

Dermatoglyphics – A Blueprint In Ecc Risk Prediction

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ABSTRACT

Dermatoglyphics is study of the fine patterned dermal ridges on volar surfaces of soles, palms, and ridges. It can be used as a predictive model to diagnose orofacial disease conditions. Genetics plays a very important role in determining the dermatoglyphic patterns. Since caries is a multifactorial disease with the influence of genetic pattern, dermatoglyphic patterns can be correlated with early childhood caries. Dermatoglyphics can be an extremely useful method of primary investigation in assessing ECC in children with a suspected genetic base. Early prediction for high-risk children can help in using effective and efficient caries preventive measures that are a part of the pedodontist arsenal. Dermatoglyphics is a non-invasive and early predictor of dental caries in children, so as to initiate preventive oral health measures at an early age. Mass education is required to amplify this research into clinical practice and evade a new epoch in caries research. This article provides an overview on various dermatoglyphic patterns , methods of assessing them , their genetic influence with ECC and the significance of using dermatoglyphics as a marker in ECC diagnosis.

Keywords : *Dermtoglyphics , patterned ridges*

INTRODUCTION

The palms of the hands and the soles of the feet are covered with two distinct classes of marks. The most distinct among them are the creases or folds of the skin These folds or creases could be an indicator of certain congenital abnormalities. Scientifically the term palmistry means dermatoglyphics (derma-skin; glyphics-carvings).¹ The term was coined in 1926 by Cummins and Midlo,² and Harold however , Cummins is regarded to be the father of dermatoglyphics.[1]

Dermatoglyphics is the study of precise patterned dermal ridges on volar surfaces of soles and palms .The volar pads are nothing but mound shaped elevations which are present on all the fingers above the proximal end on the distal metacarpal bone. The size and position of these pads are responsible for the ridge patterns to an extent.[3,4]

THE DERMAL RIDGES AND ODONTOGENESIS – AN ECCENTRIC CONJUNCTION

Towards the end of the 19th century, Galton put forth a rule called ‘proof of no change’, which states that an individual’s dermatoglyphics remain unchanged throughout his/her lifetime. Since it is unique for each person, and is not same even in monozygotic twins, studying them can determine a number of parameters which could be helpful in diagnosing and treatment of examined individuals. 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.[5]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.[6] The dermal ridges formation begins during the 12th week of the intrauterine life and almost gets completed by the 24th week of intrauterine (I.U) life which correlates to . the same time as that of tooth formation in intrauterine life. This conveys that the genetic meaning contained in the genome, normal or abnormal, is decoded during this stage and could also be replicated by dermatoglyphics [7]. The environmental factors influenced or modified the resulting ridges which are genetically determined [8]. The ectoderm, from which the epidermis is derived, plays an important role in the configuration of several structures such as the teeth [9]. If an intrauterine dermal damage take place, a tooth anomaly might be expected [10].

EARLY CHILDHOOD CARIES PREDICTION– AN ENIGMA :

Caries is one of the most common chronic diseases present in children worldwide, countless adults and children are affected [11]. Early Childhood Caries (ECC) is a significant public health problem in both developing and industrialized countries which continues to affect babies and preschool children worldwide [11]. It is a chronic, transmissible, infectious disease with a complex and multifactorial aetiology [11]. According to the American Academy of Paediatric Dentistry (AAPD) guidelines ECC is defined as the presence of 1 or more decayed (noncavitated or cavitated), missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of 6 [12]. In children less than 3 years of age, tooth with smooth-surface caries is considered to have severe early childhood caries (S-ECC) [12]. In children between ages 3 to 5, 1 or more cavitated, missing tooth surface (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of ≥ 4 at age 3, ≥ 5 at age 4, or ≥ 6 at age 5 surfaces constitutes S-ECC [12]. The cause of caries is multifactorial and includes environmental and genetic factors. The extent of each of these factors causative to dental caries can change for every individual [13]. Though early childhood caries is not life threatening its impact on individuals and communities is significant; resulting in pain, mutilation of function, deleterious influence on the child's growth rate, body weight and ability to thrive, thus dropping the quality of life [14]. Although there are a variety of methods to identify ECC but there is no method to predict it [15]. The principle behind considering dermatoglyphic pattern as genetic marker for dental caries is that the epithelium of finger buds as well as enamel that is the most vulnerable dental tissue to caries have same ectodermal origin and both develop at the same time in the intra Uterine life [15,16]. Thus with genetic susceptibility and added environmental factors the proneness for caries due to abnormality in the tooth structures may be reflected in the dermatoglyphics namely whorls, loops and arch patterns [17].

