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Relationship of Dermatoglyphics with Dental Caries among Pre-School Children- A Hospital Based Study

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ABSTRACT

Introduction

Dermatoglyphics is the study of the intricate dermal ridge patterns on the skin covering the palmar and plantar surfaces of hand and feet. The basis of considering dermatoglyphic patterns as genetic marker for dental caries is that the epithelium of finger buds as well as enamel has ectodermal origin, and both develop at the same time of intrauterine life.

Methods

This study was conducted to examine the relationship ofdermatoglyphics with dental caries among 310 childrenaged 2-6 year old in a private dental hospital in Kathmandu, Nepal. The prevalence of caries was recorded using "Dentition status and treatment needs" (WHO basic oral health assessment form, 1997). They were divided into three groups as follows: Group I (dmft score = 0–2), Group II (dmft score = 3–4) and Group III (dmft score ≥5). Black duplicating ink was used to record finger prints (both right and left hand) of all the subjects .The frequency of occurrence of type of dermatoglyphic pattern on fingertip of each digit was noted.

Results

No statistically significant association was seen between dermatoglyphic pattern and dental caries in right hand. Statistically significant association was seen between dermatoglyphic pattern and dental caries in 3rd digit of left hand (P-value <0.05).

Conclusions

Dermatoglyphics serves as a diagnostic tool in predicting dental caries at an early age and hence preventive treatment strategies can be planned.

Keywords: Dental caries; Dermatoglyphics; Fingerprint pattern.

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INTRODUCTION

"Dermatoglyphics" is a harmonious union of two words Derma which means skin and Glyphe meaning carve. It deals with the study of ridge patterns on fingertips, palms, soles and toes.[1] The dermal patterns once formed remain constant throughout life.[2] The genesis of the dermal ridges occurs with relation to the volar pads. It appears during the 12th week of the and is completed by the 24th week of intrauterine (I.U) life which coincides with the time of tooth formation.[3] This foundation can be considered as a genetic marker for dental caries.[4] This imparts that the genetic meaning contained in the genome, normal or abnormal, is decoded during this stage and could also be replicated by dermatoglyphics.

Caries is one of the most common chronic diseases, although variety of methods are available to identify caries but there is no method to predict it.[5] Dermatoglyphic pattern may be utilized to study the genetic basis of dental caries as it might prove to be inexpensive and effective tool for screening. Hence, the objective of this study was to examine the relationship of dermatoglyphics with dental caries among children aged 2-6 year old in a private dental hospital in Kathmandu, Nepal.

METHODS

The study was a hospital based cross-sectional survey of 310 children of 2 to 6-year-old who visited Department of Pedodontics and Preventive dentistry in CODSH-Nepal Medical College. It was carried out for 6 months from March to December 2021. Ethical approval was obtained from Institutional Review Committee of Nepal Medical College (NMC_IRC), (Ref No. 50-074/075).Written informed consent was obtained from parents/guardian of each child before the participation. Children with special health care needs,skin disorders affecting fingers, children with trauma to fingertips and those who were not willing to participate in the study were excluded from the study. Oral examination was performed using a mouth mirror and probe under illuminated light in the Department of Pedodontics, Nepal Medical College. The children were examined clinically in the dental OPD by a single trained clinician. Convenience sampling technique was done. The sample size was calculated using formula n=Z2 pq/d2. Taking Z=1.96 at 95% Confidence interval, p=0.54[6], q=0.46 and d=0.06, the sample size was calculated as 265. Clinical assessment of dental caries was done by using dentition status and treatment need (WHO basic oral health proforma, 1997) for deciduous teeth. They were divided into three groups as follows: Group I (dmft score = 0–2), Group II (dmft score = 3–4) and Group III (dmft score ≥5).[6] Children's hands were washed with soap and water to eradicate any dirt and oil from the ridged skin and air dried to improve the quality of finger prints.Black duplicating ink was used to record finger prints (both right and left hand) of all the subjects. The digits was guided and pressed tightly against the white bond paper clipped on to a hard board. The palmer/fingerprints obtained were analyzed by a magnifying lens (×2) for their clarity.

