It is any ridge configuration with two or more tri-radii. One tri-radius is on radial and the other on the ulnar side of the pattern (Figure 3). Subtypes of whorl patterns include:

a) *Plain/simple/concentric whorl* composed of ridges that

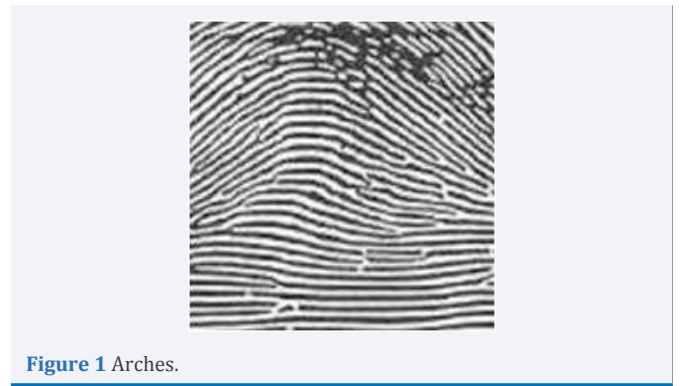


Figure 1 Arches.



Figure 2 Loops.



Figure 3 Whorls.

are commonly arranged as a succession of concentric rings or ellipses.

b) *Spiral whorl* is a configuration in which ridges spiral around the core in either a clockwise or a counter clockwise direction.

c) *Central pocket whorl* is a pattern containing a loop within which a smaller whorl is located. Central pockets are classified as ulnar or radial according to the side on which the outer loop opens.

d) *Lateral pocket/twinned loop pattern* is composed of interlocking loops.

e) *Accidentals/complex patterns* are one in which patterns cannot be classified as one of the above patterns.

Some represent a combination of two or more configurations such as a loop and a whorl, triple loops and other unusual formations.

Palmar patterns

The palm has been divided into several anatomically designed areas and includes thenar areas; four inter-digital areas, and the hypothenar area (Figure 4).

i) Thenar and first inter-digital area: These two areas are closely related anatomically and are considered one area. Patterns, when present, are most often loops.

ii) Second, third and fourth inter-digital area: Configurations encountered in the inter-digital regions are loops, whorls, vestiges and open fields.

iii) Hypothenar area: Patterns commonly seen are whorls, loops and tented arches.

Quantitative analysis

Many dermatoglyphic characteristics can be described quantitatively, e.g. by ridge counting, and measuring distances or angles between specified points.

USE OF DERMATOGLYPHICS IN DENTISTRY

Recently, recognition of irregular fingerprints among patients with periodontitis, dental caries and certain types of congenital anomalies like cleft lip and palate has drawn attention of investigators to the field of dental dermatoglyphics. The work conducted by various authors on use of dermatoglyphics in dentistry is as follows:

Dermatoglyphics and cleft lip and palate (CL/P)

Zarakauskaitė et al. [10] in their case control study suggested that there are some significant dermatoglyphic peculiarities in persons with CL/P in comparison with control group. The patterns on thenar eminence in hands of those with CL/P were six times rarer than in controls ($p < 0.05$). There was a significant difference ($p < 0.05$) between the control group and persons with CL/P by count of all tri-radial (controls-98%, CL/P-87.3%), the main line A ended more often in fields 5' and 5'' in persons with CL/P in comparison with their parents and there were

significantly more arches, double loops and ulnar loops in with CL/P than in control dermatograms.

Scott et al. [11] studied dermatoglyphic prints from individuals with non-syndromic CL/P ($n=460$) and their unaffected relatives ($n=254$) from the Philippines and China. The significant associations between particular pattern types and CL/P were not the same in both populations. Increased radial and ulnar loops were observed in CL/P patients.

Mathew et al. [12] studied dermatoglyphic patterns of 100 children between age of 5-15 years with no difference between sexes of which 50 consisted of the study group (non-syndromic children with CL/P) and remaining 50 consisted of control group (healthy children without any anomalies). It was observed that oral cleft individuals had an increased frequency of ulnar loops as the ridge configuration as compared to control group.

