



## **Dermatoglyphics: A Tool in Detection of Dental Caries**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author SMA first drafted the manuscript. Author ARL managed to collect the sample and recorded finger prints. Author DBGB revised and approved the final documented manuscript. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/BJMRR/2016/22065

#### Editor(s):

(1) Joao Paulo Steffens, Department of Dentistry, University of Uberaba, Brazil.

#### Reviewers:

(1) Manuel Restrepo, Sao Paulo State University, Brazil.

(2) Rodrigo Crespo Mosca, Sao Paulo University, Brazil.

(3) Anonymous, University of L'Aquila, Italy.

(4) Neha Saksena, Shree Guru Gobind Singh Tricentenary University, India.

Complete Peer review History: <http://sciencedomain.org/review-history/12507>

**Original Research Article**

**Received 16<sup>th</sup> September 2015**

**Accepted 23<sup>rd</sup> November 2015**

**Published 2<sup>nd</sup> December 2015**

### **ABSTRACT**

This study was undertaken to evaluate the dermatoglyphic pattern among deaf and mute children affected with caries and children without caries. A total of 400 school children in the age group of 4-9 years were selected using purpose sampling method. Their fingerprints were recorded using duplicate ink and the frequency of occurrence of type of dermatoglyphic pattern of finger tips was noted. The caries experience was clinically assessed by dmft/DMFT index. Statistical analysis was performed using Mann-Whitney test. Though, the arch pattern was commonly seen in children with caries and control group it was not statistically significant. Finger prints of caries free females and females with caries showed more of arch followed by loops. In caries free males common pattern was arch and in males with caries the pattern seen was arches followed by loops. However, these findings were not statistically significant. Dermatoglyphics can be an appropriate method to explore

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the possibility of a non-invasive and an early predictor of dental caries. Since, this is an inexact science, further extensive research and studies in the field have to be done in order to determine the significance of dermatoglyphics with dental caries.

*Keywords: Dental caries; dermatoglyphics; fingerprint pattern.*

## 1. INTRODUCTION

Palmistry in scientific terms is called as “dermatoglyphics” (“derma” means skin and “glyphic” means carvings). It is a study of palmer and plantar dermal ridge carvings on hands and feet. These finger prints found in an individual are unique and remain unchanged during lifetime [1]. At present, the study of hand has moved far from the popular image of sooth saying hand readers and theologians. Apart from their use in identification of individuals by forensic experts, the current state of medical dermatoglyphics is such that association between fingerprint patterns and various conditions such as diabetes mellitus [2], hypertension [3], congenital heart diseases [4] and many others has been established. Reasons for the above variations in dermatoglyphics findings associated with various diseases may be due to the fact that, morphogenesis of dermatoglyphic structures and organogenesis is a co-incident with same time period and programmed by genetic expressions which are interrelated. The basis of considering dermatoglyphic pattern as genetic marker for dental caries is that the primary palate develops during 6-13<sup>th</sup> week of intrauterine life. Epithelium of finger buds and enamel has ectodermal origin and both develop at the same time of intrauterine life [5]. Similarly development of dermal ridges and congenital deafness seems to be developing at same time. About 50% of cases of childhood hearing impairment are genetically determined. Several studies have shown that caries is high in these children [6]. Dental treatment is the greatest unattended health need for these children. Thus when combined with other diagnostic procedures dermatoglyphics can serve as a useful diagnostic tool. The aim of the present study was to determine dermatoglyphic pattern in caries and caries free deaf and mute children.

## 2. MATERIALS AND METHODS

A deaf and mute school from Abha, Saudi Arabia. was selected using purposive sampling method, where 400 school children between age group of 4-9 years were selected using random sampling method. An informed consent from principal of the school was taken before the

onset of the study and ethical clearance was obtained from ethical review committee of the institution. A week prior to the study letter was sent to parents regarding the study. They were assured that children’s hand print will not be used for any purpose other than the present study. After obtaining approval from the parents the children were included in the study. Each child was designated a sample number and that same number was written on their recording sheet and DMFT index was written on a separate sheet against their respective sample number. The study group included children with dental caries in 5 or more teeth based on DMFT index and control group consisted of children without any dental caries. Children with skin disorders, trauma to finger tips and uncooperative children were excluded from the study.