Qualitative dermatoglyphics analysis: Sir Francis Galton in 1892 classified the finger print patterns into three types loops, whorls and arches. Loops: A loop is a series of epidermal ridges which enter the pattern area from one side of the digit, recurves and exits from the same side. It comprises of one core and one triradii.[7,8] (Figure 1)

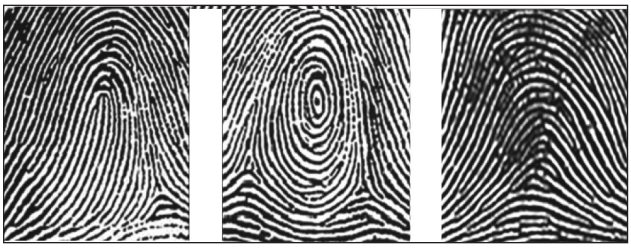

Figure 1. Loops pattern.

Figure 2. Whorl pattern Figure.

Figure 3. Arch pattern.

Whorls: A whorl is a concentric arrangement of ridges, which consist of one core and two or more triradii. They may be simple, double looped, central pocketed or accidental.[7,8] (Figure 2)

Arches: It is the simplest ridge pattern formed by successive epidermal ridges which enter the finger from one side and exits from the other forming an arch like curve at the centre.[7,8] (Figure 3)

Data Entry and analysis was done using Statistical Package for Software Science (SPSS Version 17.0). Descriptive statistics wascalculated for mean and standard deviation. Chi-square test was used to compute levels of association between the variables.

RESULTS

A total sample of 310 children 2-6 years of age was screened to assess the dermatoglyphic pattern and caries status. Out of the total children who participated in the study 151(48.7%) of them were males and 159 (51.3%) of them were females. Majority of males63 (20.3%) and females 88 (28.3%) were 6 years of age (Table 1).

children had loop, whorl and arch onfingers of left and right hand respectively. Overall loop pattern was most prominent followed by whorl and arch (Figure 4). In the analysis of 3100 finger prints of 310 children, the percentage of loops

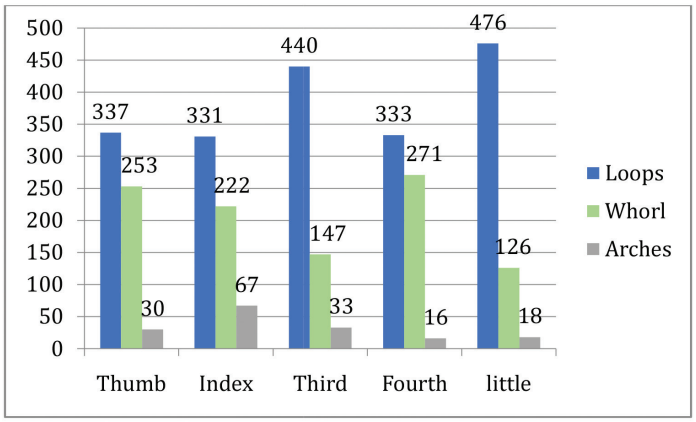

Figure 4. Distribution of dermatoglyphic patterns in all fingers in total of left and right sides.

was 61.83%followed by whorls 32.8% and arches was 5.29%.

Table 2 shows the age and gender wise distribution of the study subjects according to different caries experience. Across all age groups, majority of children belonged to Group III (dmft ≥5) followed by Group II (dmft 3–4) and Group I (dmft 0–2).

Table 1. Age and Gender wise distribution of children (n=310).

Age (in years)	Gender		Total n (%)
	Male n (%)	Female n (%)	
2	5 (55.56)	4 (44.44)	9 (2.90)
3	17 (60.71)	11 (39.29)	28 (9.03)
4	16 (53.33)	14 (46.67)	30 (9.68)
5	50 (54.35)	42 (45.65)	92 (29.68)
6	63 (41.72)	88 (58.28)	151 (48.71)

On evaluating the distribution of the study subjects according to dermatoglyphic patterns it was revealed that a total of 1917, 1019and 164

Table 2. Age and genderwise distribution of the children in relation to their caries experience (n=310).