Balgir et al. [13] studied dermatoglyphic characteristics of 69 cases of CL/P and 28 isolated CP cases. They were evaluated for finger patterns, digital patterns, inter-digital patterns, types of C- and D-line. It showed variations in patients and controls. Wider 'atd' angle (more than 30°) and dermatoglyphic asymmetry were noted in the patient groups. There was also a significant increase in the ulnar loop and arch patterns among the CP patients.

Saxena et al. [14] studied 294 subjects (48 cleft subjects and 50 healthy controls with both their parents) and found increased frequency of loops and arches and low mean total ridge count in cleft subjects. Increased frequency of loops and arches with decreased frequency of whorls, mean total ridge count, and atd angle of right hand was found in parents of cleft group as compared with the parents of the controls.

Dermatoglyphics and dental caries

Atasu et al. [15] studied dermatoglyphic configurations in caries-free students and the students with extensive caries and found there was significant difference in dermatoglyphic patterns in these two groups as caries free students had more ulnar loops on the fingertips and the students with extensive caries had more whorls on the finger tips.

Sharma et al. [16] studied to determine if there is any significant correlation between salivary bacteria interactions, dermatoglyphics, and dental caries. In this study, a total of 90 subjects were evaluated and found that the subject group had positive correlation with loops and *Streptococcus mutans* growth likened to control group that had negative correlation with both.

Dermatoglyphics and periodontal diseases

Atasu et al. [17] conducted a study with the aim of finding a finger-tip pattern type that would identify the patients with periodontal diseases. When the finger-tip patterns of the patients were compared with those of Periodontally Healthy (PH) individuals, the decreased frequencies of twinned and transversal ulnar loops on all fingers of the patients with Juvenile Periodontitis (JP), 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 Progressive Periodontitis (RPP), and the increased frequencies of concentric whorls and transversal ulnar loops on all fingers of the patients with Adult Periodontitis

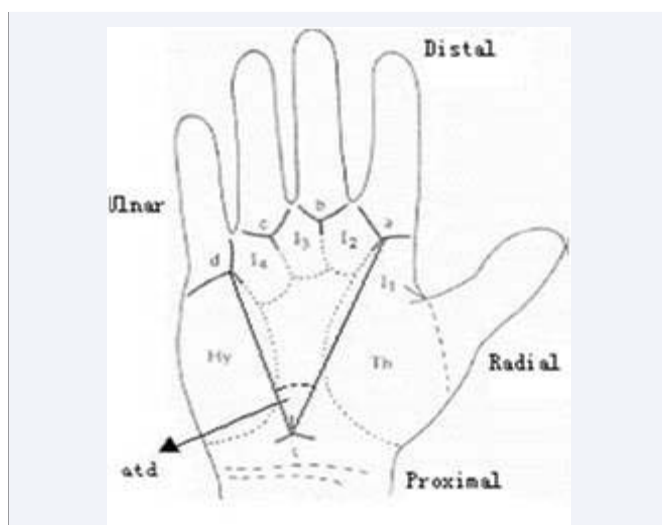


Figure 4 Palm patterns.

(AP), an increased frequency of the tri-radial on the palms and soles of the patients with JP were found. The authors concluded that in the light of these findings dermatoglyphics could be used together with the other diagnostic methods such as clinical and radiologic investigations and in the identifying of the patients from distinct groups of PD's.

Dermatoglyphics and potentially malignant disorders and oral carcinomas

A prospective study was carried out by Tamgire et al. [18] to collect the dermatoglyphic prints of the gutkha chewers with and without Oral Submucous Fibrosis (OSMF). Study consisted of 200 subjects divided into two groups. Group A consisted of 100 gutkha chewers without OSMF and group B consisted of gutkha chewers with OSMF. The results showed a highly significant decrease in simple whorl pattern with increase in composite whorl pattern on left little finger in Group B as compared with Group A, decrease in composite whorl pattern of right index finger in Group B when compared with Group A, increase in simple whorl pattern on right thumb in Group B when compared with Group A, increase in composite whorl pattern on left thumb in Group B as compared with Group A and decrease in radial loop on left index finger in Group B when compared with Group A.

