Research Article

Submitted: Apr 21, 2023
Accepted: Jul 10, 2023
Published: Aug 21, 2023

# Correlation between Dermatoglyphics and Dental Caries in 3-5 Years Old Children

**Dr. Rasna Shrestha,[1] Dr. Sumita Upadhyay,[2] Dr. Swagat Kumar Mahanta,[3] Dr. Rojina Deoju[4]**

[1,2,4]Department of Paedodontics and Preventive Dentistry, Kathmandu University School of Medical Sciences, Dhulikhel, Kavrepalanchok, Nepal

[3]Department of Community Dentistry, Kathmandu University School of Medical Sciences, Dhulikhel, Kavrepalanchok, Nepal

Correspondence :

Dr. Rasna Shrestha. Email: sth.rasna@gmail.com

## ABSTRACT

**Introduction:** Dental caries has multifactorial aetiology and recently, role of genetic factors is considered important. 'Dermatoglyphics' literally is descriptive of delicately sculpted skin surface, inclusive of single ridges, and their configural arrangements. It can be considered as marker for dental caries as both epithelium of finger buds and enamel are ectodermal in origin and develop during same intrauterine period.

**Objective:** To record and evaluate finger prints and to explore its correlation with dental caries in children aged 3-5 years.

**Materials and Method:** An analytical cross-sectional observational study was done from 2022-03-01 to 2022-09-04 in two groups comprising of 160 individuals (80 in each group) of 3-5 years visiting the tertiary care hospital, Kavrepalanchok, Nepal included by convenience sampling. First group had decayed, extracted, and filled teeth due to caries (def ≥1) and second group had def score 0. Dermatoglyphic patterns of all 10 palmar digits were recorded using Cummins and Midlo method and assessed using magnifying glass (2×). For analysis, SPSS v.16 software was used.

**Result:** On comparison of mean number of patterns, loop and whorl pattern were significantly higher in def ≥1 group as compared to def 0. Same results were demonstrated by correlation test where loop and whorl showed significantly moderate correlation with def status, whereas arch pattern showed strong negative correlation which was also statistically significant.

**Conclusion:** A significant association between fingerprints and caries was found. Thus, this could be a valuable non-invasive anatomical tool for screening and hence in devising measures for prevention of the disease.

**Keywords:** Dental caries; dermatoglyphics; finger prints; genetic.

## INTRODUCTION

Dental caries is one of the most common dental disease, with approximately 36% of world's population having caries in their permanent teeth and 9% in their deciduous teeth.[1] Aetiology of caries is multifactorial, in which host, agent, and environmental factor play significant role. More recently, the role of genetic factors in determining caries predisposition has been given importance, and dermatoglyphics have been used as an oral genetic marker.[2]

**Citation**
Shrestha R, Upadhyay S, Mahanta SK, Deoju R. Correlation between dermatoglyphics and dental caries in 3-5 years old children. J Nepal Dent Assoc. 2023 Jan-Jun;23(36):3-8

Dermatoglyphics (in ancient Greek "derma = skin," "glyphic = carving") is the scientific study of naturally occurring patterns on the surfaces of hands and feet.[3] The term was coined by Dr. Harold Cummins in 1926 and is regarded as the "Father of Dermatoglyphics." [2,4,5]

The association of dermatoglyphics with various diseases including oral may be due to the coincidence in the morphogenesis of dermatoglyphic structures and organogenesis, and both may be programmed by interrelated genetic expressions.[6] The formation of finger ridges is under the control of both environmental and genetic factors, thus they serve as a reflection of genetic and early developmental events.[7]

The present study was hence designed to evaluate the correlation between dermatoglyphics and dental caries by analysing the finger prints of subjects with or without dental caries.