### 2.1 Recording of Finger Prints

Recording of fingerprint patterns of the study subject was achieved with a rolling impression technique using black printer’s ink, as prescribed by the Kentucky state police, USA [7]. To avoid duplication of finger prints, the fingers were numbered from 1-5 for left little finger to the thumb, and from 6-10 for right thumb to right little finger of the hand respectively. The hands were cleaned with soap and water and then scrubbed thoroughly with an antiseptic lotion (Savlon) and allowed to dry. This was done to enhance the quality of finger prints by removing sweat & dirt from the skin surface. Duplicating ink was applied with the use of cotton applicator to all the distal phalanges of the fingerprint. Impressions were taken on a white proforma sheet with blocks for each finger. The finger prints were then verified and the whole procedure was repeated to ensure proper recording of the fingerprints. The obtained dermatoglyphic patterns for finger tips i.e. presence of arches, loops and whorls were assessed with the help of magnifying glass (5x) by a single blinded examiner (Fig. 1).

### 2.2 Statistical Analysis

The data pertaining to finger prints was entered into a MS Excel spreadsheet (MS Office Excel 2010) and subjected to statistical analysis. All the

analysis was done using SPSS (Statistical Package for Social Science Version 18). Comparison of mean number of fingers between caries free and caries group was done using Mann-Whitney U test. A p-value <0.05 was considered statistically significant.

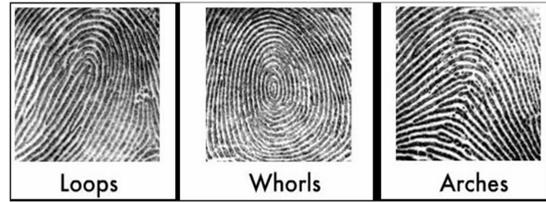
**3. RESULTS**

A total of 400 children were included in the study of whom 205 (51%) were boys and 195 (49%) were girls. They were further sub divided in to two groups as caries (102 boys & 98 girls) and control (103 boys and 97 girls) groups. Comparison of mean number of fingers between caries and control group was done using Mann-Whitney U test. Though the arch pattern was common in both caries & control group, it was not statistically significant (Table 1). Fingerprints of caries free females and females with caries showed more of arches (3.59±1.17) followed by loops (3.53±1.26) pattern. However these findings were not statistically significant. (Table 2). In caries free male children common pattern seen was arches (3.69±1.22). Where as in males with caries the pattern seen was arches (3.66±1.09) followed by loops (3.44±1.30). However, these findings were not statistically significant (Table 2).

**4. DISCUSSION**

The study of dermal ridge pattern has long fascinated men through the ages and attempts have been made to predict the future of individuals based on the ridge patterns. Towards

the end of 19<sup>th</sup> century, Galton put forth a rule called 'proof of no change' which states that an individual's dermatoglyphics remain unchanged throughout his/her life time. The key figure in the development of dermatoglyphic study was done by Czech doctor Jan Purkinije.



**Fig. 1. Classification of finger ridge pattern**

He suggested that the dermatoglyphic patterns might have both genetic and diagnostic importance [8]. Through decades of scientific research, dermatoglyphic has come to be recognized as a powerful tool in diagnosis of psychological, medical & genetic conditions [9]. It is also considered as a window & sensitive indicator of congenital and intrauterine anomalies [10]. Basically, the skin lines on the fingers are formed during second trimester and do not alter in an individual during his life. The dermal ridges are formed during 6<sup>th</sup> week of gestation and reach maximum size during 12<sup>th</sup> – 13<sup>th</sup> week. The epidermal ridges of fingers, palms and facial structures form from the same embryonic tissue (ectomesenchyma) during same embryonic period (6-9 weeks) [11]. The genetic message either normal or abnormal is deciphered during this

**Table 1. Comparison of mean number of dermatoglyphic pattern in caries and caries free children**

Finger print pattern	Caries group		Control group		P value
	Mean	Standard deviation	Mean	Standard deviation	
Whorl	3.02	.89	2.92	.80	0.289 (NS)*
Loop	3.34	1.24	3.49	1.23	0.188 (NS)*
Arch	3.64	1.19	3.60	1.13	0.699 (NS)*

*A p-value of <0.05 was considered statistically significant. \*Not Significant*

**Table 2. Dermatoglyphic analysis between males & females**

Gender	Dermatoglyphic pattern	Caries group		Control group		P- value
		Mean	Standard deviation	Mean	Standard deviation	
Male	Whorl	2.92	.92	3.13	.90	0.066 (NS)*
	Loop	3.44	1.30	3.16	1.20	0.078 (NS)*
	Arch	3.66	1.09	3.69	1.22	0.563 (NS)*
Female	Whorl	2.92	.65	2.88	.88	0.493 (NS)*
	Loop	3.55	1.15	3.53	1.26	0.972 (NS)*
	Arch	3.55	1.18	3.59	1.17	0.966 (NS)*

