(International Print/Online Journal)

SJIF IMPACT FACTOR: 6.829
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 8, Issue 4 , Page No: 288-297
July-August 2025

IJMSCR

Role of Intelligence Quotient and Genetics in the Prediction of Dental Caries - An Observational Study

[1]Dr. Bandi Jyothsna[*], [2]Dr. Th. Kotaiah, [3]Dr. P. Lakshmi Prasanna, [4]Dr. B. Jayachandra Reddy, [5]Dr. M. Deepika, [6]Dr. Rachapalli Manasa

[1,6]Post Graduate Student, [2]Professor & HOD, [3]Associate Professor, [4,5]Assistant professor
Department of Pediatric and Preventive Dentistry, Govt. Dental College & Hospital, Kadapa

***Corresponding Author:**
Dr. Bandi Jyothsna
Post Graduate Student, Department of Pediatric and Preventive Dentistry,
Govt. Dental College & Hospital, Kadapa

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Aim: The aim of this study was to compare the reliability of genetics (Dermatoglyphic, Cheiloscopic, and Rugoscopic patterns) and IQ for assessing the risk of dental caries in children. Methodology: Subjects were selected based on stratified random sampling method and observations were made using standard method for each parameter. For IQ- Assessed using Ravens Colored progressive matrices, Dental caries- Using deft/ DMFT scores, Dermatoglyphics- By using Cummins and Midlo classification for fingertip patterns, Cheioloscopy- By using Tsuchihashi and Suzuki's classification, Rugoscopy- By using Thomas and Kotze classification of palatal rugae patterns. Results: According to current research, there is a correlation between dental caries, dermatoglyphics, and IQ. The loop pattern was the most prevalent fingerprint pattern among the kids with higher deft scores (61.5%). Regardless of a child's caries condition, the most common lip print pattern was discovered to be branching. Additionally, regardless of the dexterity scores, the most common palatal rugae shape in our study cohort was wavy, accounting for 63% of the total. Level of significance was set at p value < 0.05 termed as statistically significant. Conclusion: Relation between IQ and dental caries was statistically significant and are correlated. Even though the relation between genetic patterns and dental caries are statistically not significant, they are correlated.

Keywords: Children, Genetics, Dermatoglyphics, IQ, Dental Caries

Introduction

The term Dermatoglyphics was introduced in a presentation at the 42nd annual meeting of the American Association of Anatomists in 1962 by Cummins [(1)]. It is a harmonious blend of two words "Derma" which means skin and "Glyphe" meaning carve, which gives an impression that something has been carved out of skin [(2)]. In other words, it reflects the study of epidermal ridges and their patterns they make on the fingers, palms, and soles [(3)]. These features of dermatoglyphics are formed during the 13th/14th week of the developing embryo and once formed remain permanent and never change throughout the life except in the dimension in commensurate to the growth of an individual. H. K. Kumbnani stated that this fact has been tested and confirmed in 1976[(2)], the most ideal place to scrutinize the age of the appearance of the features of dermatoglyphics was the museum of the institute of Anatomy in the institute of Human Genetics, Medial College, University of Lüebeck, where the embryos are preserved in glass jars at different ages of their developments. On critical examination the age of the appearance of the said features was authenticated to be 13th week [(2)].

Lip prints are typical lines and fissures that occur in the area where the human lip transitions from the inner labial mucosa to the outer skin. Each person's lips have distinct grooves that can be used to identify them. Grooves present on the human lips are unique to each person and can be used to determine identity. The study of these grooves or furrows present on the red part or the vermilion border of the human lips is known as cheiloscopy and it was first noted by anthropologists, *R. Fischer* who was the first to describe it in 1902 [(4)].

The ridges on the anterior portion of the palatal mucosa, on each side of the median palatal raphe, and behind the incisive papilla are referred to as palatal rugae, also known as Plicae Palatinae Transversae and Rugae Palatina [(5)]. These genetic patterns are unique to each individual. It has wide application in the field of Forensics. In addition, it acts as a powerful tool in the diagnosis of psychosocial, medical, and genetic conditions through many decades.