Elluru Venkatesh [19] carried out a study to determine whether specific dermatoglyphic patterns exist which help in predicting the occurrence of oral squamous cell carcinoma and oral leukoplakia. This study comprised of 30 subjects with oral squamous cell carcinoma, 30 subjects with oral leukoplakia and 30 individuals with habits and no lesions as controls. Arches and loops were more frequent in cases than in controls whereas whorls were more frequent in the control group ($p < 0.01$). Loops were at higher frequency in the inter-digital areas in cases than in control ($p < 0.05$). However the distribution of hypothenar and thenar pattern was statistically insignificant. Similarly there was no correlation between atd angle, ab count, total finger ridge count and oral leukoplakia and oral squamous cell carcinoma. This study concluded that dermatoglyphic patterns may have a role in identifying individuals either with or at risk for developing oral leukoplakia and oral squamous cell carcinoma.

Dermatoglyphics and bruxism

With the aim to examine the dermatoglyphic patterns of finger and palm, 38 bruxism patients, 18 being female were studied by Polat et al. [20]. Bruxism patients demonstrated an increase in frequency of whorls, I loops, and t tri-radial. There was decrease in frequency of ulnar loops, atd angle, IV, H and t'' tri-radial than the controls. Furthermore, the main line A ended more frequently in sector 5' in bruxism patients when compared with controls. There is no significant difference between the total finger ridge counts and a-b ridge counts the subjects with bruxism and that of the controls. This study summarized that when combined with other clinical features in bruxism, dermatoglyphics can serve to strengthen a diagnostic impression.

Dermatoglyphics and malocclusion

Reddy et al. [21] conducted a study using dermatoglyphics to predict and compare Class I, Class II, div. 1, div.2 and Class III malocclusions. A total of 96 subjects were divided into 3

malocclusion groups, i.e. Class I (control group), Class II, div.1, div.2 and Class III (experimental group) in the ages of 12-14 years. The dermatoglyphic findings revealed that the craniofacial Class II, div.1, div.2 pattern was associated with increased frequency of arches and ulnar loops and decreased frequency of whorls, whereas in Class III, there was an increased frequency of arches and radial loops with decreased frequency of ulnar loops. In predicting Class III malocclusion, based on frequency of arches, the sensitivity values were found to be higher and more reliable than the sensitivity values of Class II, div.1 and div.2 malocclusion. From their study, the authors of the present study observed that dermatoglyphics might be an appropriate marker for malocclusion.

Another study was conducted by Tikare et al. [22] to assess the relationship between fingerprints and malocclusion among a group of high school children. A total of 696 high school children aged 12-16 years were randomly selected. The authors found a statistical association between whorl patterns and classes I and II malocclusion ($p < 0.05$). However, no overall statistical association was observed between fingerprint patterns and malocclusion ($p > 0.05$).

Dermatoglyphics and other dental disorders

Different authors through their studies have found a positive correlation between dermatoglyphics and dental diseases like taurodontism and dental fluorosis [23,24].

CONCLUSION

The authors of the present study strongly feels that dermatoglyphics should be adopted by more dental professionals and researchers for oral cavity related studies, leading to more new discoveries for an early diagnosis, treatment and better prevention of many genetic disorders of the oral cavity and other diseases whose aetiology may be influenced directly or indirectly by genetic inheritance.

REFERENCES

1. Sharma Anshu, Palvi, Kapoor Dheeraj. Dermatoglyphics, Dentistry and Diagnosis-A Review. Baba Farid University Dental Journal. 2010; 1: 45-48.
2. Gh. Mohd. Bhat, M. Arif Mukhdoomi, Bahir Ahmed Shah, Mohd Saleem Ittoo. Dermatoglyphics: in health and disease - A review. International Journal of Research in Medical Sciences. 2014; 2: 31-37.
3. Ram Nath Sharma, Rajendra K. Sharma. Anthropology. Atlantic Publishers & Dist. 1997; 90.
4. Rokaya H Ahmed, Mohammed I Aref, Rania M Hassan, Noura R Mohammed. Dental fillings and its correlation to apoptosis that induced by using dental fillings. Nature and Science. 2010; 8: 54-57.
5. Natekar PE, DeSouza FM. Fluctuating asymmetry in dermatoglyphics of carcinoma of breast. Indian J Hum Genet. 2006; 12: 76-81.
6. Sridevi NS, Delphine Silvia CR, Kulkarni R, Seshagiri C. Palmar dermatoglyphics in carcinoma breast of Indian women. Rom J Morphol Embryol. 2010; 51: 547-550.
7. Kiran K, Kavitha Rai, Amitha M Hegde. Dermatoglyphics as a noninvasive diagnostic tool in predicting mental retardation. Journal of International Oral Health. 2010; 2: 95-100.
8. Pratibha Ramani, Abhilash PR, Herald J Sherlin, Anuja N, Priya

