

Dermatoglyphics: A New Diagnostic Tool in Dental Caries Prediction!

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Abstract

Genetics is the basis for dermatoglyphics and hence an effective tool for preliminary investigations in conditions with suspected genetic basis. Dermatoglyphics is the study of dermal ridge configurations on palmar and plantar surfaces of hands and feet. Dermal ridges and craniofacial structures are both formed during intra-uterine life, therefore hereditary and environmental factors leading to dental caries may also cause peculiarities in fingerprint patterns. The aim of this study was to evaluate and correlate the dermatoglyphic peculiarities i.e. finger prints and caries experience, through cost effective means, which can be used in field studies. This study concluded that the specific finger prints may be used as a potential non-invasive anatomical tool for early prediction of dental caries in children so as to initiate the preventive oral health measures at an early age.

Keywords: Dermatoglyphics; Finger Prints; Genetic Abnormalities; Dental Caries

Introduction

A fingerprint is the pattern of ridges and valleys on the surface of the finger. Fingerprints are found in humans and some animals. They are unique to all individuals and remain unchanged over the lifetime [1]. For centuries the features of the hands have fascinated scholars, sages, theologians, doctors and layman alike. Rather through decades of scientific research, the hands have come to be recognized as a powerful tool in the diagnosis of psychological, medical and genetic conditions [2]. Dermatoglyphics, proposed by Cummins and Midlo (1926) [3] implies the study of patterned tracteries of fine ridges on digits, palms and soles. Dermal ridges appear during 12th week of intrauterine life and are completed by 24 weeks of intrauterine life [4].

Interest of dermatoglyphics in medicine was aroused when abnormal dermal patterns were noted in Down's syndrome [5]. A number of disorders like Turner's syndrome [6], Klinefelter's syndrome [7], leukaemia [8], rubella syndromes [9], thalidomide drugs in pregnancy [10] also exhibit unusual dermatoglyphic findings. Based on the fact that development of teeth, alveolus and palate occurs at the same time as the development of dermal patterns studies [11,12] were done correlating dermal patterns with normal occlusion and malocclusions since they are both genetically governed structures. The present study was undertaken to evaluate the probability of a correlation between dental caries and dermatoglyphics. The aim of this paper was to evaluate and correlate the dermatoglyphic peculiarities i.e. finger prints and caries experience, through cost effective means, which can be used in field studies.

Materials and Method

A case-control study was designed and approved by institutional ethics committee, comprising of a total number of 300 cases, obtained from schools in Nagpur, India. Data was collected from these 300 children between the ages of 5 and 16 years irrespective of the gender. Out of 300 subjects, 150 subjects were grouped into study group and the remaining 150 subjects were considered as the control group. The study group included children with dental caries in 5 or more teeth based on the DMFT index performed and control group consisted of normal, healthy children without any dental caries. Considering the ethical issue and confidentiality of fingerprints of patients, informed consent was obtained from the school head masters and the detail of the study was explained to the parents of the subjects and permission was obtained. Cotton, black kajal, soap, gloves, magnifying lens were used as armamentarium. A case sheet was prepared to record the personal details of the children, DMFT index and fingerprints of all the 10 fingers.

Subject's hand were cleaned and dried before imprinting. A thin layer of kajal was applied to the fingers tips. An imprint of five fingertips was recorded on case record sheet. The same procedure was repeated in relation to the other hand. Prints were dried and studied using a magnifying lens to identify the finger tips patterns. After taking the imprints of all fingers, kajal was removed by using soap and water. Exclusion criteria in our study were children with skin disorders, trauma to fingertips, unco-operative children and children whose parents did not give consent. The various patterns of fingerprints were analyzed according to the standard guidelines for classification of patterns [13-18]. Fingerprints have been classified according to their global ridge patterns using the Henry System ridge pattern classifications including the left loop, the right loop, the arch, the tented arch, and the whorl (Figure 1) [19,20].