IQ and genetic patterns (Dermatoglyphics, Cheiloscopic patterns, Rugae patterns) have same origin, as neural tissue and epidermis are embryonic ectodermal derivatives [(6)]. The basis of using genetic patterns and IQ as a tool for screening Dental Caries is solely reliable on two factors. First, the genesis of these patterns occurs during the 12th week of the intrauterine life and is completed by the 24th week of intrauterine life (second trimester of intrauterine life). During this time, tooth formation also occurs in intrauterine life [(5,7)]. Consequently, this conveys that the genetic information contained in the genome (normal or abnormal) is decoded during this stage and could also be replicated by dermatoglyphics [(7,1)]. Second, epithelium of primary palate as well as finger buds develops from the same site and both are of ectodermal origin [(1,7)]. Thus, it could be conjectured that with genetic predisposition and added environmental factors the susceptibility for Dental Caries due to abnormality in the tooth structures may be reflected in the genetic variables, (namely Dermatoglyphics, Cheiloscopic patterns, Rugae patterns) [(9)].

To quantify dental health status, an index named Decayed, Missing, and Filled teeth (DMFT) is used. DMFT or DMFS is the sum of the number of decayed, missing due to caries, and filled teeth/teeth surfaces in the permanent set of teeth. Another similar index named 'def' is also used which is equivalent to DMF index and is generally used for measuring dental caries in primary dentition [(1)]. These indices are one of the simplest and most commonly used indices in the epidemiological surveys of dental caries [(10)].

So, the aim of the present study was to compare role of IQ and genetics in the prediction of dental caries.

Thus, the objectives of this study were as follows:

i. To record the fingerprint, lip print, and palatal rugae patterns among children of age group 6years to 11years
ii. To observe a prevalent and specific dermatoglyphic, cheiloscopic, and rugoscopic pattern in both groups
iii. To measure IQ, using non-verbal intelligence scale and observe the relation between IQ and dental caries
iv. To predict the efficacy of dermatoglyphic, cheiloscopic, rugoscopic pattern and IQ in assessing the risk of susceptibility to caries

Materials And Methods

Institutional Ethical Committee (IEC) Clearance certificate was obtained for conducting the study. An informed consent from principals Schools, Kadapa was taken before the onset of the study. parents were assured that any details of their children 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.

Source Of Data And Study Population

The study population was selected randomly from government schools in Kadapa town.

Study Design

The study was a cross-sectional study and a stratified random sampling method was used to include 122 children, in the age group of 6-11 years, from various selected schools. Cooperative and apparently healthy children of age group between 6-11 years were included in the study. Uncooperative children with special needs and developmental anomalies, Teeth with hypoplastic defects, Skin disorders, trauma or any pathology to the fingertips, lips and palate and those allergic to lipstick, ink pad, and alginate were excluded from the study.

Volume 8, Issue 4; July-August 2025; Page No 288-297

Procedure For Thumbprint Recording And Interpretation

All fingers were cleaned and were pressed on the blue ink stamp pad with gentle pressure followed by placing them on the white paper to take their impressions. The prints were examined using a magnifying glass, classified, and analyzed by Cummins and Midlo (1926) method of fingerprint identification into whorls, loops, and arches [Figure 1] [(5)].

