

Dermatoglyphics in dentistry: a review

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Fingerprint analysis for personal identification is well known and is unique to all individuals and remains the same for a lifetime. The hand has become a powerful tool in the diagnosis of psychological, medical, genetic conditions. Dentistry is no exception has number of diseases which can be diagnosed using the study of finger prints described as dermatoglyphics. The present review describes peculiar changes in dental diseases and gives an insight to the supporting literature.

Keywords: Dentistry; dermatoglyphics; oral diseases.

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Introduction

Derived from Greek words "Dermatoglyphics" comes from *derma* which means skin and *glyphe* which means carve and refers to the epidermal skin ridge formations which appear on the fingers, palms of the hand and soles of the feet (1). The term was coined by Harold Cummins in 1926 who is known as the "Father of Dermatoglyphics" (2). During the 6th-7th week of embryonic life finger and palm prints are formed and completed after 10-20 weeks of gestation (3). They are unique for each person and is not even same in monozygotic twins, studying them can determine a number of parameters helpful in the diagnosis and treatment of examined individuals (4). Anatomically the ridge patterns are influenced by the blood vessel nerve pairs at the border between dermis and epidermis during prenatal development. Affected by the factors such as inadequate oxygen supply, unusual distribution of sweat glands and alteration of epithelial growths. The ridge pattern is considered sensitive because it originates from the fetal volar pads just like the teeth which also develop from the ectoderm at the 6th-7th week of intrauterine life.

Dermatoglyphics are utilized for the purpose because of following reasons (i) once fully developed and remain unchanged for life. (ii) Easy scanning and recording, rapid, inexpensive, and convenient without causing any trauma to the patient or hospitalization.

Methods of recording

The various methods that are employed are:

Ink method: The advantages of this method is that it is economical, easy technique, convenient. Disadvantages include improper prints, cannot be used in case of gross malformation of limbs.

Inkless method: This technique makes use of a commercially available patented solution and specially treated sensitized paper.

Transparent adhesive tape method: This technique involves using transparent adhesive tapes to obtain fingerprint patterns

Photographic method: This technique involves use of photographs.

Dermatoglyphic pattern configuration:

The three basic dermatoglyphic landmarks found are triradii, cores and radiants.

Triradii: Formed by confluence of 3 ridges which meet at 120 degrees.

Core: Approximate center of the pattern

Radiant: Emanate from triradii and enclose the pattern area.

Fingerprint patterns: There are 3 groups: Arches, loops, whorls.

Arches: It is the simplest pattern. It is formed by succession of more or less parallel ridges which traverse the pattern area and form a curve which is concave proximally. Sometimes curve is gentle, it may swing more sharply and can be a low or high arch. These are of 2 types:

Simple arch

Tented arch

Loops: Most common pattern. A series of ridges enter the pattern area on one side of the digit, recurve abruptly, and leave the pattern on the same side. These are of 2 types:

Ulnar loop: loops open on the ulnar side.

Radial loop: loops open on the radial side.

Whorls: Ridge pattern with 2 or more triradii. One is radial and the other 2 are ulnar. These are of the following types:

Plain: Arranged in form of concentric rings or ellipses.

Table 1: Dermatoglyphics in various dental diseases

Author	Study	Observation
Zarakauskite et.al (5)	Case control study	<ul style="list-style-type: none"> ▪ Patterns on thenar eminence rarer than controls ▪ More arches, double loops ,ulnar loops
Scott et al (6)	460 Non syndromic cleft lip and palate patients and 254 unaffected relatives from Philippines and China were studied	<ul style="list-style-type: none"> ▪ Increase in number of radial and ulnar loops.
Matthew et al (7)	Dermatoglyphic patterns of 100 children between 5-15 years of which 50 consisted of study group and 50 controls	<ul style="list-style-type: none"> ▪ Increased number of ulnar loops compared to control.
Balgir et al (8)	Dermatoglyphic patterns of 69 cases of cleft lip and palate and 28 isolated cleft palate cases were studied.	<ul style="list-style-type: none"> ▪ Patient groups showed wider atd angle (more than 30 degrees) and dermatoglyphics asymmetry. ▪ Significant increase in ulnar loop and arch patterns
Saxena et al (9)	Studied dermatoglyphic patterns of 294 subjects	<ul style="list-style-type: none"> ▪ Increased frequency of loops and arches ▪ 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 to parents of controls.

