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Correlation of Dental Caries and Dermatoglyphics among children in Mathura City- a Cross-sectional Study

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Abstract

Background: Dermatoglyphics refers to study of the intricate dermal ridge configurations 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.

Materials and Methods: A cross-sectional study was performed on 200 children (caries-active and caries-free) between the age ranges of 6–13 years. The decayed, missing, and filled teeth (DMFT) score was recorded for caries-active using DMFT/dmft index. Children having a DMFT/dmft score range of 3–6 were recorded. Midlo and Cummins method (1943) of recording palm prints was used using Indiana Ink (stamp pad), roller and printing papers. The prints or patterns of each digit were inspected with the help of magnifying lens and pattern of whorls and loops in each hand were recorded.

Results: The number of whorls was found to be more in caries-active children whereas the number of loops was more in caries-free children. There was a statistically significant difference ($p<0.05$) between the groups.

Conclusion: The results of the study indicated that there was a definite correlation between the number of whorls and loops and the presence of dental caries in children. Hence, dermatoglyphics could be used as a screening method to provide adequate preventive treatment to children showing a higher caries risk as detected by the hand ridge patterns.

Keywords: Dental caries, Dermatoglyphics, Fingerprint pattern, Genetics.

Introduction

Palmistry in scientific terms is called as "dermatoglyphics" ("derma" means skin and "glyphic" means carvings).

Dermatoglyphics is a study of palmer and plantar dermal ridge carvings on the hands and feet. Unlike the palmer lines or creases which keep altering throughout life, these patterns or configurations are genetically determined and remain constant throughout one's life. The terminology was coined by Harold Cummins and Midlo in 1926, and Cummins is regarded as the "Father of Dermatoglyphics".[1]

The dermal ridges take their origin from the fetal volar pads that appear in the 6th–7th week of embryonic life, i.e. at the same time as that of tooth formation in intraembryonic life. This means that the genetic message contained in the genome (normal or abnormal) is deciphered during this period and is also reflected by dermatoglyphics.[2] These volar pads occur as mound-shaped elevations of the mesenchymal tissue situated above the proximal end of most distal metacarpal bone on each finger, in each interdigital area. The size and position of these volar pads, to a large extent, are responsible for the type of configuration of ridge patterns. The ridge patterns are completed by 12th–14th week of gestation, i.e. at the same time as that of tooth formation completion in intraembryonic life. Both primary genetic determination and development secondary to flexion function have been suggested as the mechanisms underlying the crease development.[3]

In the present work, we studied the dermatoglyphic patterns in caries-free children and children with dental caries 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.

Material and Method

A cross-sectional study was conducted in schools of Mathura city in the month of August and September 2019. Five coeducation schools were selected randomly from Mathura city. Examination was done for a period of 3-4 days in each school among the age group of 6-13 years old children.

Study sample/ Study Population

All the children who had attended the school dental examination were examined. The total examined children were divided into two groups- caries active and caries free cases with equal number(N=20) each based on inclusion and exclusion criteria from each school with the equal number of males and females included in both the groups from each school by simple random sampling. Following schools which were randomly selected for the study in Mathura-

1. Saraswati Shishu Vatika School
2. Krishna Chandra Gandhi Saraswati Vidya Mandir Inter Colleg
3. Kiran Devi Monestrty Junior High School
4. Maa Resham Devi Bhagwan Das Adarsh Senior Secondary School
5. S.Tagore Academy Public School

The inclusion criteria include: Children aged 6-13 years.

For Caries active: Children with 3 or more teeth affected by caries.

For Caries free: Children with no teeth affected by caries.

The exclusion criteria include

- Children with other disorders, i.e. mentally or physically handicapped children
- Children with skin disorders or trauma to the fingertips
- Uncooperative children and

- Children whose parents/guardians did not give consent

Armamentarium for the study

For the caries detection

1) Shepherd's crook (No. 23)
2) Mouth mirror
3) Sterile cotton

For dermatoglyphic pattern recording

1) Stamp pad (camlin)
2) Standard A4 size paper (75 gm)
3) Hard board
4) Illuminating Magnifying hand lens
5) Disinfectant (Salvon)
6) Sterile cotton
7) Clean towel
8) Roller