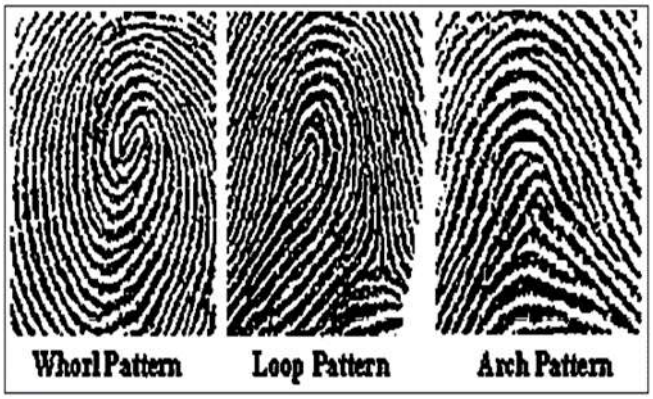


Figure 1: Cummins and Midlow method of fingerprint identification

A loop is recognized as a series of ridges that enter the pattern area on one side of the digit, recurves abruptly and leaves the pattern area on the same side. A single triradius is present, which is located laterally on the fingertip, where the loop is closed. A whorl differs from the loop in the aspect of a concentric arrangement of ridges, with two or more triradii in the latter. Arches show the simplest ridge pattern, which is formed by the succession of one or more parallel ridges, which cross the finger from one side to the other without recurving. These patterns usually do not show the presence of triradii [(5)].

The procedure of Lip print recording and interpretation

The lips of the participants were cleaned and lipstick was dabbed evenly over the vermillion border of the lip and participants were asked to rub both the lips to spread the applied lipstick uniformly. After 1 min, the adhesive portion of the cellophane tape was placed over the lips and then pressed comfortably toward the corners of the lips. The cellophane strip was then stuck to the white bond paper for a permanent record. The lip prints were then analysed by Tsuchihashi and Suzuki's classification [Figure 2] using a magnifying glass into:

1. Vertical: comprising of complete or incomplete longitudinal fissures/patterns
2. Branched: branching Y-shaped pattern
3. Intersected: criss-cross pattern
4. Reticular: typical chequered pattern, fence-like [(5)]

Volume 8, Issue 4; July-August 2025; Page No 288-297

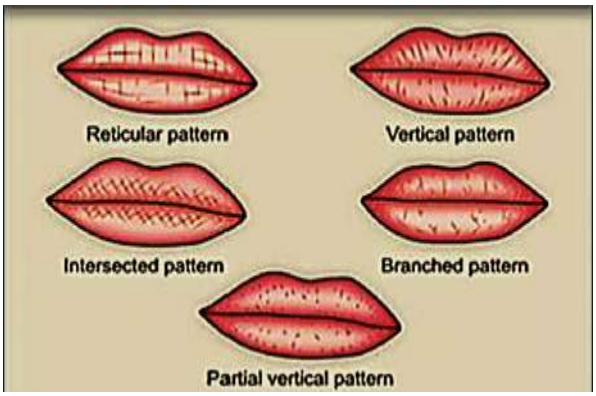


Figure 2: Tsuchihashi and Suzuki's classification of lip prints

The procedure of palatal rugae pattern recording and interpretation

Photographs and impressions (Alginate) of the upper arch of all participants under study were taken and casts were poured using dental stone. The rugae patterns were studied on the casts and classified based on the Thomas and Kotze classification [Figure 3] [(5)]

The rugae were divided into four types based on their shape.

1. Curved: They had a crescent shape and curved gently
2. Wavy: If there was a slight curve at the origin or termination of curved rugae
3. Straight: They run directly from their origin to termination
4. Circular: Rugae that form a definite continuous ring

Unification was said to have occurred when two rugae joined at their origin or termination:

1. Diverging: If two rugae had the same origin from the midline but immediately branched
2. Converging: Rugae with different origins from the midline, but joined on their lateral portions.