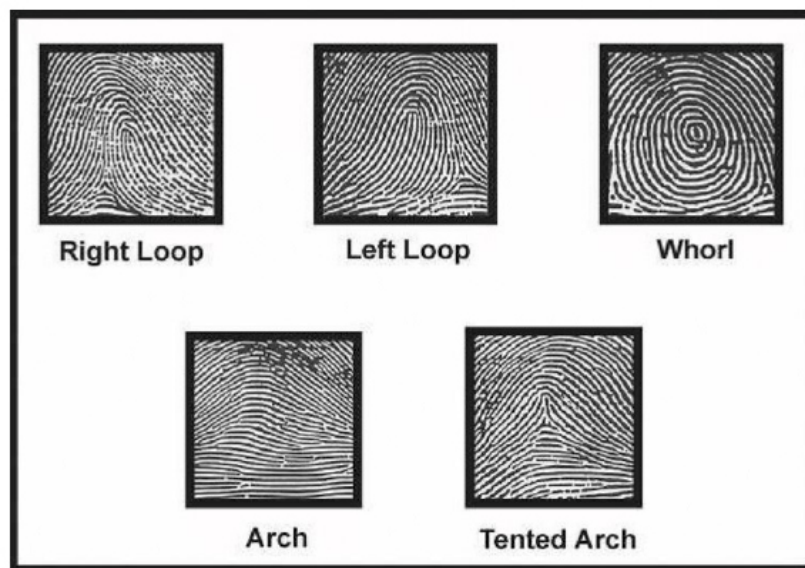


Figure 1: Henry System ridge pattern classifications.

The data recorded was entered in Microsoft Excel sheet and applied for statistical analysis. Statistical analysis was performed using nonparametric tests and t-test to compare the dermatoglyphic pattern changes between the study group and the control group and was applied for each variable, to compare the proportions and p-value.

Findings

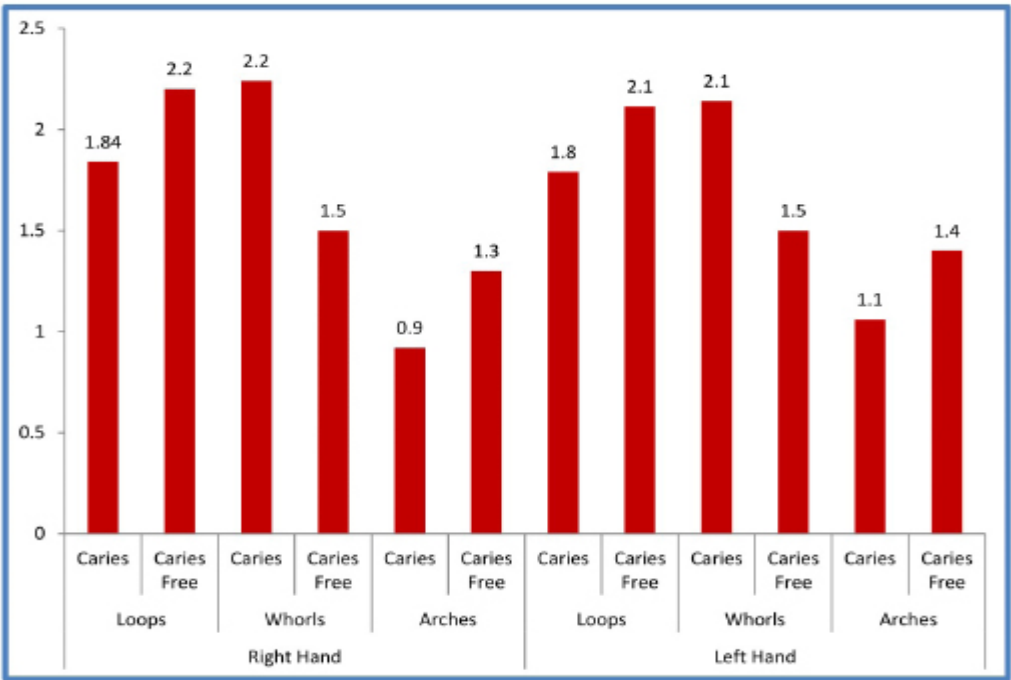


Figure 2: Mean no of loops, whorls and arches in the school children.