Age (in years)	Gender	Group I n (%)	Group II n (%)	Group III n (%)
2	Male	-	-	5 (100.00)
	Female	2 (50.00)	1 (25.00)	1 (25.00)
3	Male	-	3 (17.65)	14 (82.35)
	Female	4 (36.37)	2 (18.18)	5 (45.45)
4	Male	4 (25.00)	2 (12.50)	10 (62.50)
	Female	1 (7.13)	5 (35.71)	8 (57.14)
5	Male	4 (8.00)	6 (12.00)	40 (80.00)
	Female	6 (14.29)	6 (14.29)	30 (71.42)
6	Male	6 (9.52)	8 (12.70)	49 (77.78)
	Female	14 (15.91)	18 (20.45)	56 (63.64)

Figure 5 shows the distribution of the study subjects according to loop pattern. Majority of the children (114, 66.67%; 112, 67.47%) with loop pattern on left and right thumb belonged to group III (dmft ≥5). On the left and right 1st digit, maximum children (108, 66.26%; 121, 72.02%) with loop pattern belonged to group III (dmft ≥5) . Similarly, the loop pattern on left and right 2nd, 3rd and 4th digit (142, 67.3%; 154, 67.25%; 119, 68%; 102, 64.56%; 161, 67.93%; 164, 68.62%) children, respectively, belonged to group III (dmft ≥5).

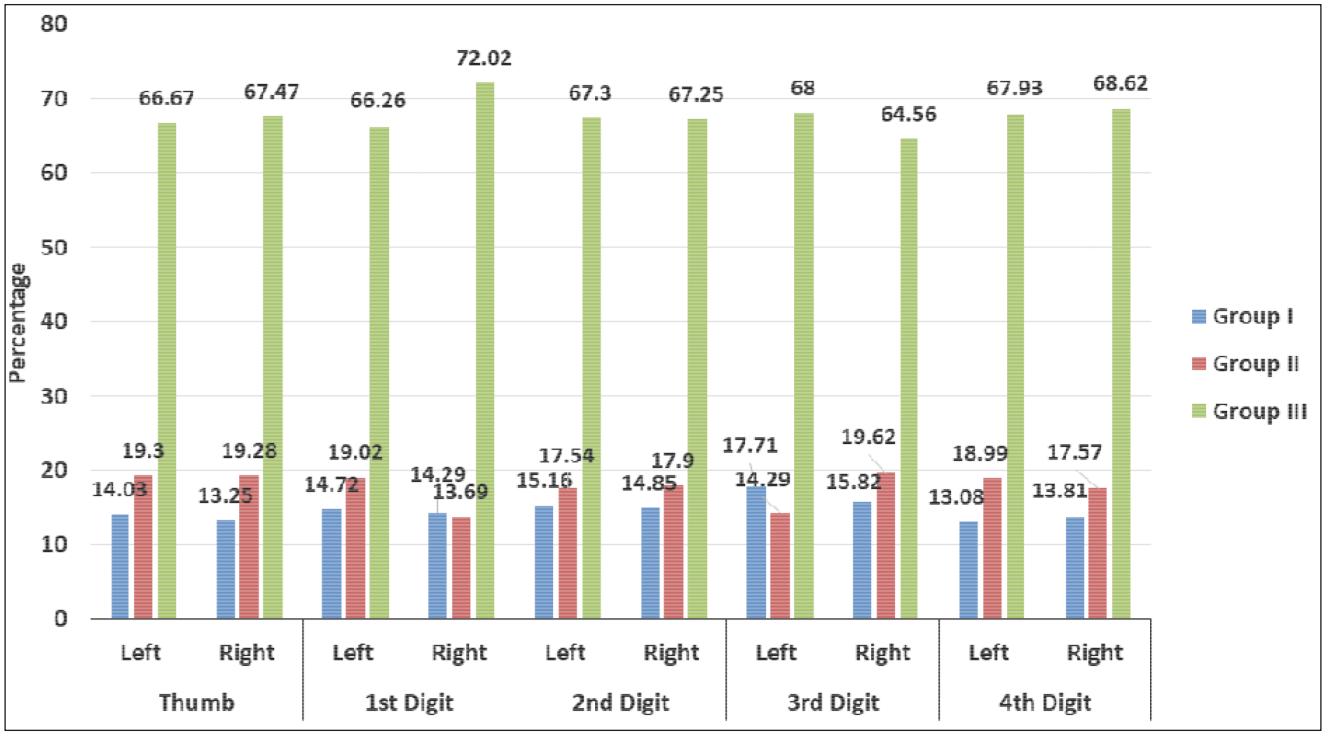

Figure 5. Distribution of loop pattern in relation to caries experience.

