



## Correlation between dermatoglyphics and dental caries prevalence in 3-7 years old children

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### Abstract

**Introduction:** Despite advances in oral healthcare, dental caries remains the most common chronic disease among children globally. The epithelium of finger buds and enamel develop during the same time period of intrauterine development also are both ectodermal in origin. Hence, is the basis for thinking of dermatoglyphic patterns as a marker for dental caries.

**Aim and objective:** To record and correlate the dermatoglyphic patterns and its correlation with dental caries prevalence.

**Material and method:** The study was conducted on 250 school going children of age between 3-7 year old in Rishikesh. The method which was used to record dermatoglyphic patterns was Stamp ink pad and assessed using magnifying glass.

**Result:** Statistically significant increase in the number of whorls and double whorls and TRC were seen in children with high DMFT index showing increased prevalence of dental caries.

**Conclusion:** Dermatoglyphic pattern proved to be very effective, non-invasive and inexpensive technique in early prediction of dental caries and guides the people to detect and prevent the dental caries at an initial stage.

**Keywords:** Correlation, glyphics, dermatoglyphics

### Introduction

The study of the human hand has always been fascinating, not only to anthropologists and physicians but also to psychologists, writers, painters, sages, and chiromancers. [1] 'Dermatoglyphics' is the word derived from Greek words 'Derma' i.e. skin and 'Glyphics' which means carvings. Harold Cummins is known as the "Father of Dermatoglyphics" and this term was introduced by him and Midlo in 1926. [2] Dermatoglyphics or palmistry is the study of the permanent dermal ridges of the hand and feet. Dermatoglyphics is a useful tool for preliminary investigation of conditions with a suspected genetic basis. The epithelium of the finger buds, the enamel, which is the most susceptible dental tissue to caries, as well as the early fetal brain development have an ectodermal origin and develop at the same time of intrauterine life, in the 6th to 7th week of gestation and completed by 20th to 24th week of gestation. [3] Currently, the dermatoglyphics have been used to predict many oral diseases such as precancerous lesions, oral clefts, dental caries and many other conditions. Of these dental caries is one of the most predominant disease that exists globally and affects all age groups in general. [4]

Dental caries is an irreversible, progressive and multifactorial disease which has genetic susceptibility as one of the factor. The epithelium of finger buds and enamel both has the ectodermal origin. Hence, the dental tissue whether normal or abnormal can be explained by dermatoglyphics. [5]

Gallon in 1892 classified ridge patterns of distal phalanges into three basic types: whorls, loops, and arches. A) Arch pattern: This constitutes the simplest form of pattern. Types of arch patterns include: i) Simple or plain arch pattern: This comprises of ridges crossing fingertips from one to another side without curving; ii) Tented arch pattern: This pattern is characterized by a point of confluence termed as "triradius"

as the ridges radiate from this point to three directions. This triradius is localized near midline axis of distal phalanx; B) Loop pattern: It is the most common ridge pattern. In this, ridges enter on one side, undergo abrupt recurve, and leave on the same side. If the ridge opening is on ulnar side, the loop is called "ulnar loop"; if it opens on a radial side, it is called "radial loop." The triradius is laterally located on one side where loop has closed end. These may vary in size and shape or may be plain or double loops; C) whorls: This pattern contains two or more triradii. Henry in 1973 used the "whorl" for ridged encircling core. He designated more complex patterns as "composites." The "concentric whorl pattern" is arranged as succession of concentric elliptical rings. "Double or spiral whorl pattern" is seen as spirals around a core either in clockwise or anti-clockwise direction. Complex patterns comprised of triradii and whorls are termed as "Accidentals." Sometimes, configurations composed of loop or whorl or triple loops can also be classified as "Arch with loop" and "Arch with whorl." [6] This study aimed towards determining a correlation between the dermatoglyphic patterns and dental caries prevalence in primary dentition bearing children.

### Material and method

The present study was conducted on 250 school going children of age between 3-7 year old in Rishikesh. Procedure of the study was explained to the, parents, school authorities and consent was obtained prior to the commencement of the study. Ethical clearance was also obtained.

### Study Population

Study population included children attending school during dental camps, children visiting the hospital belonging to the age group of 3-7 years.

**Dermatoglyphic pattern recording and interpretation**

Cummins and Midlo's ink method was used to record finger and hand prints. Children's hands were cleaned with soap and water and then an antiseptic lotion was used to eradicate any dirt and oil from the ridged skin. Finally, hands were air dried in order to improve the quality of finger and palm prints.