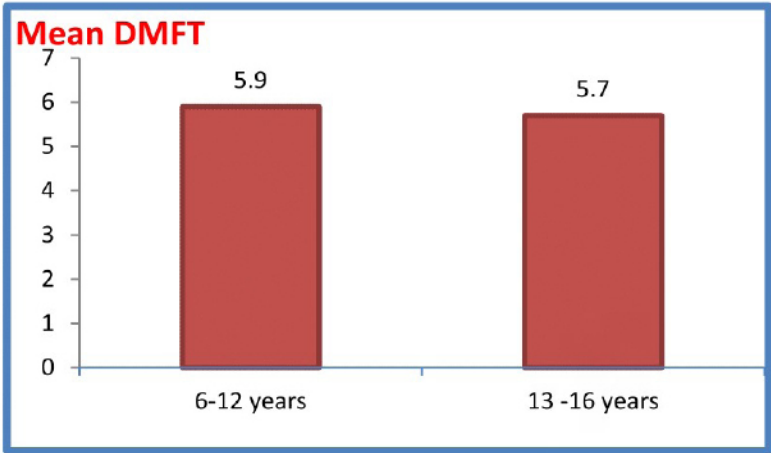


Figure 3: Comparison of mean DMFT in (6 - 12 yrs) and (12 - 16 yrs) children.

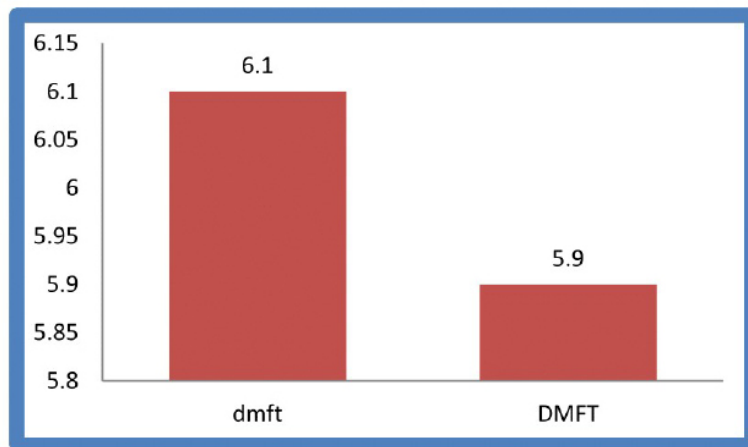


Figure 4: Comparison of mean dmft and DMFT in (6-12 yrs) children.

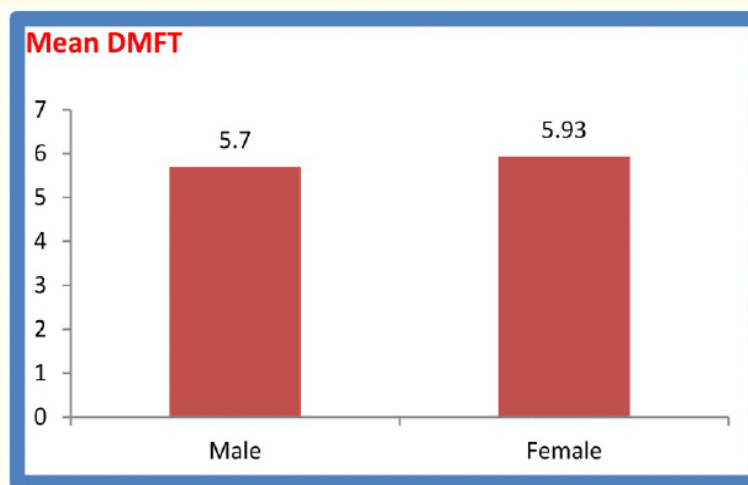


Figure 5: Comparison of dmft/DMFT among male and female children.

