

REVIEW ARTICLE



Dermatoglyphics in dentistry: A review

Dara Balaji Gandhi Babu¹, Shaik Mohammed Asif²

¹Department of Oral Medicine & Radiology, Panineeya Institute of Dental Science and Research Center, Hyderabad, Telangana, India, ²Pacific University, Pacific Hills, Debari, Udaipur, Rajasthan, India

Correspondence

Dr. Shaik Mohammed Asif, Pacific University,
Pacific Hills, Debari, Udaipur - 313 024,
Rajasthan, India. E-mail: drasif_2002@
rediffmail.com

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Abstract

Dermatoglyphics, coined by Cummins and Midlo in 1926, is a branch of genetics dealing with the skin ridge system. They have been studied for fortune telling by palmists and as a definitive and unalterable tool for identification by forensic experts. From cradle to grave, until the body decomposes fingerprints remain unchanged. In many respects, it has been used as an adjunct to other disciplines, serving as a vehicle to resolve broader biomedical problems. Dermatoglyphics can be a good diagnostic adjuvant for identification of various genetic disorders, oral diseases, and helpful in forensic science.

Keywords: Dermatoglyphics, genetic disorders, oral diseases

Introduction

Human skin, the largest and delicate organ of the human body can perform many vital functions in life. The palms of the hands and the soles of the feet are covered with two totally distinct classes of marks. The most conspicuous are the creases or folds of the skin which interest the followers of palmistry.^[1] The term was coined in 1926 by Cummins and Midlo, although Cummins is considered to be the father of dermatoglyphics.^[2] Toward the end of the 19th century, Galton put forth a rule called "proof of no change," which states that an individual's dermatoglyphics remains unchanged throughout his/her lifetime.^[3] Due to their unique nature, studying them can determine a number of parameters, which could be helpful in diagnosing and treatment of examined individuals.^[4,5] Thus, it is considered to be an important tool in assessing the genetic trait, evaluation of children with suspected genetic disorders and also in forensics. It is noted that subjects with chromosomal abnormalities had unusual ridge formations. The ridges are influenced by blood vessel-nerve pairs at the border between the dermis and epidermis during prenatal development and factors, such as inadequate oxygen supply, unusual distribution of sweat glands, and alterations of epithelial growths could influence the ridge patterns.^[5,6] The ridged skin is considered to be a sensitive indicator of intrauterine dental anomalies because it originates from the fetal volar pads as the teeth, which also originate from the same ectodermal layer in the 6-7th week of embryonic life.^[7] Hence, when an intra-uterine

dermal damage occurs, a tooth anomaly can be expected. In a similar way, development of dermal ridges and congenital deafness seems to be interlinked as they develop at around the same time.^[8]

History

- Herschel (1858) was the first to experiment with fingerprints in India.^[9]
- Galton (1892) with his extensive research demonstrated the hereditary significance of fingerprints and biological variations of different racial groups.^[10]
- Sir Edward Henry (1893) published the book "The classification and uses of fingerprints," commencing a modern era of fingerprint identification.^[11]
- Schaumann and Alter's (1976) published the book "Dermatoglyphics in medical disorders."^[12]

Classification of Fingerprints

The basic characteristic pattern of fingerprint was classified in 1892 by Galton. He classified the patterns into three types: Arches, loops, and whorls.^[13,14] the whole of the human palm shows certain other features like ATD angle (This angle is formed by lines drawn 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.^[14] (Triradii is a point of convergence for three regions that separate almost parallel ridges).

Methods of Printing^[15,16]

The methods used for palm printing is inexpensive and rapid.

Ink method

One of the most widely used method. The necessary equipment consists of printer's ink, a roller, a glass or metal inking slab, a sponge rubber, and good quality paper preferably with a slightly glazed surface.^[15,16]

Faurot inkless method

Commercially available patented solution and specially treated sensitized paper is used in this method.^[15]

Transparent adhesive tape method

In this method, the print is produced by applying a dry coloring pigment to the skin and lifting it off with the transparent adhesive tape. The coloring agent may be colored chalk, dust, India ink, standard ink, carbon paper, graphite stick or powdered graphite, common oil pastel crayon, etc., Advantage is prints are clear and not smudged and can be preserved for an indefinite period of time.

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.^[16]

Special methods

It allows the study of the correlation between the epidermal patterns and the underlying bone 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).

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.

Indications

Clinically, dermatoglyphics is used in diagnosing various conditions such as mental retardation, autism, schizophrenia, Alzheimer disease, and even in predicting appearances of addiction diseases like alcoholism. It can also be used to determine genetic predispositions for dyslexia or hyperactivity and also as clinical markers for various types of trisomy. It is also used as a Biometric identifier. Many researchers have investigated dermatoglyphics in various fields.

Dermatoglyphics in Dentistry

Dermatoglyphics has drawn attention in the field of dentistry and has been used to unveil oral diseases such as dental caries, oral cancer, bruxism, malocclusion, anomalies of teeth, cleft lip, cleft palate, periodontal disease, dental fluorosis, and also in unveiling truth with forensic odontology.

Periodontal disease

Atasu and Akyuz (2005),^[7] observed a decrease frequency of twinned and transversal ulnar loops in fingers of the patients with juvenile periodontitis, a decreased in double loops on all fingers and an increased frequency of radial loops on the right second digits of the patients with rapidly progressing periodontitis.

Malocclusion

Tikare *et al.* (2010)^[17] revealed a statistical association between whorl patterns among Class 1 and 2 malocclusion children

Bruxism more of whorls and a less of ulnar loops were noticed in patients with bruxism than the controls. They also demonstrated a lower frequency of angle than controls.^[18]

Squamous cell carcinoma, leukoplakia Venkatesh *et al.* (2008)^[2] 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.

Cleft lip and palate

Balgir (1992)^[19] in his study noticed an increased frequency of ulnar and radial loops in patients with cleft lip and palate than arches and whorls in patients without cleft lip and palate.

Down's syndrome

A marked increase of the ulnar loops on the fingertips is virtually a constant feature of the dermatoglyphics in Down's syndrome.^[20]

Acute myelogenous leukemia

Rosner in his study reported increased radial loops on the right hand of males and in females, an increased atd angle and a higher frequency of hypothenar patterns of the left palms.^[21] Menser and Pervis-Smith have reported an increase of arches and a decrease of ulnar loops in the fingertips of a group of patients with acute blast cell leukemia.^[22]

Diabetes mellitus

Wider "ATD" angle and the additional axial triradii were seen in patients with diabetes mellitus.^[23]

Oral submucous fibrosis

Increase in frequency of arches and decrease in the frequency of simple whorls decrease in atd angle were noticed in patients with oral submucous fibrosis.^[24]

Forensic odontology

In a comparative study among 100 children (50-healthy, 50-mentally challenged) an increased frequency of loops and transverse palmar crease line among the mentally challenged children were observed.^[25]

Advantages

The major advantages of dermatoglyphics are that scanning or recording is cost effective, rapid and can be done in the clinics without hospitalization and without causing any trauma. It also requires minimum equipment and data collected can be preserved for lifelong.

Limitations of dermatoglyphics

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

Conclusion

Fingerprints are known to be unique and unalterable and hence an excellent tool for population studies, personal identification, morphological, and genetic research. Any deviation in dermatoglyphics patterns indicates a genetic difference between control group and abnormal population. Though dermatoglyphics is considered an inexact, science has moved from obscurity to acceptability as a diagnostic tool. Extensive research in this field is required in order to determine the validity.

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