**Finger and palm prints**

Black duplicating ink pad was used to record finger prints (both right and left hand) of all the subjects. The student's right palms were pressed against the ink pad, guided and pressed tightly against the white bond paper clipped on to a hard board which was kept firm, followed by pressing it firmly against the bond paper 2-3 times; because the second

or third recording was satisfactory and readable. The same procedure was repeated for the left hand. Dental experience of children was measured using def index [6].

**Method of reading handprints**

The handprints obtained were checked for their clarity with a magnifying glass (×2×) and coded. The presence of core and the triradii of the dermatoglyphic pattern were checked thoroughly to include the handprint in the study.

**Analysis of finger print patterns**

Predominantly three dermatoglyphic patterns were observed in fingertips, arch pattern, loop pattern, and whorl pattern [Fig 1]. [7] In addition, axial t triradius (ATD) angle and total ridge counts (TRC) were also calculated in the subjects.



Fig 1: Dermatoglyphic patterns

**ATD angle:** A feature of the palm that captures the relative position of three triradii-A and D, usually located on distal palm just inferior to the 2<sup>nd</sup> and 5<sup>th</sup> fingers, respectively and T whose location can vary on the proximal palm from just distal to the wrist, up to the center of the palm [Fig 2A]. ATD angles were measured for each palm print by drawing

two straight lines through the “A” and “T” triradii and the “D” and “T” triradii and measuring the resulting angle [Fig 2A]. The ATD angles were compared and assessed for increase or decrease in mean frequencies between the groups.

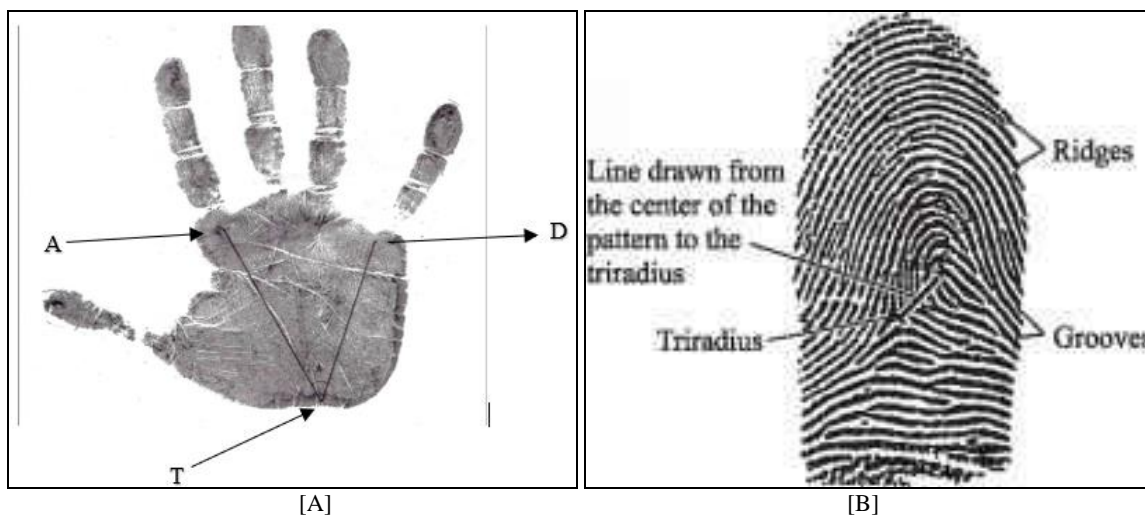


Fig 2

**Total ridge count**

Ridge count was done by drawing a line from the triradius to the center of the pattern and determining the number of intersected ridges between these two points. Arches score zero because they have no triradii and thus there are no ridges to count. A loop has one triradius. In whorls, which have two triradii, counts are made from each triradii and the larger one is used. A TRC is the summation of the ridge count for all ten fingers. It was assessed for increase or decrease in mean frequencies between the groups.

**Statistical analysis**

Data were analyzed. ANOVA test was used to test the association between dental caries and dermatoglyphic pattern of right and left hand.

**Results**

The evaluation and comparison of patterns in all the 250 children of both right and left thumb and index fingers was done.