Figure 6 shows the distribution of the study subjects according to whorl pattern. Majority of the children (91, 75.21%; 99, 75%) with whorl pattern on left and right thumb belonged to group III (dmft ≥5).

In the left and right 1st digit, maximum children (85, 75.89%; 77, 70%) with whorl pattern belonged to group III (dmft ≥5). Similarly, the whorl pattern on left and right 2nd, 3rd and 4th digit (63, 79.74%; 53, 77.95%; 94, 72.87%; 108, 76.06%; 50, 79.37%; 49, 77.78%) children, respectively, belonged to group III (dmft ≥5).

of the children (13, 72.22%; 7, 58.33%) with arch pattern on left and right thumb belonged to group III (dmft ≥5). On the left and right 1st digit, maximum children (25, 71.43%; 20, 62.5%) with arch pattern belonged to group III (dmft ≥5).

Similarly, the arch pattern on left and right 2nd, 3rd and 4th digit (13,65%; 11, 84.62%; 5,83.3%; 8, 80%; 7, 70%; 5, 62.5%) children, respectively, belonged to group III (dmft ≥5).

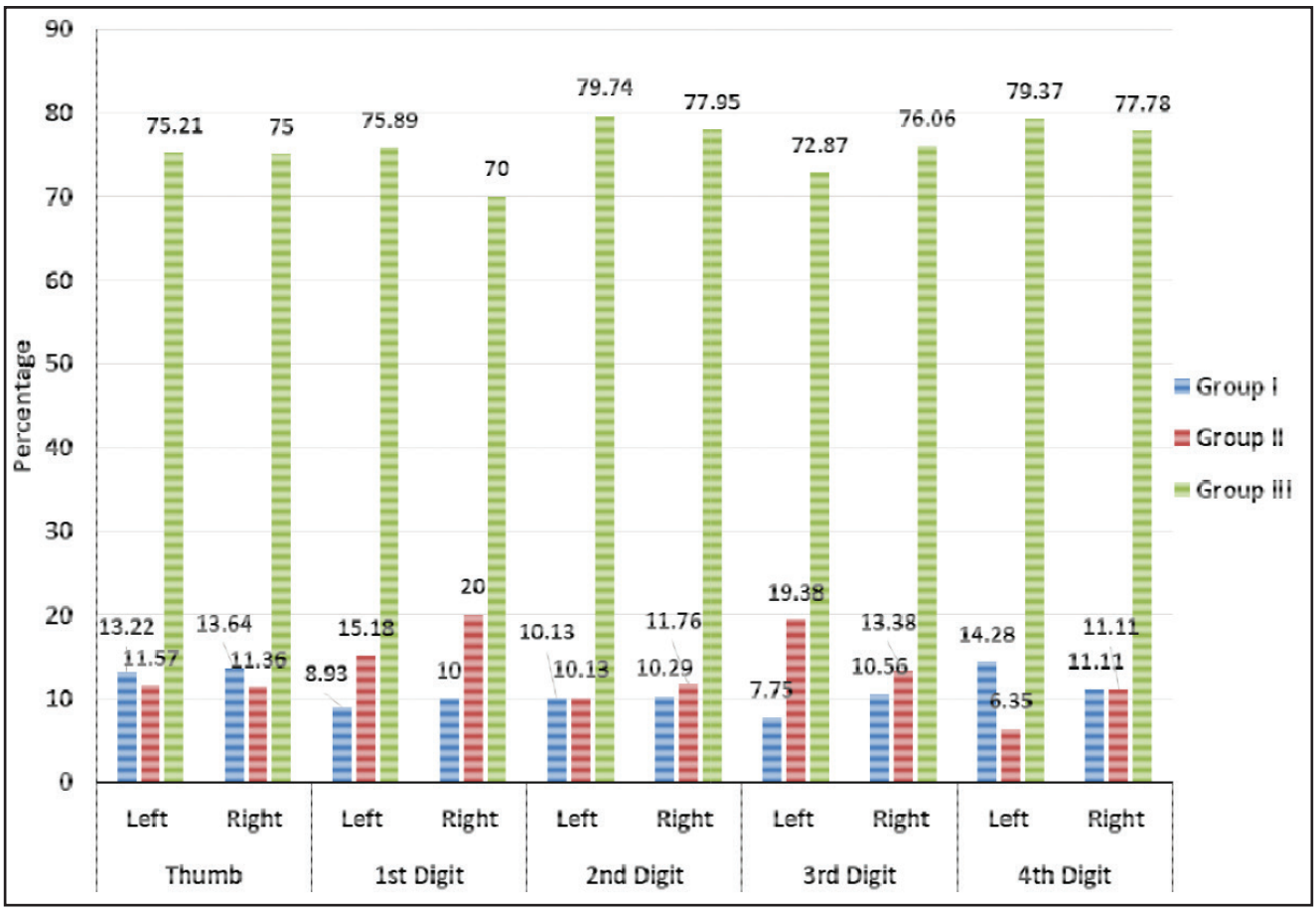

Figure 6. Distribution of whorl pattern in relation to caries experience.

Figure 7 shows the distribution of the study subjects according to arch pattern. Majority

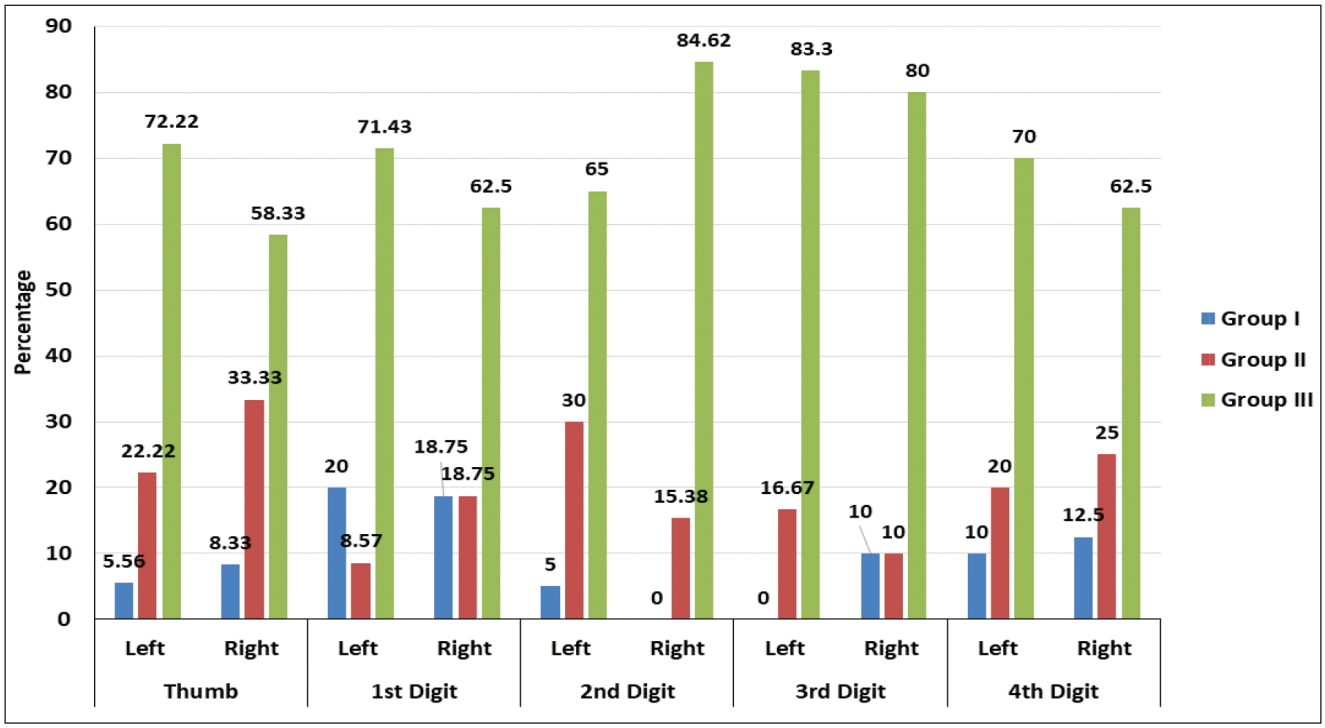

Figure 7. Distribution of arch pattern in relation to caries experience.