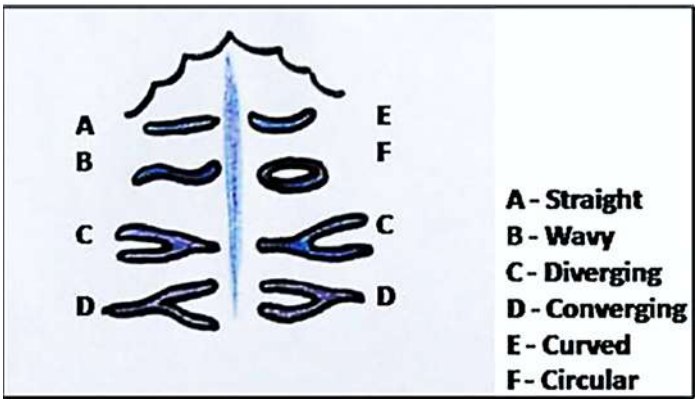


Figure 3: Thomas and Kotze classification of palatal rugae patterns

IQ Test

The IQ was measured by Raven's colored progressive matrices, a nonverbal intelligence scale. Suitable for the age groups of 5 to 11 years. Scores were analysed and IQ grading (1 -5) is awarded based on CPM norms and percentiles [(6)].

Volume 8, Issue 4; July-August 2025; Page No 288-297

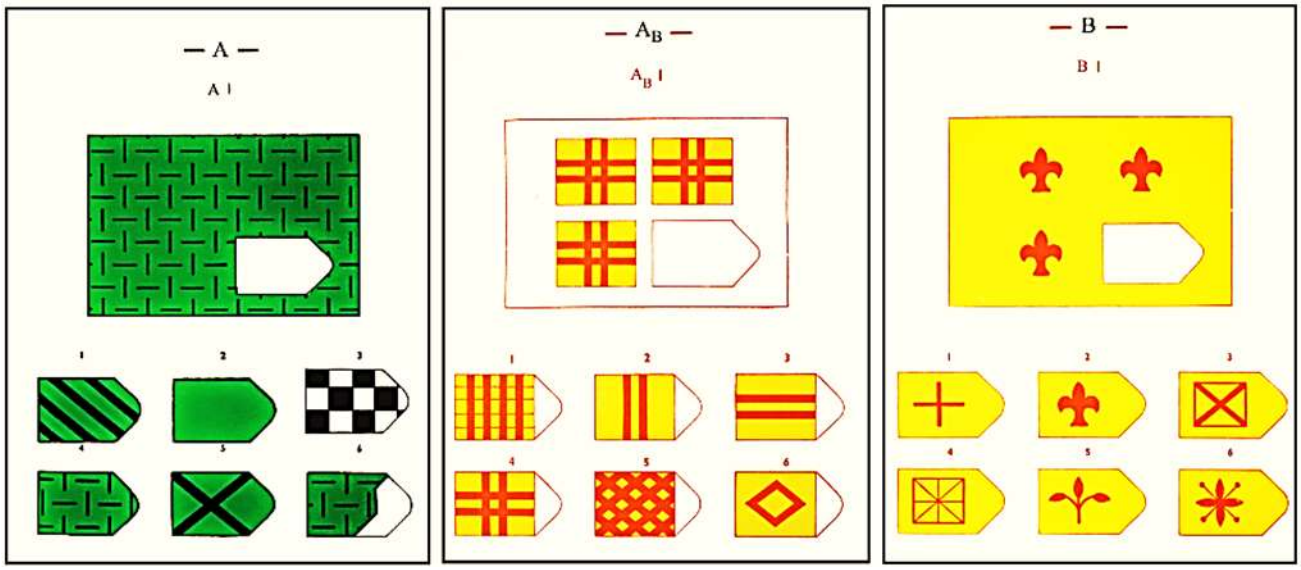


Figure 4: Examples of Task Sheets of Ravens Colored Progressive Matrices. A: Identification of a patch in a continuous pattern (correct item is on lower row furthest to the left). AB: Identification of a patch of a discrete pattern (correct item is lower row furthest to the left). B: Identification of a patch in a continuous pattern with discrete items (correct item is upper row in the middle).

Statistical Analysis

Statistical analysis was done using SPSS version 23, Descriptive statistics was done to get the mean deft /DMFT. chi square test was used to assess the level of significance. The level of significance was set (P< 0.05) termed as statistically significant.