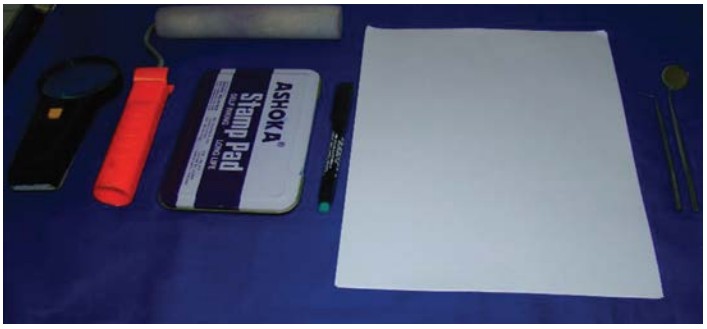


Fig. 1: Armamentarium for dermatoglyphic pattern recording

Methology

Caries Detection

Among total study population, 200 children with caries and without caries were taken. In the caries-active group, the cases having caries in three or more teeth were included. DMFT score was recorded with the use of mouth mirror and Shepherd's crook (No.23).

Recording of handprints

Midlo and Cummins method of recording palm prints was used using Indiana Ink (stamp pad), roller and A4 size printing papers for collecting their prints. Mouth mirror and explorer was used for detecting and recording caries in children. First, the hands of the cases were scrubbed using soap-water and allowed to dry. After this, the hands of the cases were pressed on the stamp pad and the print was recorded on the printing paper along with pressure applied using the roller. Right-hand prints were recorded followed by left-hand prints.[4]

The entire palm print along with digits was recorded in a single impression. Later, the DMFT score was recorded for the caries-active individuals.

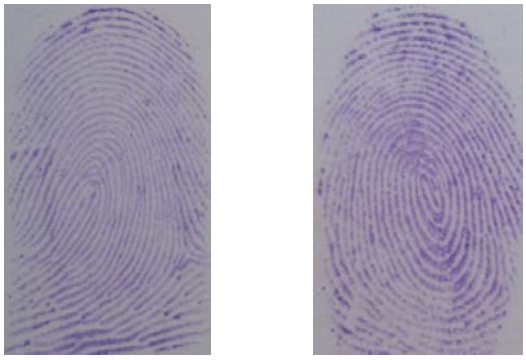
Analysis of handprints

A loop {Fig.2 (a)} is documented as a series of ridges that enter the pattern area on one side of 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 {Fig.2 (b)} varies from the loop in the feature of concentric arrangement of ridges, with two or more triradius in the latter. A whorl may be spiral, symmetrical, double looped, central-pocketed or accidental, depending on the internal structure of the whorl pattern.

Evaluation of pattern

Dermatoglyphic patterns of all 10 palmar digits were recorded using Cummins and Midlo method. Whorls and loops were counted on each digit and palm of both right and left hand for each case. They were inspected using a magnifying lens and data were recorded.



(a) (b)

Fig. 2: Dermatoglyphic patterns (a) Loops

(b) Whorls

Statistical Analysis

Recorded data were then entered into an excel sheet and analyzed using SPSS (version 21). The mean and the proportion of caries free and caries active cases for different variables was statistically analyzed using z-test.

Results

The results showed a significant change in the dermatoglyphic pattern between caries and the caries-free group. The frequency of whorls was found to be more in caries group and the frequency of loops more in caries-free group.

Table 1 shows Gender wise distribution of Loops and Whorls in caries-free cases in which the sum of loops in males was 320 (6.4±2.01) and in females was 300(6±2.14) whereas the sum of whorls in males was 155 (3.1±2.17) and in females was 141 (2.82±2.25). The results showed no statistically significant difference between both gender groups for loops (p value=0.3353.) and for whorls (p value= 0.5264).

In Table 2 there was Gender wise distribution of Loops and Whorls in caries active cases. The sum of loops in caries active males was 163 (3.26±2.05) and females was 172(3.44±1.62) with the sum of whorls in caries active males was 302 (6.04±2.31) and in females was 307 (6.14±1.79).The results showed no statistically significant difference between both gender groups for loops (p value=0.934.) and for whorls (p value= 0.626). When the total number of loops in both the caries active and caries free cases were compared it was found out that the number of loops were found to be more in caries free cases and the number of whorls were found to be more in caries active cases. The result showed highly statistically significant difference between both the groups (p value<0.05) {Table 3}.

No statistically significant difference was observed between caries and caries-free group with respect to loops and whorls in between right and left hands {Table 4 & Table 5}.