- Premkumar Chandrasekar, G.Sentamilselvi, et al. Conventional Dermatoglyphics–Revived Concept: A Review. *International Journal of Pharma and Bio Sciences* 2011; 2: 446-458.
9. Roopam K Gupta, Aruna K Gupta. New, easy and effective method to take dermatoglyphic prints. *National Journal of Medical Research* 2013; 3: 45-47.
 10. Egle Zarakauskaitė, Ausra Matulevičienė, Algirdas Utkus, Vaidutis Kucinskis, Laura Linkeviciene. Orofacial clefts with associated anomalies in Lithuania. *Acta Medica Lituanica* 2007; 14: 17–23.
 11. Scott NM, Weinberg SM, Neiswanger K, Brandon CA, Daack-Hirsch S, Murray JC, et al. Dermatoglyphic fingerprint heterogeneity among individuals with nonsyndromic cleft lip with or without cleft palate and their unaffected relatives in China and the Philippines. *Hum Biol.* 2005; 77: 257-266.
 12. Mathew L, Hegde AM, Rai K. Dermatoglyphic peculiarities in children with oral clefts. *J Indian Soc Pedod Prev Dent.* 2005; 23: 179-182.
 13. Balgir RS. Dermatoglyphics in cleft lip and cleft palate anomalies. 1993; 30: 341-346.
 14. Runjhun Subhanand Saxena, Maria Priscilla David, Indira AP. Dermatoglyphic evaluation in subjects and parents of cleft lip with and without cleft palate. *The Cleft Palate-Craniofacial Journal* 2013; 50: e105-e110.
 15. Atasu M. Dermatoglyphic findings in dental caries: a preliminary report. *J Clin Pediatr Dent.* 1998; 22: 147-149.
 16. Sharma A, Somani R. Dermatoglyphic interpretation of dental caries and its correlation to salivary bacteria interactions: an in vivo study. *J Indian Soc Pedod Prev Dent.* 2009; 27: 17-21.
 17. Atasu M, Kuru B, Firatli E, Meric H. Dermatoglyphic findings in periodontal diseases. *Int. J Anthropol.* 2005; 20: 63-75.
 18. Fulzele Rr, Chimurkar Vk, Rawlani Ss, Sherke Ar. Qualitative dermatoglyphic analysis of finger tip patterns in patients of oral submucous fibrosis. *Journal of Dental and Medical Sciences* 2013; 6: 24-27.
 19. Elluru Venkatesh. Palmar dermatoglyphics in oral leukoplakia and oral squamous cell carcinoma patients.
 20. 14.139.159.4:8080/jspui/bitstream/123456789/2964//Elluru%20venki.pdf.
 21. Polat MH, Azak A, Evlioglu G, Malkondu OK, Atasu M. The relation of bruxism and dermatoglyphics. *J Clin Pediatr Dent.* 2000; 24: 191-194.
 22. Reddy S, Prabhakar AR, Reddy VV. A dermatoglyphic predictive and comparative study of Class I, Class II, div. 1, div.2 and Class III malocclusions. *J Indian Soc Pedod Prev Dent.* 1997; 15: 13-19.
 23. Tikare S, Rajesh G, Prasad KW, Thippeswamy V, Javali SB. Dermatoglyphics--a marker for malocclusion? *Int Dent J.* 2010; 60: 300-304.
 24. Genc A, Namdar F, Goker K, Atasu M. Taurodontism in association with supernumerary teeth. *J Clin Pediatr Dent.* 1999; 23: 151-154.
 25. Singh Sanjeet, Singh Deepti Jawa, Jaidka Shipra, Jaidka Rishi. Determination of susceptibility to fluorosis using dermatoglyphics. *Journal of Orofacial and Health Sciences.* 2012; 3: 15-21.

Cite this article

Prabhu N, Issrani R, Mathur S, Mishra G, Sinha S (2014) Dermatoglyphics in Health and Oral Diseases-A Review. *JSM Dent* 2(4): 1044.