Results

The present study was carried out to assess the correlation and to predict the efficacy of various genetic patterns of lip print, thumbprint, palatal rugae and IQ in assessing the risk of susceptibility to caries. A total of 122 children were included in the study out of which 64 were boys and 58 were girls. Based on the mean deft score the children were categorized into three groups. Group1- (0 to 5); Group 2- (6 to 10); Group 3- (11 to 15).

Table 1: Descriptive Statistics

	n	Minimum	Maximum	Mean		
	Statistic	Statistic	Statistic	Statistic	Std. Deviation	Std. Error
DMFT/deft	122	0	14	2.95	3.004	0.272
Valid n	122					

The most common fingerprints pattern in the children with higher deft scores was loop pattern (61.5%), followed by arches (36%) and whorls (2.5%) [Table 2]. The branched pattern of lip prints was found to be the most prevalent in all children irrespective of their caries status [Table 2]. And also, among palatal rugae shapes, wavy type was found to be the most prevalent (63%) one in our study population, irrespective of the deft scores [Table 3]. Considering the palatal rugae unifications, it was found that converging type was more prevalent in children with less deft scores compared to those with high deft caries [Table 3]. The straight pattern of lip prints was found to be the most prevalent followed by branched pattern in all children irrespective of their caries status [Table 4].

Volume 8, Issue 4; July-August 2025; Page No 288-297

Table 2: representation of dermatoglyphic patterns and DMFT/deft					
DMFT/deft groups & Dermatoglyphics					Chi square test
	Group 1	Group 2	Group 3	Total	
Loops	65	7	3	75(61.5%)	P= 0.174
Whorls	1	2	0	3(2.5%)	
Arches	33	11	0	44(36%)	

Table 3: representation of rugoscopic patterns and DMFT/deft					
DMFT/deft groups and Rugoscopy					Chi square test
	Group 1	Group 2	Group 3	Total	
Curved	15	2	0	17(13.9%)	P= 0.245
Converging	10	7	1	18(14.8%)	
Divergent	3	0	0	3(2.5%)	
Wavy	66	9	2	77(63%)	
Straight	4	0	0	4(3.3%)	
Circular	3	0	0	3(2.5%)	

Volume 8, Issue 4; July-August 2025; Page No 288-297

Table 4: representation of cheiloscopic patterns and DMFT/deft					
DMFT/deft & Cheiloscopy					Chi square test
	Group 1	Group 2	Group 3	Total	
Straight	57	13	2	72(59%)	P= 0.599
Reticular	8	1	0	9(7.4%)	
Intersected	11	0	0	11(9%)	
Branched	15	4	1	20(6.4%)	
Irregular	10	0	0	10(8.2%)	

Each correct answer provided was given a score of 1 which made up of 0 to 36 score on the RCPM. The total raw score was then given a percentile based on the matrix table provided in test manual (Raven, 1995). The percentile point was used as the basis of participant's IQ level which was then categorized as Intellectually superior (95th and above), Definitely above average (95th and above), Average (25th – 75th), below average (25th and below) and intellectually impaired (5th and below). The referred matrix table in Raven manual (1995) consists of group of score obtained and divided into different clusters of age and percentile point [(11)].

Considering IQ & deft, it was found that high IQ children were comparatively least prone to caries with statistical significance (P= 0.012) [Table 5].