**DMFT Score**

**Fig 3:** comparison of DMFT on the basis of type of pattern on index finger

Pattern	Index Pattern Right			Index Pattern Left		
		Mean	Std. Deviation		Mean	Std. Deviation
Whorl/plain whorl	29	3.45	1.682	47	3.85	2.821
Double whorl	20	2.35	1.424	32	3.22	2.587
Arch with whorl	13	2.31	1.109	29	2.66	2.092
Arch	42	3.19	2.381	36	3.19	1.910
Arch with loop	17	3.06	1.886	11	2.27	1.794
Plain Loop	25	2.84	2.718	24	2.96	1.899
Right Loop	37	3.43	2.703	7	2.29	2.289
Left Loop	4	1.75	1.258	18	2.11	1.323
Central pocket Loop	6	2.83	2.317	3	2.33	1.155
Accidental	22	2.41	2.443	14	1.64	1.393
Double Loop	15	2.80	2.336	9	2.67	1.581
F VALUE	1.878			1.917		
p- VALUE	0.045 *			0.044*		

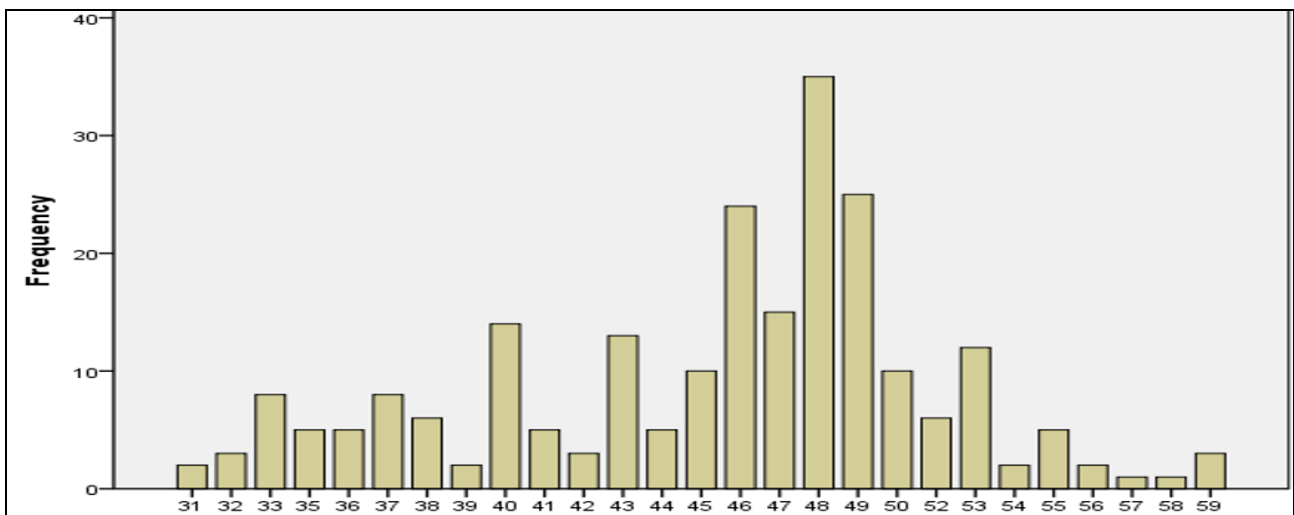
**Fig 4:** Comparison of DMFT on the basis of type of pattern on thumb

Pattern	Thumb pattern right			Thumb pattern left		
		Mean	Std. Deviation		Mean	Std. Deviation
Whorl/plain whorl	25	3.24	2.385	35	2.80	1.907
Double whorl	6	3.83	2.927	4	3.75	2.630
Arch with whorl	3	2.00	1.732	9	2.89	1.453
Arch	38	3.92	3.017	43	3.95	2.786
Arch with loop	7	3.29	2.138	9	2.00	.707
Plain Loop	39	3.05	1.959	39	3.33	2.192
Right Loop	17	2.35	1.902	11	2.27	2.240
Left Loop	30	2.90	2.280	33	2.85	2.476
Central pocket Loop	22	2.32	1.427	13	2.15	1.772
Accidental	23	2.26	1.789	17	2.18	1.976
Double Loop	20	2.45	1.538	17	2.29	1.312
F value	1.595			1.915		
P- value	0.039*			0.044*		

In the index finger comparison, the plain whorl pattern showed highest DMFT index showing a DMFT score >3 in both right and left index fingers. [Fig 3]  
 In the thumb finger comparison, the double whorl pattern s

howed highest DMFT index showing a DMFT score >3 in right thumb and arch type pattern in left thumb fingers. [Fig 4]

