

## Dermatoglyphics: A Genetic Marker of Dental Caries

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### Abstract

Study of dermatoglyphic patterns is useful in diagnosis of various genetic related diseases as well as a valuable adjunct in judicial and legal investigations. Genetic factor also plays an important role in etiology of dental caries. Study of configuration of dermal ridges on palmar and plantar surfaces of hands and feet is called dermatoglyphics. As dermal ridges and tooth structures are formed almost during the same period of intra uterine life, so hereditary and environmental factors causing dental caries in tooth can show similar alterations in dermal ridge patterns. So keeping in view these common factors, we decided to study correlation between dental caries and dermatoglyphic patterns among subjects.

**Keywords:** Dermatoglyphics, Whorl, Loop Pattern, Dental Caries.

### Introduction

Many many years ago, Aristotle recognized the potential of features of the hand and these features had been studied by scholars and medical professionals for centuries. Most important lines and patterns on the hands are used by forensic experts as an adjunct tool for identification of criminals. These patterns can also be used by medical and dental professionals as an adjunct for diagnosis of medical and dental conditions with genetic predeposition. The scientific study of intricate patterns found on hands and feet is called "Dermatoglyphics". Dermatoglyphics is combination of two words 'Derma' i.e. skin and 'Glyphics' i.e. carvings present on skin. This term was coined by Cummins and Midlo in 1926 [1].

Both epithelium of the skin surface and enamel have the ectodermal origin and are formed in intrauterine life [2,3]. Also, genetic factor plays an important role in formation of both. Thus keeping in view of these factors, study of dermal patterns of skin may help in prediction of susceptibility of dental caries [4].

Hence this study was undertaken with the aim to investigate and analyse the relation between dermatoglyphic pattern variations and susceptibility to dental caries among a group of dental students. Another objective is to suggest patient of dermatoglyphics to help dentist to guide the patient to take preventive measures to control dental caries before its initiation.

### Materials And Methods

The present study was conducted in Genesis Institute of Dental Sciences and Research in the Department of Conservative Dentistry and Endodontics.

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**Study Design**

This study was conducted on 200 dental students aged between 18 and 25 years, divided into two groups of 100 students each. The dmft score was the criteria to select the experimental group which included students with dmft score = 4 or more and control group (n=100) which consisted of students with no caries/dmft score = 0.

**Method of Collection of Data**

Firstly, hands of each student involved in study were thoroughly cleaned and allowed to dry. After this, ink was applied on the four digits as well as thumb of right hand using stamp pad and were firmly pressed against the bond paper stabilized on a hard smooth surface. Impressions taken may be repeated to choose the most satisfactory and readable among them. The same procedure was applied for the left hand. These dermatoglyphic patterns (impressions) were evaluated using a magnifying glass (6xs).

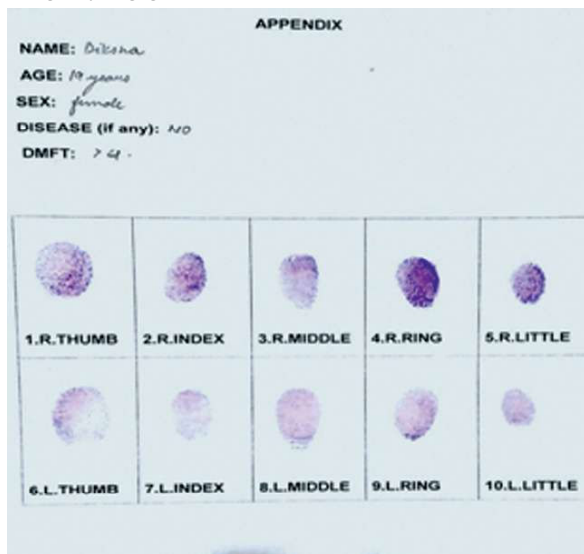


Fig. 1: A Photograph showing the method of collecting data on bond paper



Fig. 2: Magnifying glass

**Qualitative Dermatoglyphic Analysis**

The frequency of true patterns of loops, whorls and arches (Fig. 1) were counted on the fingertips of all the 10 digits of students with dental caries and caries free students. They were assessed for increase or decrease in frequencies. Study of fingerprint patterns given by various students included in the study was done.

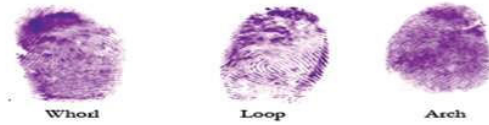


Fig. 3: A Photograph showing different Finger Print Patterns



Fig. 4: A photograph showing measurement of total ridge count in whorl and loop patterns.

**Statistical Analysis**

Statistical analysis was done for the collected data using SPSS software statistical computer package, version 22. The qualitative data was presented as frequencies and compared by Chi square test, the quantitative data was presented as mean and standard deviation (SD) and compared by independent student t test. The differences between the two groups were considered significant at  $p \leq 0.05$ .

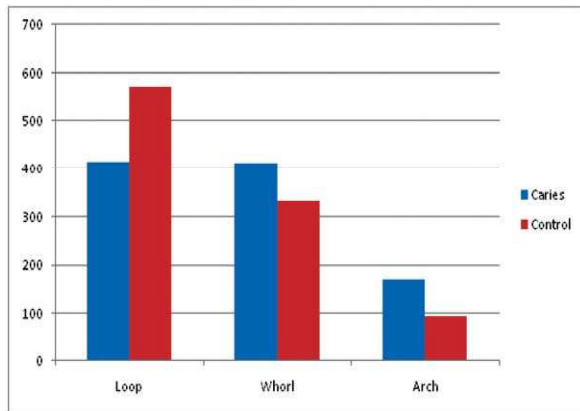
**Results**

Graph 1 and Table 1 shows the comparison of frequency of loops, whorls and arch pattern for both groups. Caries active group had an increased frequency of whorls and decreased frequency of loops while Caries free group had a decreased frequency of whorls and increased frequency of loops. When both groups were compared, there were statistically significant differences.

