



Review Article

Dermatoglyphics and its importance in oral cancer

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ABSTRACT

Dermatoglyphic patterns were recorded using standard ink method. The result showed in SCC, there was an increase in frequency of arch and ulnar loop patterns on fingertips, decrease in frequency of simple whorl patterns on fingertips, decrease in frequency of palmar accessory triradii on right and left hands. Significant findings in OSF included an increase in frequency of arch and ulnar loop pattern, decrease in frequency of simple whorl patterns on fingertips, decrease in ATD angle on right hand decrease in frequency of palmar accessory triradii on right hand. The results revealed that the field of dermatoglyphics holds promising results for determining the genetic susceptibility of individuals to develop SCC and OSF.

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1. Introduction

From time immemorial, fortune tellers have been studying and interpreting the characteristic pattern of the hands to satisfy man's eagerness to know the future. In the field of science over the decades, the features and patterns in the hand have been aiding in the diagnosis of psychological, genetic and other medical disorders. In the developing foetus, epidermal ridge patterns or fingerprints form early between sixth and seventh week of intrauterine life and are fully formed by 21st week, gradually develop through infancy and remain unchanged lifelong. Hence these patterns could be used as an indicator for gene or chromosomal abnormalities.¹

Dermatoglyphics is the study of different patterns of dermal ridges on palms, digits, and soles. The word comes from two Greek words i.e. derma (skin) and glyphe (carve). This term was coined by Harold Cummins in 1926 who is otherwise called "Father of Dermatoglyphics".^{1,2}

Fuller IC investigated and formulated a research to evaluate the dermatoglyphic pattern of patients suffering from diabetes, schizophrenia, gastro intestinal problems,

chronic respiratory disorders and various cancers and this study revealed significant differences in the digital ridge counts, maximum ATD angles, and distal palmar loop ridge counts.^{1,3} The relevance of dermatoglyphics in the medical and dental field is not in diagnosis, but for prognostic values of the diseases. It is put to use not in defining a prevailing or an incident disease, but to pinpoint people with the genetic predilection to develop certain diseases. The science of dermatoglyphics is thus not only limited to academic identification of association of patterns to particular disease, but has evolved has a screening technique to identify people at risk of developing certain medical and dental illness, who could be followed up and monitored for early onset symptoms.²

2. History

1. Herschel (1858) was the first to experiment with fingerprints in India.
2. Galton (1892) with his extensive research demonstrated the hereditary significance of fingerprints and biological variations of different racial groups.

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3. Sir Edward Henry (1893) published the book "The classification and uses of fingerprints," commencing a modern era of fingerprint identification.
4. Schaumann and Alter's (1976) published the book "Dermatoglyphics in medical disorders."⁴

3. Types of Fingerprints

In the year 1892, Sir Francis Galton published a book, 'Finger Prints' in which he narrated a classification system based on the number of triradii- a junction point of three regions distinguishing almost parallel ridges. Galton's fingerprint system enumerated three most common fingerprint patterns:

3.1. Arch

Arches are devoid of having triradii. Tri-radius is formed by the confluence of three ridge systems that tend an angle of approximately 120° with one another.

Arch pattern is further described as plain and tented arch.

3.2. Loop

It is the most widely appearing type of pattern (65% population) on the fingertip. A sequence of ridges appear in from one side of the digit, recurve unanticipated, and leave the pattern area ipsilaterally.

Types of loop: Depending on the side where the loop opens it is classified as:

1. Ulnar loop (60%): The loop has an opening towards the ulnar margin of the digit.
2. Radial loop (5%): The loop opens towards the radial border.

3.3. Whorl

The word 'whorl' literally meaning turn or convolutions and the pattern is marked by a sequences of concentric circular ridges, or spiral ridges - some of the lines make a through turn though minimally. This configuration has more than or at least two triradii, one such being towards the radial and the other on the ulnar margin of the pattern. Henry in 1937 referred to the term 'Whorl' for those ridges that actually position around an existing core.

This pattern can further be grouped into subsets like-

Plain whorl; Central pocket loop; Double loop and Accidental whorl.⁵

The whole of the human palm shows certain other features like ATD angle which is theoretically formed by straight lines originating from the digital triradius [a] to the axial triradius [t] and from this triradius to the digital triradius [d]), H-loop, IV loop, and triradius.



Fig. 1:

4. Methods of Printing

The methods used for palm printing are inexpensive and can easily be applied swiftly.

4.1. Ink method

One of the most widely used method. The equipment are- printer's ink, a roller, a slab of glass or metal for inking, a rubber sponge, and a glazed paper having a good texture.

4.2. Faurot inkless method

For this method readily available branded solutions in the market are available which are used with previously treated sensitized papers.

4.3. Transparent adhesive tape method

A dry colouring pigment is applied over the fingertip first, followed by lifting off the print on a transparent adhesive tape. Various colouring agents or pigments viz. coloured chalk, dust, India ink, standard ink, carbon paper, graphite stick or powdered graphite, common oil pastel crayon, etc. can be used. This method produces clear smudge free prints which can be stored for an indefinite period thus making it more advantageous.

4.4. Photographic method

It is based on the principles of total internal reflection which occurs when an object is pressed against a prism. The

magnified image is photographed by a polaroid camera.