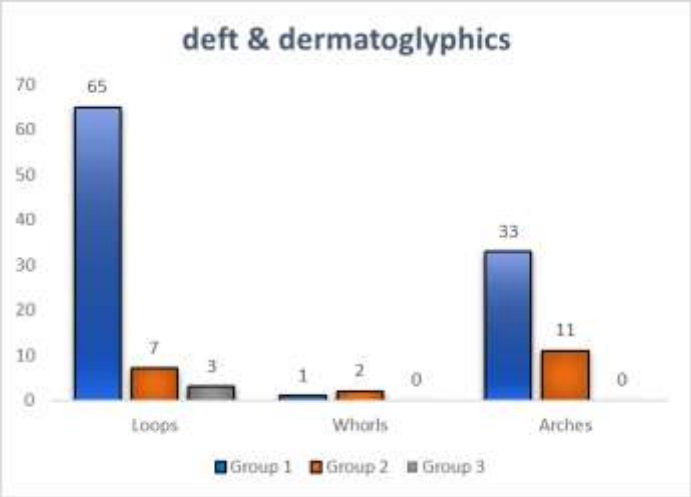
Table 5: representation of IQ and DMFT/deft						
	DMFT					Chi square test
IQ		1	2	3	Total	P= 0.012
	1	32 (31.7	8 (44.4%)	0 (0%)	40 (32.8%)	
	2	15 (14.9%	2 (11.1%)	0 (0%)	17 (13.9%)	
	3	15 (14.9%	6 (33.3%)	3 (100	24 (19.7%	
	4	24 (23.8	1 (5.6%)	0 (0%)	25 (20.5%)	
	5	15 (14.9	1 (5.6%)	0 (0%)	16 (13.1%)	
	Total	101 (100%)	18 (100 %)	3 (100%)	122 (100%)	

Volume 8, Issue 4; July-August 2025; Page No 288-297

Discussion

Dental Caries and Genetics

It has been described that loops and whorls are the most common finger patterns by Reed T, Madhusudhan et al, Namratha T et al., confirms the results of our study. Most recurrent dermatoglyphic pattern observed were loop pattern followed by whorls (Graph 1). There is not any significant relationship (P = 0.174) b/w loop pattern and higher incidence of dental caries. This was, however, contradicting the studies by Navit et al concluding that whorls predict lower incidence of caries and also studies by Anitha et al., Sanghani et al, Singh et al., stating that whorls are more prevalent in caries active children. The reason for this difference in results may be because of the different classifications used to analyze the fingerprints and may also be due to the higher number of participants that were considered during their studies.

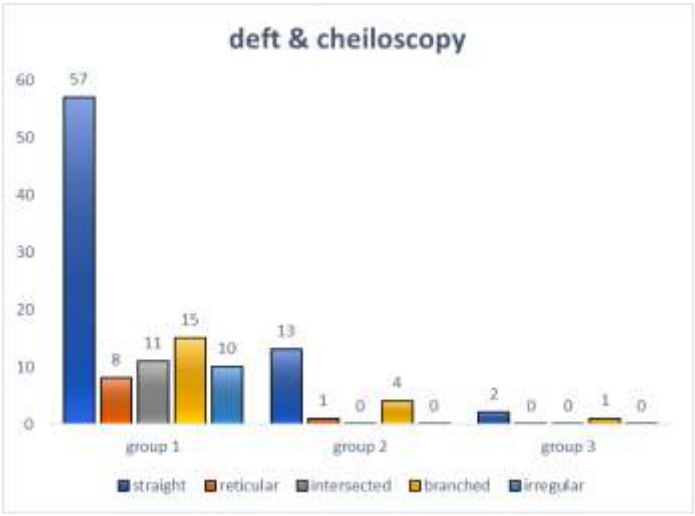


Graph 1: Association between dermatoglyphic patterns & DMFT/deft

Given the genetic factors contributing to the development of dental caries, dermatoglyphics can serve as a tool for early detection. Notably, individuals without dental caries tend to exhibit a higher prevalence of loop patterns, while those with severe caries often display a greater frequency of whorl patterns. This insight allows for the introduction of preventive measures at an early stage. In a developing nation like India, dermatoglyphics could prove to be a noninvasive, cost-effective, and practical method for predicting and addressing dental caries [12,13].

Various studies have reported differing findings regarding lip patterns. Tsuchihashi's research on the Japanese population identified the intersected lip pattern as the most prevalent [14]. In contrast, Vahanwala and Parekh's study in Mumbai revealed that the vertical lip pattern was most common [15]. Sivapathasundharam, Prakash, and Sivakumar examined the lip prints of the Indo-Dravidian population and also found the intersected lip pattern to be dominant [15]. Meanwhile, Verghese and colleagues observed that the reticular lip pattern had the highest frequency in Kerala [15].