No statistically significant association was seen between dermatoglyphic pattern and dental caries in right hand (Table 3). Statistically significant association was seen between dermatoglyphic pattern and dental caries in 3rd digit of left hand (P-value 0.043)(Table 4).

Table 3. Association between Dermatoglyphic pattern and Dental caries in right hand (n=310).

	Dental caries	Dermatoglyphic pattern			p-value
		Arch	Loop	Whorl	
		n (%)	n (%)	n (%)	
Thumb	Present	12 (100.00)	156 (93.98)	120 (90.91)	0.367
	Absent	-	10 (6.02)	12 (9.09)	
1st Digit	Present	28 (87.50)	158 (94.05)	102 (92.73)	0.416
	Absent	4 (12.50)	10 (5.95)	8 (7.27)	
2nd Digit	Present	13 (100.00)	210 (91.70)	65 (95.59)	0.504
	Absent	-	19 (8.30)	3 (4.41)	
3rd Digit	Present	9 (90.00)	144 (91.14)	135 (95.07)	0.39
	Absent	1 (10.00)	14 (8.86)	7 (4.93)	
4th Digit	Present	8 (100.00)	221 (92.47)	59 (93.65)	>0.99
	Absent	-	18 (7.53)	4 (6.35)	

Chi square test, p-value<0.05 statistically significant*

Table 4. Association between Dermatoglyphic pattern and Dental caries in left hand (n=310).

	Dental caries	Dermatoglyphic pattern			P-value
		Arch	Loop	Whorl	
		n (%)	n (%)	n (%)	
Thumb	Present	18 (100.00)	160 (93.57)	110 (90.91)	0.33
	Absent	-	11 (6.43)	11 (9.09)	
1st Digit	Present	30 (85.71)	151 (92.64)	107 (95.54)	0.14
	Absent	5 (14.29)	12 (7.36)	5 (4.46)	
2nd Digit	Present	19 (95.00)	193 (91.47)	76 (96.20)	0.351
	Absent	1 (5.00)	18 (8.53)	3 (3.80)	
3rd Digit	Present	6 (100.00)	157 (89.71)	125 (96.90)	**0.043***
	Absent	-	18 (10.29)	4 (3.10)	
4th Digit	Present	10 (100.00)	219 (92.41)	59 (93.65)	>0.99
	Absent	-	18 (7.59)	4 (6.35)	

Chi square test, P-value<0.05 statistically significant*

DISCUSSION

Dental caries is a chronic, complex, multifactorial disease for which a number of causative agents like host and environmental factors have been proposed. There are numerous host factors for dental caries that are genetically determined.[9] Genetic variations in the host factors may contribute to increased risks for dental caries. The dermatoglyphic patterns can be used as an oral health marker, which can determine the genetic predisposition of children to dental caries. Dermatoglyphic patterns make good material for genetic studies, because unlike stature, intelligence, and body weight, they are not significantly influenced by age or by postnatal environmental factors. It has the advantage of remaining stable throughout life and therefore can be compared among individuals of different ages.[10] According to the global burden of oral disease dental caries is still a major health problem in most industrialized countries as it affects 60-90% of school aged children and the vast majority of adults.[11] In a review considering the dental caries scenario in the children of Nepal, it was revealed that caries was prevalent in both primary and permanent dentition in different age groups.[12] In the present work, we studied the dermatoglyphic patterns to determine the usefulness of dermatoglyphics in predicting the genetic susceptibility of children to dental caries through a cost-effective means which can be used in field studies.

In the present study 3100 finger prints of 310 children were analyzed, it was found that there was an increased frequency of Loops (61.83%) among this study population followed by Whorls (32.8%) and Arches (5.29%). Our findings were consistent with the previous studies regarding frequency of dermatoglyphic patterns in a population.[4,12-13] These aforementioned studies also reported that caries free children expressed more amount of loop patterns followed by whorls and arches. The loop pattern was also common in a study done in Indian and Nepali population.[14,15] In this study, presence of loop pattern in the third digit of left handwas significantly associated with high dmft score in individuals. Our results were in contrast to the

previous studies done in an Indian population where the whorls pattern was found to be higher in individuals with high caries experience.[16-6] These results were also in accordance with the study done by Nidhi et al and another study which was done in children from Bihar.[17,18] However, a cross-sectional done in Bengalee children reported high incidence of caries in individuals with ulnar loop pattern, similar to our study.[19]