Discussion

Dental caries is a microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic substance of the tooth. The relative roles of heredity and environmental in the pathogenesis of dental caries has intrigued clinical and basic researchers for decades. There are numerous host resistance and risk factors for dental caries that are genetically determined [13]. In this cross sectional study, the frequency of whorls were found to be more in caries group than in caries free group and this mean is also statistically significant ($p < 0.05$). The frequency of loops and arches were found to be more in caries free group than caries group (Figure 2). This mean loop difference is statistically significant ($p < 0.05$). In the present study the mean dmft score for the

6 - 12 years old was 6.1, the mean DMFT score for the 6 - 12 years old was 5.9 and the mean DMFT score for 13 - 16 years old was 5.7 in the school children but this difference is statistically non-significant p value is ($p > 0.05$) (Figure 3,4). The mean DMFT for male is 5.7 and for female is 5.93 and this difference is also statistically non-significant (Figure 5).

In this study, the frequency of whorls were found to be more in caries group and the frequency of loops and arches more in caries free group. These obtained results are in line with a study done by Metin Atasu among Dental students in Marmara University, Turkey [21]. Similarly a study done by Sharma A and Somani R in Ghaziabad among 3 - 6 years old children showed decreased frequency of loops in caries group compared to caries free group [22]. In this study age was restricted from 5 - 16 years, to determine the genetic etiology and avoid the time related carious lesion, usually encountered later in life i.e. Time, the fourth contributing factor in dental caries and also less than 5 years of age was excluded, as the children below this age group are usually uncooperative. Madan., *et al.* [23] found that the handprints of caries-free children showed maximum ulnar loops. The caries group showed maximum occurrence of whorls ($r = 2:1$) Abhilash., *et al.* [24] found that Dental caries susceptibility of an individual increases with an increase in the incidence of whorl pattern (83% correlation). All the variables show statistically significant value, with a degree of divergence of specific dermatoglyphic patterns among study and control group. Both the above studies were unable to correlate arches pattern which was found to be statistically significant in caries free group, in our study.

The mechanisms whereby teeth are patterned in the jaws are poorly understood at present, but the available evidence indicates that the conserved signal pathways play important roles in determining the positions of the teeth. The current knowledge on the molecular mechanisms of dental placode formation has been derived largely from studies on syndromes called ectodermal dysplasias. Studies have shown that enamel knot represents an organisational centre, which orchestrates cuspal morphogenesis. The enamel knot shares many similarities with the apical ectodermal ridge of the developing limbs as both consist of non-dividing cells, both express Fgfs, Bmps and Msx-2 and both act as signalling centres. Teeth morphogenesis and cusp anatomy have significant roles in the prevalence to dental caries. Hence dental caries and finger prints may be correlated in this study, although exact relationship still needs to be established [25,26].

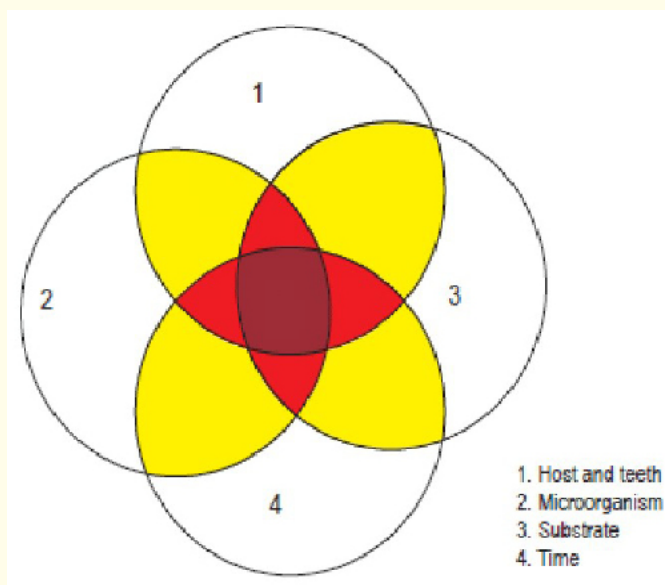


Figure 6: Contributing factors in dental caries [24].

Conclusion

Specific finger prints may be used as a potential non-invasive anatomical tool for early prediction of dental caries in children so as to initiate the preventive oral health measures at an early age. The comparative studies in different geographical areas and on larger scale, to identify the dermatoglyphic patterns is further required in this regards.

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Conflict of Interest

None.

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