NOMENCLATURE OF FINGER PRINT PATTERNS :

The basic dermatoglyphic landmarks, which are core (or “Center” of pattern, shown as red circle in Figure 1) and triradii (or “Delta” of pattern, shown as green circle in Figure 1). Ideally, a triradii is the point of the confluence of three ridges that forms an angle of approximately 120° with each another. If these ridges do not tend to meet, triradial point is represented by a short, dot-like ridge known as “Island”. Sir Francis Galton, in 1892, gave the basic nomenclature of the types of fingerprint patterns. There are a variety of fingerprint patterns observed ,the most common patterns are loops,whorls and arches .

A loop [Figure 2] is recognized as a series of ridges that enter the pattern area from one side of digit, recurves abruptly and tends to leave the pattern area on the same side. The loops can be further classified into ulnar loops and radial loops.[4] A single triradius is present, laterally on the fingertip, where the loop closes. If the ridge opens on ulnar side (away from thumb), it is called as ulnar loop, and if it opens toward the radial side (toward thumb), it is called as radial loop.

A whorl [Figure 3] varies from the loop in the aspect that there is concentric arrangement of ridges, with two or more triradii . Among all the dermatoglyphic patterns observed , arches [Figure 4] are the simplest ridge

pattern, which are formed by the succession of one or more parallel ridges that cross the finger from one side to the other with no recurving. These patterns usually do not show the presence of triradii, except when the tented arch is present that will have a



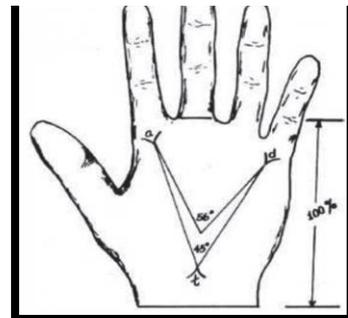
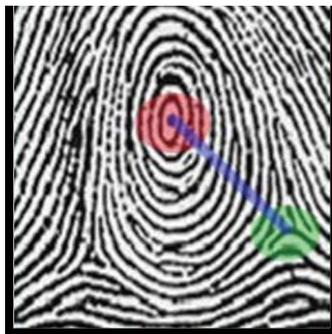
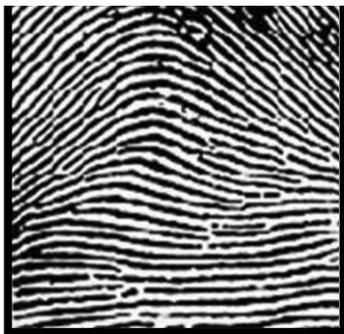
triradii point near its midline.

Figure 3: Whorls pattern

Figure 1 Core and triradii

Figure 2 Loops pattern

Demographic patterns as adapted from study done by Miodrag Stošljevi, Milosav Adamovi.:*Dermatoglyphic characteristics of digito-palmar complex in autistic Boys in Serbia. Vojnosanit Pregl* 2013; 70(4): 386–390.[4]



measurement of the palm that captures the relative position of three triradii-a and d, which are usually located on distal palm just beneath to the 2nd and 5th fingers, respectively and t whose location might vary on the proximal palm from being distal to the wrist, up to the center of the palm. The angle formed at the intersection of the two straight lines drawn between the 'a' and 't' triradii and 'd' and 't' triradii is the resulting Atd angle [Figure 6].