*A p-value of <0.05 was considered statistically significant. \*Not Significant*

period and is reflected by dermatoglyphics. Thus, with genetic susceptibility and added environmental factors the proneness for caries due to abnormality in tooth structures like alterations in dental hard tissues like structure of dental enamel, tooth eruption and development may be reflected in dermatoglyphics in the form of whorl and loop patterns [12]. Hence, dermatoglyphics could indicate a genetic susceptibility to dental caries. The pathogenesis of caries process is rather well understood today, and caries attack rate in humans is a consequence of various attributes. Genetically regulated processes identified as contributing to caries incidence include tooth eruption, tooth morphology, density or structural integrity of the enamel, composition of secretion of salivary gland and salivary flow, the immune response and reduction in the clearance of the bacteria. Miller concluded from his study that there is a strong genetic component in primary teeth which effects the incidence of caries [13]. Individuals with high resistance to dental caries had a specific immunoglobulin with in saliva conveying immunity by lysing the cariogenic bacterial cells. It was suggested that this phenotype was inherited and transmitted as an autosomal dominant trait [14]. Thus, genes and genetic abnormalities that leads to abnormal structural organization of teeth and its environment leads to increased susceptibility to dental caries. Studies reveal that HLA DR6-1,2,3 had a significant relationship to dental caries, with increased susceptibility to dental caries, enamel defect as well as low dose response to streptococcus mutans antigens. Various investigation have proved that genes in the HLA complex are associated with altered enamel development and increased susceptibility to dental caries. Specific allelic variants of these genes could be used as a potential marker to assess the increased dental caries risk [15]. Dental caries demonstrates the graded continuous variation pattern, where sharp distinction between the average and high afflictions are not possible. So, only two extreme differences such as "no caries" and caries on "three or more teeth may be expected to demonstrate noticeable variation. Hence, the subjects in our group were divided in to caries and caries free group. We did not include dermatoglyphics of children with syndromes, as the literature suggests them to show a peculiar pattern, and oral hygiene maintenance is variable in them in comparison to normal healthy children [10]. The age group of 4-9 years was chosen to include the primary dentition and also to have a larger children base. In the present study,

dermatoglyphic data were collected in accordance with the method used by Tikare et al [7] by rolling impression technique using black printer's ink, as prescribed by the Kentucky state Police USA. The other methods of recording handprints include photography, scanners and biometric machines. Blinding of the examiner was done and single examiners carried out the reading of all fingerprints to decrease inter examiner variability. We designed and undertook this study to evaluate and analyze dermatoglyphic pattern in deaf and mute caries & caries free children. In the present study, the frequency of arches was found to be more in both caries & caries free group. However, it was not statistically significant. These findings are not in accordance with the study conducted by Bhat et al among deaf and mute children where, the frequency of whorls were found to be more in caries group and loops in caries free group [16]. Similar study conducted among deaf and mute school children from Punjab, showed an increase frequency of whorls in caries group [6]. Abhilash et al concluded that dental caries susceptibility of an individual increased with incidence of whorl pattern and decreased with incidence of loop pattern [17]. Few studies have also reported that study subjects with dental caries had lower frequency of loops and higher growth of Streptococcus mutans as compared to control group [18]. There was a high frequency of arch noticed in caries group of males & high frequency of arch and loops noticed in caries group females. However, it was not statistically significant. These findings are not in accordance with study conducted by Madan et al where, the frequency of whorls was more common in females with caries [19]. In future digital dermatoglyphic may have a major role in identifying people either with or at increased risk for dental caries so that either risk reduction measures or earlier therapy may be instituted. The limitation of this study is, only one school from this region was considered. Whereas more stratified sample may show accurate results. There is no way of finding out whether genetics or environmental factors play a dominating role in occurrence of dental caries. Dermatoglyphic patterns of parent/child should be compared for better results.

## 5. CONCLUSION

To conclude, dermatoglyphics can be an appropriate method to explore the possibility of a non-invasive and an early predictor of dental caries. Given the expenses involved in

conducting the analysis of chromosome themselves, it can prove to be an extremely useful tool for primary investigations. Since, dermatoglyphic is an inexact science, further extensive research and studies in this field have to be done in order to determine the significance of dermatoglyphics with dental caries.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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