Table 1: Comparison of Finger Print Pattern between Caries Active and Caries Free Students

Group	Caries active		Caries free		Total	
Pattern	No.	%	No.	%	No.	
Thumb Finger						
Loop	92	46.0	120	60.0	212	53.0
Whori	92	46.0	64	32.0	156	39.0
Arch	16	8.0	16	8.0	32	8.0
$\chi^2 = 8.724 \quad p = 0.013$						

		Index finger				
Loop	68	34.0	112	56.0	180	45.0
Whori	76	38.0	60	30.0	136	34.0
Arch	56	28.0	28	14.0	84	21.0
		$\chi^2 = 21.971 \quad p < 0.001^{**}$				
		Middle finger				
Loop	112	56.0	116	58.0	228	57.0
Whori	48	24.0	52	26.0	100	25.0
Arch	40	20.0	32	16.0	72	18.0
		$\chi^2 = 1.119 \quad p = 0.571$				
		Ring finger				
Loop	80	40.0	80	40.0	160	40.0
Whori	100	50.0	1088	54.0	208	52.0
Arch	20	10.0	12	6.0	32	8.0
		$\chi^2 = 2.308 \quad p = 0.315$				
		Little finger				
Loop	64	32.0	144	57.0	208	52.0
Whori	96	48.0	28	24.0	144	36.0
Arch	40	20.0	8	4.0	48	12.0
		$\chi^2 = 68.103 \quad p < 0.001^{**}$				
		Total finger print				
Loop	416	41.6	572	57.2	988	49.4
Whori	412	41.2	332	33.2	744	37.2
Arch	172	17.2	96	9.6	268	13.4
		$\chi^2 = 54.786 \quad p < 0.001^{**}$				

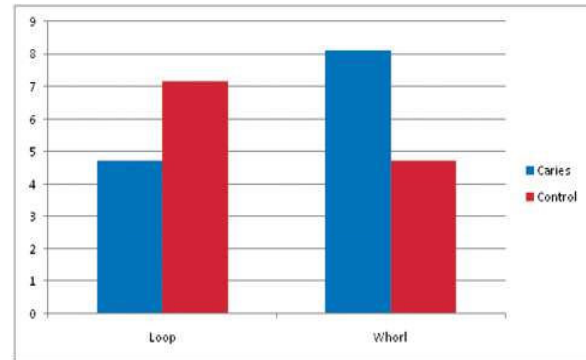


**Graph 1:** Shows the Frequency of Finger Prints Pattern in Caries Active and Caries Free Students

The comparison of mean values of total finger ridge count for loops and whorls is shown in Table 2. The mean values of loops in caries active group was  $4.72 \pm 1.15$  and that for caries free group was observed to be  $7.16 \pm 1.05$ . The mean value of whorls in caries active group was observed to be  $8.11 \pm 1.08$  and that for caries free group it was  $4.73 \pm 0.94$ . When both groups were compared, there were statistically significant differences ( $p = 0.000$ ) as regards the mean values of loops and whorls ridge counts.

**Table 2:** Shown Mean Values of Finger Ridge Counts for Caries Active and Caries Free Children.

Groups	Caries Active	Caries free	Significance
Variables	Mean $\pm$ SD	Mean $\pm$ SD	t p
Loop	$4.72 \pm 1.15$	$7.16 \pm 1.05$	16.457 0.000
Whorl	$8.11 \pm 1.08$	$4.73 \pm 0.94$	-15.297 0.000



**Graph 2:** Showing the Mean Count of Finger Ridges of Caries Active and Caries Free Children

### Discussion

Dental caries is a multifactorial disease which causes demineralization of the inorganic portion as well as destruction of the organic substance of the tooth. This disease can have multiple etiologies [6].

One of them is involvement of genetics. That might be the reason for inheritance of pattern of dental caries similar in members of the same family over several generations [7]. It has been proved that the type of fingerprints are unique and has genetic predisposition. These dermal patterns are unique for particular person and remain constant throughout life [8,9].

In the present study when the 400 hand prints of 200 children were analyzed (Table 1), it was found that there was an increased frequency of loops (49.4%) among this study population followed by whorls (37.2%) and arches (13.4%). These findings are consistent with the previous studies [10,11] regarding frequency of dermatoglyphic patterns in a population.

The results of the present study indicated that, Caries active group showed increased frequency of whorls as compared to frequency of whorls present in Caries free group and also showed that caries active group had a decreased frequency of loops as compared to loops present in caries free group (Table 1). These results are coinciding with the results obtained by Atasu et al. [12] and Vijender et al. [13].

Also, there was statistically significant total

finger ridge count of whorls in caries active children while there was highly statistically significant total finger ridge count of loops in caries free students (Table 2). These results were agreed with the results concluded by Sengupta *et al.* [14].

### Conclusion

Due to genetic component playing role in etiology of dental caries dermatoglyphics can be used to detect caries at initial stages. Specifically, caries-free individuals showed increased frequency of loops, whereas subjects with high caries score had more percentage of whorl patterns.

So, that preventive measures can be introduced at an early stage. For developing country like India, we can prove it to be a noninvasive, inexpensive and effective indicator for dental caries.

#### *Conflicts of Interest:*

There are no conflicts of interest.

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