## MATERIALS AND METHOD

An analytical, cross-sectional, observational study was conducted among 160 children among 3-6 years old from 2022 March 1st to 2022 September 4th after ethical approval in the department of Paedodontics and Preventive Dentistry, Kathmandu University School of Medical Sciences (KUSMS), Dhulikhel, Kavrepalanchok, Nepal. The ethical clearance was obtained from institutional research committee (Ref. 02/22), KUSMS. A convenience sampling was done and the sample size was determined based on the formula of mean difference:

$$n_{1=}(\sigma_1^2 + \sigma_2^2/\kappa)\,(Z_{1-\alpha/2} + Z_{1-\beta})^2 / \Delta^2$$

$$n_2 = (K^* \sigma_1^2 + \sigma_2^{2)}\,(Z_{1-\alpha/2} + Z_{1-\beta})^2 / \Delta^2$$

Where, $n_{1=}$ sample size of Group 1 (def ≥1); $n_2$ =sample size of Group 2 (def 0); $\sigma_{1\,=}$ standard deviation of Group 1 (def ≥1) = 0.6; $\sigma_{2\,=}$ standard deviation of Group 2 (def 0) = 1.5. The Group 1 (def ≥1) mean = 0.3; Group 2 (def 0) mean = 0.9; Hence, Δ = difference in group means = 0.6. The ratio of Group def ≥1 to Group def 0, K= ratio = $n_2$/ $n_1$ = 1:1. Here, $Z_{1-\alpha/2\,=}$ two-sided Z value = 1.96 for 95% confidence interval; $Z_{1-\beta}$ = power 80% = 0.84. The values were substituted based on the study done by Nezam et al.[8]

The minimum sample size calculated per group was 57 which was rounded of to 80 in each group

Prior information was given to the parents about the study and written informed consent was taken. They were assured that children's handprints would not be used for any other purpose than the present study. The present study was conducted in full accordance with the World Medical Association's Declaration of Helsinki. The study population was divided into two groups comprising of 80 individuals each on the basis of def score, Group 1 (def ≥1) and Group 2 (def score 0). Children having 10 finger tips who were willing to participate in the study and were physically abled were included in the study. Children having experienced trauma to their fingertips, uncooperative and physically challenged were not included in the study. Cummins and Midlo's ink method was used to record finger prints on both right and left hand of all the subjects.[9] The finger palm were pressed against the ink pad, guided and pressed tightly against the white bond paper clipped on the hard board which was kept firm, followed by second time which was readable and satisfactory. Caries experience was also measured using def index given by Grubbel[10] in 1944 and data were recorded as per designed proforma. The finger prints were checked for their clarity with magnifying glass (2×) and coded. Predominantly three dermatoglyphic patterns were observed that were arch pattern, loop pattern, and whorl pattern (Figures 1, 2).

Data were collected and entered into the Microsoft Excel Sheet and analysed using SPSS Statistics for Windows, version 16.0 (SPSS Inc., Chicago, Ill., USA). Chi-square test was used to test the association between dental caries status and dermatoglyphic pattern of right and left hand. "P" value of less than 0.05 was considered statistically significant.

**Figure 1: Figure depicting the record of finger prints of both hands of a patient.**

**Figure 2: Figure depicting different types of patterns: whorl, arch right, arch left, and loop respectively.**

## RESULT

On examination of distribution among def ≥1 and def 0 groups, it was observed that whorls 62 (79.50%) and loop 61 (78.20%) were almost similar in the right side followed by arch 48 (61.50%). On left side similar findings were observed where loop patterns were slightly higher 73 (93.60%) than whorls pattern (Table 1).

When mean number of patterns, loop and whorl pattern were compared, it was found to be significantly higher in def ≥1 group as compared to def 0 (Table 2). Same results were demonstrated by correlation test where loop and whorl showed significantly moderate correlation with def status, whereas arch pattern showed strong negative correlation which was also statistically significant (Table 3).

**Table 1: Distribution of pattern in children on right and left hands in def ≥1 and def 0 groups.**

| | Pattern | Right n (%) | Left n (%) |
|---|---|---|---|
| def ≥1 | Loop | 61 (78.20) | 73 (93.60) |
| | Whorl | 62 (79.50) | 71 (91.00) |
| | Arch | 48 (61.50) | 60 (76.90) |
| def 0 | Loop | 13 (16.70) | 25 (32.00) |
| | Whorl | 39 (50.00) | 28 (35.90) |
| | Arch | 78 (100) | 78 (100) |

**Table 2: Comparison of patterns in children on def ≥1 and def 0 groups.**

| | Loop | Whorl | Arch |
|---|---|---|---|
| def ≥1 | 4.74±1.9 | 3.12±1.67 | 2.13±1.36 |
| def 0 | 0.74±1.09 | 0.89±0.38 | 8.37±1.06 |
| P value | <0.001 | <0.001 | <0.001 |