The atd angles are used to compare and assess the increase or decrease in mean frequencies between different group of individuals .

Figure 4 : Arches pattern

Figure 5 : method of ridge counting

Figure 6 atd angle

RECORDING OF THE HAND PRINTS AND CARIES STATUS :

Caries status of the child should be recorded using standardized indices such as def /dmft indices [4]. After consent is obtained from the parents, the child should be cautioned about not spilling over the dye on their body /clothing. Minimal amount dye possible should be used for good clarity of the impression. The handprints should be observed in a sequential manner under a magnifying glass with $\times 2$ power, from the left hand 4th digit until the thumb followed by the thumb of right hand until the 4th digit. [15] Dermatoglyphic analysis should include Qualitative analysis that includes fingertip patterns and Quantitative analysis that includes finger ridge count, total finger ridge count, and distal deviation of axial triradius or atd angle. All digits should be clearly recorded with thumb separately due to its spatial orientation.

Total ridge counting can be done by drawing a line joining the core and the triradii at right angles to the ridge area. All the ridges which cross this line are counted, and those ridges which end before touching the line are not counted. If a ridge bifurcates before reaching the line, it is counted as two ridges.[19]

APPLICATIONS OF DERMATOGLYPHICS AS MARKER FOR ECC:

Dermatoglyphics is considered as a reflector of congenital abnormalities and is also a sensitive indicator of intrauterine anomalies[15]. The dermatoglyphic patterns have been used as an oral health marker, which can foresee the genetic predisposition of children to dental caries. The children and their parents are observed to show similar pattern of occurrence of dental caries. This can be attributed to the genetic inheritance of salivary pH, enzymes, salivary flow and tooth morphology.[20] Various studies done by Sharma et al (2010), Bhat pk et al (2012) and Nidhi et al (2011) have suggested that increased observation of frequency of Whorl type finger print patterns on the right hand of the third digit showed a positive correlation with high ecc risk in children especially females.[1,21,22] Among the loops the radial loops are more commonly observed than ulnar loops in females. Arches are the least common pattern in patients with ecc and are more found in caries free children [23]. On observing the quantitative parameters, Ahmed et al Atasu et al have concluded that the axial triradius 'atd' angle is wider in (that is $>56^\circ$) in caries free children, and narrower (that is between 45° and 56°) in children presenting with ECC and the total ridge count (TRC) is higher in children who are caries free than in children presenting with ECC.[10,23] Streptococcus mutans is one of the main causative agent in dental caries. Thus colony count of s.mutans when correlated to the dermatoglyphic patterns revealed that increased frequency of occurrence of whorl patterns in children with high s.mutans count and more loops and arches presented with low s.mutans levels.[24]

THE PARADIGM SHIFT:

Early childhood caries presents as a worldwide disease in children. Though multifactorial causation is hypothesised, identification of children with strong genetic association at high risk can help in early intervention as in 3-5 years before incipient lesions get cavitated, anticipate and introduce preventive oral procedures at very young ages. The procedure is a new cutting edge tool in ECC prediction as it is completely non-invasive and reliable and simple to be performed and cost effective at community levels. This practice can be included as part of routine medical examinations for better outcomes.

Although genetic influence is seen predominant, environmental factors can also modify the diseases nature thus placing into doubt the application of dermatoglyphics. Also, further more studies are needed to confirm

the patterns in monozygotic twins ,consistency of the results and prescribe definitive cut off values to group children as low risk , moderate risk and high risk categories based on the finger print patterns.[24].

CONCLUSION :

Dermatoglyphics opens up a new arena as a genetic marker of ecc. However, further large scale investigations are required to precisely evaluate the significance of these variations in the dermatoglyphic pattern in children with ecc. Dermatoglyphics has moved from a state of ambiguity to acceptability as a diagnostic tool. In the future it may serve as an important tool that can predict the future oral health of a person.

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