4.5. Special methods

It allows the study of the relation existing between the epidermal ridges and the underlying bony structures (radiodermatography), evaluation of the sweat pores (hygrophotography) or study of the spatial shape of the ridged skin areas, as done in mammals (plastic mold method).

4.6. Numerical method

Algorithm of generation of images of fingerprints is applied and miniature models are created. The model creates and evaluates digital coding of a fingerprint and also enables record keeping of the data of minutiae and types of patterns.

Besides the above said methods there are other methods used for recording fingerprints such as-Lipstick method, Rubber and Plaster Of Paris casts, Scanning electron microscopy (Misumi, et al. in 1984), Integrated Automated Fingerprint Identification System (IAFIS).⁴

4.7. Indications

1. Dermatoglyphics can be applied for various diagnostic purposes such as mental retardation, autism, schizophrenia, Alzheimer disease, and even in foretelling the presence of substance abuse disorders like alcoholism.
2. It can also be used to delineate genetic susceptibility for dyslexia or hyperactivity and also acts as clinical marker for various types of trisomy.
3. It is found to be used as a Biometric identifier. There has been various studies investigating dermatoglyphics in various fields.
4. Dermatoglyphics has drawn attention in the practice of dentistry and has been used to demonstrate oral diseases such as dental caries, oral cancer, bruxism, malocclusion, anomalies of teeth, cleft lip, cleft palate, periodontal disease, dental fluorosis, and also in medico legal purposes and investigations with forensic odontology.⁴

5. Discussion

Venkatesh et al. (2008) in their study to determine the dermatoglyphic pattern in subjects with leukoplakia and oral squamous cell carcinoma found that among 30 patients diagnosed with leukoplakia, 30.70% had whorls, 6.30% had loop and arch type of fingerprint respectively and in oral squamous cell carcinoma patients it was found that 60.70% had a loop, 32.30% had whorl, and 7.0% had an arch pattern of fingerprints.⁶

Gupta A and Karjodkar FR (2013) conducted a survey to look over the palmar dermatoglyphics in 120

patients suffering from Squamous cell carcinoma and Oral submucous fibrosis and find a dermatoglyphic marker with the individuals divided into four groups based upon their tobacco/areca nut using habit and presence of the disease. Dermatoglyphic patterns were recorded using standard ink method. The result showed in SCC, there was an increase in frequency of arch and ulnar loop patterns on fingertips, decrease in frequency of simple whorl patterns on fingertips, decrease in frequency of palmar accessory triradii on right and left hands. Significant findings in OSF included an increase in frequency of arch and ulnar loop pattern, decrease in frequency of simple whorl patterns on fingertips, decrease in ATD angle on right hand decrease in frequency of palmar accessory triradii on right hand. The results revealed that the field of dermatoglyphics holds promising results for determining the genetic susceptibility of individuals to develop SCC and OSF.⁷

Jayalakshmi B, Avinash Tejasvi ML, Harsha Bhayya, Shilpa J, Vammi Sirisha (2020) analyzed the correlation of palmar dermatoglyphics pattern in OSMF, leukoplakia and healthy patients. The study was comprised of 45 patients which were divided in to four separate groups group I -OSMF consisted of (grade-I, II, III, IV), group II - leukoplakia, group III -habits without lesion, group IV-control group. In all the patients palm prints were recorded using hp scanner and finger tips pattern were recorded using intraoral camera and results showed that whorls on left hand were more common in group IV than in group I,II,III. Whorls on right hand were same in group I, II group less group III. Loops were more in group I, II, III, less in group IV. Absence of arches seen in group I and ii 6.7% in group III and 13.3% in group IV. Mean ATD triangle was less in group I, II, III when compared to group IV.⁸

1. Sharma R et al. demonstrate significant correlation between salivary bacteria interactions, dermatoglyphics, and dental caries and found that subject group had a decreased frequency of loops in contrast to control group which had an increased frequency of loops on all palmar digits.⁹

Abhilash PR et al. also investigated and scrutinized the significance of dermatoglyphics in predicting the susceptibility of individuals to develop dental caries and reported similar results as Sharma et al.¹⁰

5.1. Advantages

1. Cost effective, rapid and can be done in the clinics without hospitalization and without causing any trauma.
2. Requires minimum equipment and data and can be preserved for lifelong.

6. Limitations

1. It is difficult for the dermatoglyphics patterns to be diagnostically useful if the patient has gross malformations of limbs.
2. Care should be taken while recording the prints to apply the ink material in adequate amounts.
3. A thin or thick application results in improper prints.⁴

7. Conclusion

As premalignant diseases and oral squamous cell carcinoma have a genetic basis, with the knowledge of dermatoglyphic patterns, individuals who are prone to develop these lesions can avoid the trigger factors. The relevance of dermatoglyphics is not for diagnosis, but for prevention, by predicting a disease, and not for defining an existing disease, but for identification of people with the genetic predisposition to develop certain diseases. Thus, the dermatoglyphic patterns may be utilized effectively to study the genetic basis of various diseases. In developing countries, as it is a noninvasive, inexpensive and effective tool for screening and foretell the probability of occurrence of various diseases.

8. Source of Funding

None.

9. Conflict of Interest

The authors declare that there is no conflict of interest.

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