**Table 3: Correlation between def score and finger prints.**

| | r value | P value |
|---|---|---|
| Loop | +0.58 | <0.001 |
| Whorl | +0.59 | <0.001 |
| Arch | -0.74 | <0.001 |

Dependent variable- def score

## DISCUSSION

Individual susceptibility to dental caries varied from genetic factors and environmental influences.[11] Tooth enamel; most susceptible to dental caries and epithelium of finger bud are ectodermal in origin, same as that of palate and alveolar ridges and develop at the same time of intrauterine life. Therefore, abnormalities in these areas are influenced by combination of hereditary and environmental factors, but only when the combined factors exceed a certain level, abnormalities are expected to appear. This threshold theory has been advanced by studies of Carter (1969) and Matsunga (1977) and is now well accepted.[12] Dermatoglyphics is considered as a window of congenital abnormalities and is sensitive indicator of intra uterine anomalies. It is known to be one of the best available diagnostic tools in genetic disorders.[13]

Dental caries being a multifactorial disease, numerous host factors have been proven to be genetically determined.[14] The development of dermatoglyphic pattern begins with the appearance of foetal pads in the sixth week of gestation and ends with the appearance of finished patterns on the surface of the skin in the 24$^{th}$ week of gestation. From this stage onwards, they are unaffected by environment, and this explains their unique role, as an ideal marker for individual identification.[15]

The basis of considering dermatoglyphic patterns as genetic marker for dental caries is that primary palate develops during sixth to 13$^{th}$ week of intrauterine life.[4] Epithelium of primary palate as well as finger buds develops from the same site and is of ectodermal origin. The other point which needs to be mentioned is epithelium of finger buds as well as enamel has ectodermal origin, and both develops at the same time of intrauterine life.[4,12,13]

In the present study, statistically significant association was seen between the dermatoglyphic pattern and def score. The children with loop pattern showed high mean def score which was in accordance with the study done by Sengupta et al.,[16] Sharma et al.[4] and the children with arch pattern showed low def score. Similar results were reported by Singh et al.,[17] and Madan et al.,[2] where the individuals with arch pattern had less susceptibility to dental caries. Studies done by Sharma et al.,[18] Bhat et al.,[19] Thakkar et al.,[20] reported dental caries susceptibility increases with the increase in number of whorl pattern whereas the results obtained in the present study are not in line with these results. Same results were demonstrated by correlation test where loop and whorl showed significantly moderate correlation with def status, whereas arch pattern showed strong negative correlation which was also statistically significant. Therefore, a definite correlation in the dermatoglyphic patterns between children with caries and caries free was seen in the study. Thus, recording the dermatoglyphic patterns of children at an early age, during their first dental

visit would prove to be handy in predicting whether the child belongs to the high-risk group or low risk group and thereby can aid in planning a definitive preventive and treatment strategy. Relatively few studies have attempted to clarify the genetic basis of caries. One of the advanced diagnostic aids that have been used as an oral health marker to determine the genetic predisposition of children to caries is dermatogylphics. The value of dermatogylphics as an aid to diagnosis has increased with the discovery of new conditions associated with unusual configurations or pattern frequencies. In the present study it showed a significant association between fingerprints patterns and def score so this can be a noninvasive anatomical tool to predict the risk group as a screening and devise measures for prevention.

## CONCLUSION

Dermatogylphics can serve to strengthen the diagnostic impression of the diseases right from an early stage and preventive oral health measures can be obtained. The dermatoglyphic pattern variation may be an important tool in identification of people at risk of developing dental caries, which will enable an early detection and prevention of the disease. In the developing countries like Nepal, it might prove to be non-invasive, inexpensive, and effective tool for screening. It can be upcoming integral part of medicine and forensic science. The correlation of dermatoglyphic with dental caries and other dental abnormalities is still in its nascent stages and further extensive research and studies in this field have to be done.


## ACKNOWLEDGEMENT

The authors would like to thank the study participants and guardians who agreed to participate in this study.