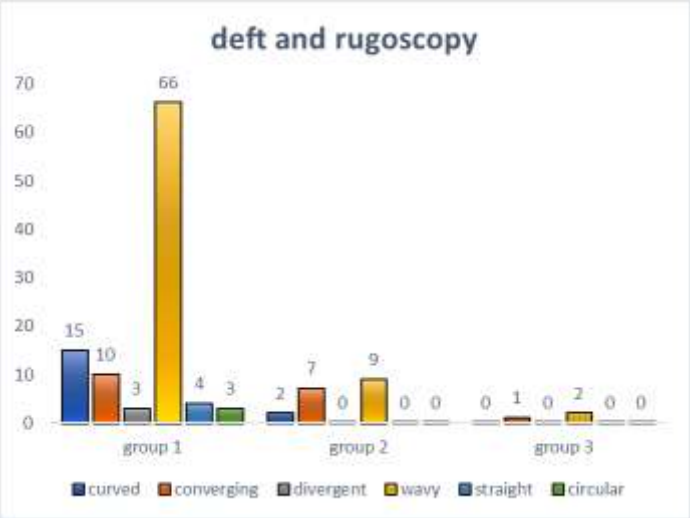
Vertical type (complete and partial together) of lip pattern was seen with higher incidence of dental caries followed by branched pattern (Graph 2) similar to the study done by MadhuSudhan et al [16]. In this study lip print patterns and dental caries does not show any significant results (P=0.599), Similar to MadhuSudhan et al and Manisha et al. [5,16]



Graph 2: Association between cheiloscopic patterns & DMFT/deft

Most common pattern of rugae observed is wavy (Graph 3) and no significant (P = 0.245) relationship was found between palatal rugae and caries similar to study by Manisha et al. [5]

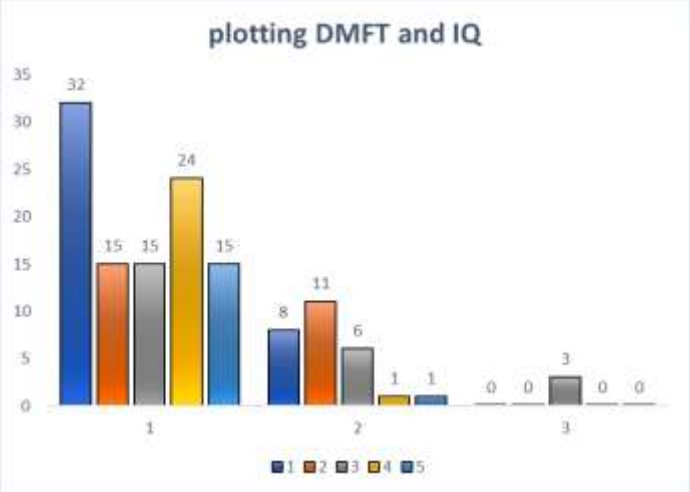
Volume 8, Issue 4; July-August 2025; Page No 288-297



Graph 3: Association between rugoscopic patterns & DMFT/deft

Dental Caries & IQ

Considering deft and IQ significant results were attained (P=0.012) it was found that there is a correlation b/w them. High IQ children were less prone to caries (Graph 4) compared to low IQ children which is similar to the study by Agarwala S [17].



Graph 4: Association between IQ & DMFT/deft

It indicates with decreasing IQ, there is non-compliance with oral hygiene maintenance, and abnormal dietary habits. IQ testing approaches should be incorporated in children's oral health promotion and oral health programs to promote better oral health and better child–clinician relationship. [17]

Limitations of the study

Due to the limited sample size, this study could not establish a statistically significant correlation with dental caries. Additionally, as the study focused on children, it was not feasible to consider their past experiences with caries.