The finding of our study also corroborated with the studies done in Indian population.[20,21] Similar studies have also been done in adult population. A cross-sectional study conducted in Bhopal city assessed the relationship between fingerprint patterns and dental caries in 18–26 years age group of students and reported dental caries experience to be the highest among students with whorl pattern followed by the central pocket loop and least among students with loop pattern.[22]

In another cross-sectional study, correlation between dermatoglyphics, dental caries and salivary pHconcluded that caries free people showed inflated frequency of loops, whereas subjects with high decay score had additional share of whorls. They also reported the total ridge count to be higher in individuals with high decayed missing filled teeth (DMFT) score.[23] A case control study was done correlating dermatoglyphics and Early childhood caries, this study revealed that presence of whorls in the index finger of the right hand predicted significantly lower risk of caries in children. The results obtained from this study created a notion on the validity of the results of the previous studies and pointed them to be chance findings.[6] In a pilot study done in Primary School Children in Kathmandu district the prevalence of dental caries was higher in deciduous teeth compared to permanent teeth.[26] Early childhood caries (ECC) is major oral health problem, mainly in socially disadvantaged populations. ECC affects infants and preschool children worldwide. This virulent form of dental caries has a lasting detrimental impact on the dentition and the associated pain from has a negative impact on children's emotional status, sleep patterns, and ability to learn or perform their usual activities.[27] Oral health has been recognized as an essential component of general health and quality of life and dermatoglyphic pattern can be utilized as oral health marker for the early prediction regarding the caries susceptibility of an individual.

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 the low-risk group and thereby can aid in planning a definitive preventive and treatment strategy. Children showing the dermatoglyphic markers for caries can be kept at customized dental visits instead of standard 6-month recall and preventive measures like pit and fissure sealants, frequent fluoride application can be considered.

Small sample size is the main limitation of the study. In addition, the study was confined to the data obtained from Nepal Medical College, so the data thus presented cannot be generalized. Further, extensive research with much larger population should be conducted.

CONCLUSIONS

The dermatoglyphic patterns can be an effective tool to study the genetic basis of dental caries. In an underdeveloped country like Nepal, it might prove to be a noninvasive, inexpensive and effective tool for oral screening. These finger patterns may represent the genetic makeup of an individual and, therefore, his/her predisposition to dental caries.The results of this study will require further extensive research in order to

determine, and evaluate the significance of these variations in the dermatoglyphic features of patients with dental caries. The patterns seen in the form of dermatoglyphics might also play a significant role in the near future not only for the purpose of screening but also for studying the pattern/behavior of dental caries.

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Conflict of interest: None

REFERENCES

1. Vijender K, Tarannum G, Anuradha P. Dermatoglyphics Interpretation of Dental Caries: An In Vivo Study. *Int J Dent Med Res* 2015; 1(6): 54–6. [Full text]
2. Konde S, Raj Ns, Kumar N, et al. Dermatoglyphics: A genetic marker of early childhood caries. *J Indian Soc Pedod Prev Dent* 2014; 32: 220–4. DOI: 10.4103/0970-4388.135828
3. Mulvihill J, Smith D. The genesis of dermatoglyphics. *J Pediatr* 1969; 75(4): 579–89. doi: 10.1016/s0022-3476(69)80453-1.
4. Somani R, Sharma A. Dermatoglyphic interpretation of dental caries and its correlation to salivary bacteria interactions: An *in vivo* study. *J Indian Soc Pedod Prev Dent* 2009; 27(1): 17-21. DOI: 10.4103/0970-4388.5081
5. Qin M, Li J, Zhang S, Ma W. Risk factors for severe early childhood caries in children younger than 4 years old in Beijing, China. *Pediatr Dent.* 2008 Mar-Apr;30(2):122-8. PMID: 18481576
6. 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. doi: 10.5005/jp-journals-10005-1331. Epub 2016 Apr 22. PMID: 27274154; PMCID: PMC4890061
7. Navit S, Chadha D, Khan SA, Singh RK, Johri N, Navit P, Sharma A, Bahuguna R. The Mystery of Handprints: Assesment and Correlation of Dermatoglyphics with Early Childhood Caries A Case-Control Study. *J Clin Diagn Res.* 2015 Oct;9(10):ZC44-8. doi: 10.7860/JCDR/2015/15513.6639.
8. Garg V, Astekar M, Sapra G, Agarwal A, Agarwal A SR. Dermatoglyphics in oral and systemic diseases. J Dent Sci Oral Rehab. *J Dent Sci Oral Rehab* 2015; 6: 109–14.[Full Text]
9. Hassell TM, Harris EL. Genetic influences in caries and periodontal diseases. *Crit Rev Oral Biol Med.* 1995;6(4):319-42. doi: 10.1177/10454411950060040401. PMID: 8664422.
10. Verbov J. Clinical significance and genetics of epidermal ridges--a review of dermatoglyphics. *J Invest Dermatol.* 1970 Apr;54(4):261-71. doi: 10.1111/1523-1747.ep12258550. PMID: 4245201.

11. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull World Health Organ.* 2005 Sep;83(9):661-9. Epub 2005 Sep 30. PMID: 16211157; PMCID: PMC2626328

12. Khanal S, Shah P, Ghimire P. Burden of Dental Caries in the Nepalese Children : A Literature Review. *J Nepal Assoc Pediatr Dent* 2021; 2: 90–96. https://doi.org/10.3126/jnapd.v2i2.43979

13. Ahmed RH, Aref MI, Hassan RM, et al. 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: 54–57.[Full text]

14. Ramagoni NK, Kumar V, Adusumilli H, Reddy KP, Kumar NP. The Relation Between Dermatoglyphics And Mesiodistal Width Of The Deciduous Second Molar And Permanent First Molar. *J Clin Diagn Res.* 2017 Aug;11(8):ZC60-ZC63. doi: 10.7860/JCDR/2017/26938.10410. Epub 2017 Aug 1. PMID: 28969275; PMCID: PMC5620922.

15. Ghimire P, Ghimire S, Khanal A, et al. Gender Specific Correlation between Lip Print , Fingerprint and Blood Groups among Adults aged 20-30 Years attending a Tertiary Health Care Centre. *Nepal Med Coll J* 2022; 24: 219–226.[Full text]

16. Anitha C, Konde S, Raj NS, Kumar NC, Peethamber P. Dermatoglyphics: a genetic marker of early childhood caries. *J Indian Soc Pedod Prev Dent*. 2014 Jul-Sep;32(3):220-4. doi: 10.4103/0970-4388.135828. PMID: 25001441.

17. Madan N, Rathnam A, Bajaj N. Palmistry: a tool for dental caries prediction!.*Indian J Dent Res.* 2011 Mar-Apr;22(2):213-8. doi: 10.4103/0970-9290.84289. PMID: 21891888

18. 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 30;9(6):2980-2984. doi: 10.4103/jfmpc.jfmpc_208_20. PMID: 32984159; PMCID: PMC7491820.

19. 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-Dec;31(4):245-8. doi: 10.4103/0970-4388.121823. PMID: 24262398.

20. Agravat D, Agarwal N, Patel P. Dermatoglyphics: A Tool for Dental Caries Prediction. *J Adv Med Dent Scie Res* 2014;2(3):66-69.[Full text]

21. Madhussudan K, Patel HP, Umesh K, Chavan S, Patel R GN. Relationship between dermatoglyphics, chiloscopy and dental caries among dental students of Visnagar town, Gujrat. *Int J Adv Res* 2015; 3(7): 952-9..[Full text]

22. Chinmaya BR, Smitha B V, Tandon S, et al. Dermatoglyphics : An indicator of dental caries in humans. *J Indian Assoc Public Heal Dent* 2016; 14(3): 272–75. *DOI:* 10.4103/2319-5932.187175

23. Tegginmani V, Veeresh T, Mujahid A, et al. Correlation between Dermatoglyphics , Dental Caries and Salivary pH : An Invivo Study. *Ethiop J Heal Sci* 2018; 29(1): 929–934. doi: 10.4314/ejhs.v29i1.15

24. Navit S, Chadha D, Khan SA, et al. The Mystery of Handprints: Assesment and Correlation of Dermatoglyphics with Early Childhood Caries A Case-Control Study. *J Clin Diagn Res* 2015; 9(10) ZC44-ZC48. doi: 10.7860/JCDR/2015/15513.6639

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