**Conflict of interest**: None.


## REFERENCES


1. Karpiński TM, Szkaradkiewicz AK. Microbiology of dental caries. J Biol Earth Sci. 2013 Mar 11;3(1):M21-4. [Full Text]
2. Madan N, Rathnam A, Bajaj N. Palmistry: A tool for dental caries prediction!. Indian J Dent Res. 2011 Mar 1;22(2):213-8. [Full Text]
3. Rajangam S, Janakiram S, Thomas IM. Dermatoglyphics in down's syndrome. J Indian Med Assoc. 1995 Jan 1;93(1):10-3. [PubMed | Full Text]
4. Sharma A, Somani R. Dermatoglyphic interpretation of dental caries and its correlation to salivary bacteria interactions: An: in vivo: study. J Indian Soc Paedod Prev Dent. 2009 Jan-Mar;27(1):17-21. [PubMed | Full Text | DOI]
5. Ahmed RH, Aref MI, Hassan RM, Mohammed NR. Dermatoglyphic study on patients with dental caries who wearing dental fillings and its correlation to apoptosis that induced by using dental fillings. Nat Sci. 2010;8:54-7. [Full Text]
6. Asif S, Lahig A, Babu D. Dermatoglyphics: A tool in detection of dental caries. British Journal of Medicine and Medical Research. 2016 Jan 10;12(10):1-5. [Full Text]
7. Kazemi M, Fayyazi-Bordbar MR, Mahdavi-Shahri N. Comparative dermatoglyphic study between autistic patients and normal people in Iran. Iranian J Med Sci. 2017 Jul;42(4):392-6. [PubMed | Full Text]
8. Nezam S, Khan SA, Singh P, Nishat R, Kumar A, Faraz SA. Correlation of dental caries and dermatoglyphic patterns: A study in pediatric population. J Family Med Prim Care. 2020 Jun;9(6):2980-4. [PubMed | Full Text | DOI]
9. Newman HH. Finger prints, palms and soles: An introduction to dermatoglyphics. By Harold Cummins and Charles Midlo. The Blakiston Co., Phila. American Journal of Physical Anthropology. 1944;2(2):227-9. [Full Text]
10. Gruebbel AO. A measurement of dental caries prevalence and treatment service for deciduous teeth. Journal of Dental Research. 1944 Jun;23(3):163-8. [Full Text | DOI]
11. Atasu M. Dermatoglyphic findings in dental caries: A preliminary report. J Clin Paediatr Dent. 1998 Winter;22(2):147-9. [PubMed]
12. Mathew L, Hegde AM, Rai K. Dermatoglyphic peculiarities in children with oral clefts. J Indian Soc Pedod Prev Dent. 2005 Oct-Dec;23(4):179-82. [PubMed | Full Text | DOI]
13. Kiran K, Rai K, Hegde AM. Dermatoglyphics as a noninvasive diagnostic tool in predicting mental retardation. J Int Oral Health. 2010 Jun 1;2(1):95-100. [Full Text]

14. Elkwatehy WM, Sheta AR. Dermatoglyphics as a non-invasive anatomical marker in early childhood caries. Int J Dentistry Oral Sci. 2016 Nov 23;3(11):366-71. [Full Text]
15. Latti BR, Kalburge JV. Palmistry in dentistry. J Adv Med Dent Scie. 2013;1(2):25-33. [Full Text]
16. Sengupta AB, Bazmi BA, Sarkar S, Kar S, Ghosh C, Mubtasum H. A cross sectional study of dermatoglyphics and dental caries in Bengalee children. J Indian Soc Pedod Prev Dent. 2013 Oct 1;31(4):245-8. [Full Text]
17. Singh E, Saha S, Jagannath GV, Singh S, Saha S, Garg N. Association of dermatoglyphic peculiarities with dental caries in preschool children of Lucknow, India. Int J Clin Pediatr Dent. 2016 Jan-Mar;9(1):39-44. [PubMed | Full Text | DOI]
18. Sharma A, Singh P, Palmar SV. Digital dermatoglyphics in congenitally deaf subjects. J Punjab Acad Forensic Med Toxicol 2007;7:10. [Full Text]
19. Bhat PK, Badiyani BK, Aruna CN, Chengappa S, Bhaskar NN. Dermatoglyphics-A new diagnostic tool in detection of dental caries among deaf and mute children. International Journal of Clinical Dental Science. 2011 Nov 1;2(4). [Full Text]
20. Thakkar VP, Rao A, Rastogi P, Shenoy R, Rajesh G, Pai MB. Dermatoglyphics and dental caries: A cross sectional study among 12 year old school children in Mangalore, India. Indian Journal of Forensic Medicine and Pathology. 2014;7(1):19-25. [Full Text]