Spiral: Spirals in clockwise or anticlockwise direction

Central Pocket: Loop within loop type of pattern

Lateral Pocket: Interlocking loops

Accidental: Cannot be classified.

Palmar patterns:

The palm is divided anatomically into thenar, second, third and fourth interdigital areas and the hypothenar area.

Thenar and First interdigital area: These two are closely related anatomically and are considered one area.

Second, third and fourth interdigital area: Configurations seen are loops, whorls, vestiges and open fields.

Hypothenar area: Patterns seen are whorls, loops, tented arches.

Use of dermatoglyphics in dentistry

Recently recognition of changes in fingerprints among patients with various dental ailments like periodontitis, dental caries and certain types of congenital anomalies like cleft lip and palate has drawn attention of researchers in the field of dermatoglyphics and further encouraged them in knowing the role of dermatoglyphics in various dental diseases.

Cleft Lip and Palate

Cleft lip and palate cause's problems in speech, feeding, hearing and may cause frequent ear infections. Different fingerprint patterns determine the predisposition of cleft lip and palate.

Dental Caries

Dental caries is one of the most common oral health diseases which affect millions of people worldwide. Dermatoglyphics can help determine the susceptibility to dental caries.

Table 2: Different studies for Dental Caries

Author	Studies	Observation
Atasu et al (10)	Studied dermatoglyphic patterns in caries free students and students with extensive caries	<ul style="list-style-type: none"> ▪ Caries free students had more ulnar loops and students with extensive caries had more whorls.
Sharma et al (11)	90 subjects were evaluated to determine the relation between salivary bacteria interactions, dental caries and dermatoglyphics.	<ul style="list-style-type: none"> ▪ Subject groups had positive correlation with loops and Streptococcus mutans growth and likened to control group which had negative correlation of both.
Padma et al (12)	Studied caries and dermatoglyphic peculiarities in deaf and mute children	<ul style="list-style-type: none"> ▪ Increase in whorl patterns in study groups and increase in loops in control groups.

Periodontal Disease

Periodontal disease leads to loss of tooth and abscess. Dermatoglyphics patterns can help determine the incidence of periodontal disease.

Table 3: Studies of Periodontal diseases and pattern of fingerprints

Author	Studies	Observation
Atasu et al (13)	Conducted study with aim of finding fingertip pattern type to help identify patients with periodontal disease	<ul style="list-style-type: none"> ▪ Decreased frequencies of twinned and transversal ulnar loops on all fingers of patients with juvenile periodontitis ▪ Decreased frequencies of double loops on all fingers ▪ Increased frequencies of radial loops on the right second digit of patients with rapidly progressive periodontitis ▪ Increased frequency of concentric whorls and transversal ulnar loops on all the fingers of patients with adult periodontitis. ▪ Increased frequency of triradii on palms and soles of patients with juvenile periodontitis was found.

Potentially Malignant Diseases and Carcinomas

Potentially malignant diseases and carcinomas especially oral cancer is affecting people

worldwide and is seen most commonly in Asian countries. Dermatoglyphic patterns help determine the genetic predisposition to such carcinomas and potentially malignant diseases.

Table 4: Dermatoglyphics of Gutka chewers

Author	Studies	Observation
Tamgire et al (14)	Carried out prospective study by collecting dermatoglyphic prints of gutka chewers with or without osmf.200 subjects divided into 2 groups. Group A -100 gutka chewers without osmf .Group B-100 gutka chewers with osmf.	<ul style="list-style-type: none"> ▪ Highly significant decrease in simple whorl pattern and increase in composite whorl pattern on left little finger in Group B as compared to Group A. ▪ Decrease in composite whorl pattern of right index finger in Group B compared to Group A, increase in simple whorl pattern on right thumb in Group B when compared with Group A ▪ Decrease in radial loop on left index finger in Group B when compared to Group A.
Elluru Venkatesh (15)	Carried out study to determine whether specific dermatoglyphic patterns exist which help in predicting the occurrence of oral squamous cell carcinoma and oral leukoplakia.30 subjects were studied with oscc,30 with leukoplakia and 30 as controls	<ul style="list-style-type: none"> ▪ Arches and loops more common in cases than in controls. Whorls more common in controls. ▪ Loops more frequent in interdigital areas than in controls ▪ No correlation between atd angle ab ridge count and total ridge count in oral squamous cell carcinoma and leukoplakia.