**ATD Angle**



**Fig 5:** ATD distribution on Right

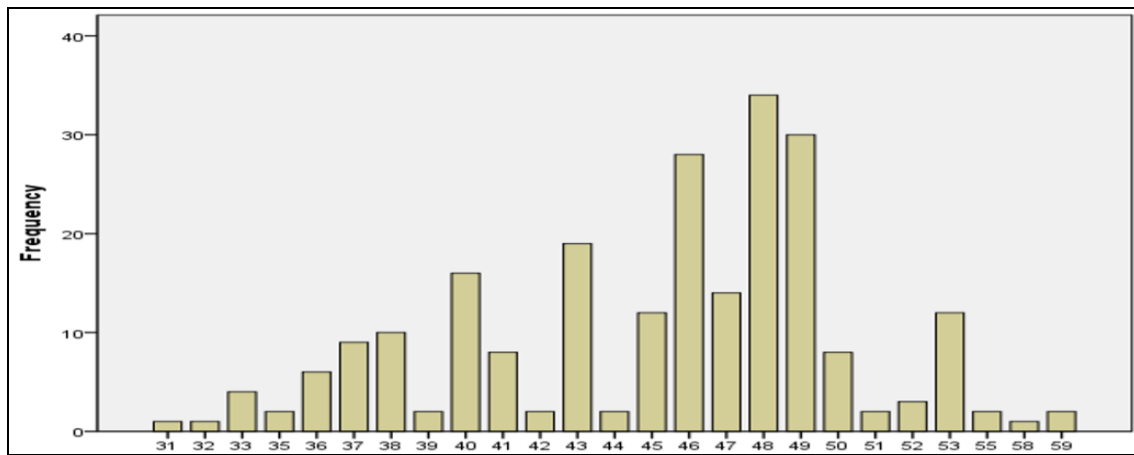


Fig 6: ATD distribution on Left

The mean ATD angle was found to be similar in both right and left hands which were statistically significant. [Fig 5,6] The Total Ridge Count (TRC) was increased in children with higher DMFT index.

### Discussion

Fingers, palm, and sole impressions are expressions of the environmental changes taking place and are inherited in nature. It has been proved scientifically that no two individuals, even monozygotic twins contain the same finger prints and thus make them a unique characteristic of every individual. Once formed, they remain constant and do not alter in the lifetime due to disease process, aging, or any other reason. [8]

The dermatoglyphic patterns have been utilised as a dental health marker that can identify a child's hereditary susceptibility to dental caries. [4]

One of the complicated microbiological diseases that mostly spreads over the world is dental caries. Numerous variables contributed to the dental caries, although the precise cause is still unknown. Although various cutting-edge materials have been created for the treatment of dental caries, prevention is still the best strategy. [9]

Early diagnosis of the disease's risk factor or underlying cause is crucial for disease prevention. Dermatoglyphics is extremely important for identifying a variety of systemic disorders, including dental caries. [9]

In 2018, Kaur *et al.* reviewed the dermatoglyphic pattern in 100 Indian children aged 6 to 12 who had dental caries. The children were separated into research and control groups. Children with DMFT scores > 4 were chosen as the study group, and children without dental caries were chosen as the control group. The salivary pH and finger prints of the study group and control group were then recorded in order to analyse the relationship between the dermatoglyphic pattern and dental caries and draw conclusions. It was discovered that there were more children with loop patterns in the control group than the study group, and this difference was statistically significant (p 0.001). [10]

In 2018, Reddy *et al.* examined the relationship between dermatoglyphic pattern and dental caries in 300 special children aged 6 to 16 in India. They came to the conclusion that the whorl pattern was more frequent in children with dental caries than the loop pattern, and that this difference was statistically significant (p=0.002). [11]

In 2018, Sharma *et al.* showed that whorl patterns were more common in participants with caries, but loop patterns

were more common in subjects without caries. The *S. mutans* and *Lactobacilli* numbers in the caries group significantly correlated with the whorl pattern (P = 0.4 and P = 0.015, respectively). This study also shown that less than six loops and more than four whorls were both associated with good caries prediction. [12]

Veeresh recorded the DMFT score (decayed, missing, filled teeth) of 300 female participants between the ages of 18 and 25 in 2019 and divided the results into three groups of 100 each: group 1 (DMFT score = 0), group 2 (DMFT score 5), and group 3 (DMFT score 5). In group 3, the average salivary pH was the lowest. According to analysis, loop pattern was shown to be the predominate dermatoglyphic pattern in groups 1 and 2, while whorl pattern predominated in group 3. [13]

In 2016, Saxena *et al.* investigated the relationship between fingerprints and dental caries in 276 schoolchildren in Kanpur, India, aged 12 to 15 years. The students were separated into three groups based on their DMFT scores. The study indicated that the loop pattern was more prevalent among children who were caries-free than it was among those who had active caries, and that it was statistically significant (p 0.05). [14]

Thakker *et al.* in 2014 showed a statistically significant increase in whorl frequency in children with dental caries experience. [15]

### Conclusion

The dermatoglyphic pattern was a very successful, non-invasive, and affordable method of predicting dental caries, and it aids patients in early detection and prevention of dental caries. further aids in the child's socialisation.

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