Conclusion

Even though the relation between genetics patterns and dental caries are statistically not significant they are correlated. This understanding paves the way for implementing preventive strategies at an early stage. In a developing country like India, Genetic Patterns has the potential to serve as a noninvasive, affordable, and effective tool for forecasting and managing dental caries. As these fields remain inexact sciences, further comprehensive research is essential to determine, verify, and assess the importance of variations in dermatoglyphic, cheiloscopic, and rugoscopic characteristics in individuals with dental caries. Relation between IQ and dental caries was statistically significant and are correlated. IQ testing can be used to promote better oral health and better child–clinician relationship.

References

1. Roy S, Sen J. Can dermatoglyphics predict dental caries? A review. Int J Health Allied Sci. 2021;10(2):95.
2. Kumbnani HK. Dermatoglyphics: a review. Antropologist Special.2007;3:285-95.
3. Rife DC. Genetic interrelationships of dermatoglyphics and functional handedness. Genetics. 1943;28(1):41.
4. Saraswathi TR, Mishra G, Ranganathan K. Study of lip prints. J forensic dent sci. 2009;1(1):28-31.
5. Agarwal M, Alex A, Konde S. Relationship between dermatoglyphics, cheiloscopy, rugoscopy, and dental caries: a cross-sectional study in Bengaluru, Karnataka. Contem Clin Dent. 2018;9(4):577-81.
6. Tharay N, Nirmala SV, Bavikati VN, Nuvvula S. Dermatoglyphics as a Novel Method for Assessing Intelligence Quotient in Children Aged 5–11 Years: A Cross-sectional Study. Int J Clin Pediatr Dent. 2020;13(4):355.
7. Mathew L, Hegde AM, Rai K. Dermatoglyphic peculiarities in children with oral clefts. J Indian Soci Pedod Prev Dent. 2005;23(4):179-82.
8. Mulvihill JJ, Smith DW. The genesis of dermatoglyphics. The J pediatr. 1969;75(4):579-89.

Volume 8, Issue 4; July-August 2025; Page No 288-297

9. Abhilash PR, Divyashree R, Patil SG, Gupta M, Chandrasekar T, Karthikeyan R. Dermatoglyphics in patients with dental caries: A study on 1250 individuals. J Contemp Dent Pract. 2012;13(3):266-74.
10. Anaise JZ. Measurement of dental caries experience-modification of the DMFT index. Comm dent oral epidem. 1984;12(1):43-6.
11. Hashmi SI, Gang GC, Chua BS. Performance of students' with learning disabilities (LD) on Ravens' Coloured Progressive Matrices. Southeast Asia Psych J. 2016;3:23-33.
12. Duggal S, Mahajan P, Monga P, Singh F, Kataria B, Mahajan A, Cheema S. Dermatoglyphics: A genetic marker of dental caries. Indian J Forensic Odontol. 2019;12(1):11-4.
13. Wang H, Yan J, Ouyang W, Xu X, Lan C, Ouyang S, et al. The correlation between dental caries and dermatoglyphics: a systematic review and meta-analysis. J Clin Pediatr Dent. 2024;48(6):45–58.
14. Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci. 1974;3:233–48.
15. Jalannavar P, Rajas P, Pooja P. Secret behind the lips: Cheiloscopy and its relation to dental caries and malocclusion. Int Journ of Sci Res. 2018;8(7):28-30.
16. Madhusudan K, Patel HP, Umesh K, Chavan S, Patel R, Patel R. Relationship between dermatoglyphics, cheiloscopy and dental caries among dental students of Visnagar town, Gujarat. Int J Adv Res. 2015;3(7):952-.
17. Chandra B, Agarwalla S, Santra A, Kundu GK. Impact of Intelligence Quotient (IQ) on Dental Caries amongst Socially Handicapped Orphan Children and Children Living with Their Parents. Int J Clin Pediatr Dent. 2022;15(S2):S230–3.

Volume 8, Issue 4; July-August 2025; Page No 288-297