Malocclusion

Most common orthodontic problem suffered by millionS worldwide is malocclusion. Malocclusion hampers speech, esthetics, swallowing and may cause dental caries and periodontal disease due to

disharmony between teeth, bone and soft tissues. Dermatoglyphics helps in determining the genetic predisposition of certain malocclusions.

Table 5: Dermatoglyphic studies of Malocclusion

Author	Studies	Observation
Reddy et al (16)	Conducted dermtatoglyphic study to compare class I,II,III, malocclusions.96 subjects divided into 3 groups: Class I – control ,Class II div 1,2 and class III –experimental group .Age group-12-14 years	<ul style="list-style-type: none"> ▪ Class II div 2 showed increased frequency of arches and ulnar loops and decreased frequency of whorls. ▪ Class III showed increased frequency of arches and radial loops and decreased frequency of ulnar loops. ▪ Sensitivity values of Class III more than Class II div 1 and 2.
Tikare et al (17)	Conducted study to assess the relationship between dermatoglyphics and malocclusion among high school children.696 high school children aged 12-14 years were randomly selected.	<ul style="list-style-type: none"> ▪ Statistical association between whorl patterns and Class I and Class II malocclusion was found.

Bruxism

Bruxism leads to attrition of teeth and soreness of muscles of mastication. Certain dermatoglyphics patterns help determine incidence of bruxism.

Table 6: Dermatoglyphic studies in Bruxism

Author	Studies	Observation
Polat et al (18)	Examined dermatoglyphics patterns of 38 patients of which 18 were females.	<ul style="list-style-type: none"> ▪ Increase in whorls, l loops, and triradii. ▪ Decrease in frequency of ulnar loops, atd angle, triradii than the controls.
Oral Tumors		Oral tumors include odontogenic and non-odontogenic tumors and dermatoglyphic patterns help determine the incidence of such tumors.

Table 7: Studies with oral tumors

Author	Studies	Observations
Polat et al (19)	Investigated dermatoglyphics patterns of patients with or without tumors	Increase in frequency of arch patterns.
Dental Arch Forms		treatment planning and to preserve it throughout the treatment to achieve a higher stability. In prosthodontic treatment it determines the treatment of edentulous and partial edentulism.
Dental arch forms are very important in orthodontics and prosthodontics. In orthodontic treatment it is very important for diagnosis and		

Table 8: studies of Dermatoglyphics relationship with arch forms

Author	Studies	Observation
Sachdeva et al (20)	Studied to identify relation between dermatoglyphics and arch forms. 90 subjects were divided into 3 groups –square, tapering, ovoid.	<ul style="list-style-type: none"> ▪ Subjects with square arch had high frequency of loops and large atd angle ▪ Subjects with tapering arches showed high frequency of whorls and small atd angle. ▪ Ovoid arch subjects had loops.

limitations

- Difficult to use as a diagnostic tool if patient has gross malformation of limbs
- Atd angle can have several disadvantages regarding its use as a parameter. One shortcoming is the size of atd angle that is affected by the amount of spreading of the fingers when the patterns are recorded. Pressure exerted also affect atd angle.
- A thick or thin application of ink can result in light or dark improper prints.

Conclusion

Dermatoglyphics is an upcoming integral part of medicine and forensic science. The correlation of dermatoglyphics with dental abnormalities is still in its nascent stage and presently it is safe to say that various finger print patterns can be

considered as an indicator for occurrence of congenital abnormalities. Dermatoglyphics has moved from obscurity to acceptability as a diagnostic tool. It may serve as an important tool that can predict the future health of a person.

Conflict of Interest

None declared

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