Discussion

In dentistry, dental caries detection can be done at an early age by the use of dermatoglyphics. The epithelium of the finger develops during the same intrauterine period as the development of enamel; hence, genetic and environmental factors affecting the development of both. Enamel is usually the first structure which gets affected by caries and, therefore, preventing its occurrence is quite necessary. Hence, palm prints can be used for detecting and preventing caries at an early age. Therefore, dermatoglyphics was used for evaluating the prevalence of caries in the present study. Studies done by Anitha et al (2014)[5], Sengupta et al (2013)[6], Navit et al (2015)[7] have shown no correlation of arches with the presence of dental caries. Hence, arches were not included in the study.

In the present study when Genderwise distribution of Loops and Whorls in caries free and caries active cases were analyzed, it was noted that incidence of loops and whorls was found more in males as compared to females in caries free groups as the sum of loops in males. The results of the present study were in accordance to the study conducted by Prakruti et al (2016)[8]. However, the results differed from the study conducted by Madan et al (2011)[9] in which the number of loops and whorls were found to be more in females than males.

Similar results of finding the highly statistically significant difference in both the groups (p value<0.05) when the comparison of number of Loops and Whorls was done in both the cases were obtained in the studies conducted by Anitha et al (2014)[5] and Prakruti et al (2016)[8]. However, the results were in contrast with the studies conducted by Navit et al(2015)[7] and Sharma et

al(2009)[10] in which they found out that the number of loops were more in the caries active group as compared to the caries free group. When the number of loops were compared in relation to hand, it was found out that mean numbers of loops were more in left hand i.e 164(1.67±0.91) than in the right hand i.e 148(1.51±1.04). The number of whorls when compared in relation to hand, it was found out that mean number of whorls was more on right hand i.e 312(3.18±1.19) than the left hand i.e 295(3.01±1.05). Similar results were obtained in the studies conducted by Prakruti et al (2016)[8].

The recording of fingerprint pattern in the initial visit can be useful in predicting the caries risk of the child. 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. Thus, dermatoglyphics can be used as an important tool in the field of dentistry for early detection and prevention of caries in children, thereby saving the children from undergoing invasive or restorative treatment at an early age. The limitation of the present study is that the imprint is affected by the amount of pressure exerted while the palm is recorded and care must be taken while recording the prints to apply the stamp ink material in adequate amounts. Its suggested and recommended that Dermatoglyphics could be used as potential noninvasive anatomical tools for screening of dental caries and guiding future research, with respect to early diagnosis, instituting preventive strategies, and more effective treatment modalities in individuals with dental caries. More studies with large sample size may validate the use of dermatoglyphics in oral and dental pathologies.

Conclusion

The results of the study indicate that there is a definite correlation between the dermal ridge pattern and dental caries in children**.** The dermatoglyphic patterns may be utilized effectively to study the genetic basis of dental caries. In a developing country like India, it might prove to be a noninvasive, inexpensive and effective tool for screening. These patterns may represent the genetic makeup of an individual and, therefore, his/her predisposition to certain diseases.

Given the expenses involved in conducting the analysis of the chromosomes themselves, dermatoglyphics can prove to be an extremely useful tool for preliminary investigations. The patterns seen in the form of 'dermatoglyphics' might play a significant role in the near future not only for the purpose of screening but also for studying the behavior of dental caries.[11]

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Legends Tables

Table 1:Genderwise distribution of Loops and Whorls in caries free cases

	Gender	N	Mean	Std. Deviation	Std. Error Mean
loops	Male	50	6.4	2.01017	.28428
	Female	50	6	2.13808	.30237
whorls	Male	50	3.01	2.16888	.30671
	Female	50	2.82	2.25596	.31904

	Males			Females			z	p
	Sum	Mean	S.D.	Sum	Mean	S.D.		
Loops	320	6.4	2.01	300	6	2.14	-0.6335	0.3353
Whorls	155	3.1	2.17	141	2.82	2.25	-0.9634	0.5264

Table 2: Genderwise distribution of Loops and Whorls in caries active cases

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Loops	Male	50	3.26	2.04849	.289
	Female	50	3.44	1.61826	.228
Whorls	Male	50	6.06	2.253	.326
	Female	50	6.30	1.711	.253

	Males			Females			z	p
	Sum	Mean	S.D.	Sum	Mean	S.D.		
Loops	163	3.26	2.04	172	3.44	1.61	-0.0821	0.934
Whorls	302	6.04	6.04	307	6.14	1.79	-0.4871	0.626

Table 3: Comparison of number of Loops and Whorls in caries free and caries active cases

	Caries	N	Mean	Std. Deviation	Std. Error Mean	Z	P
Total_loops	Caries active	100	3.25	1.713	.171	-19.56	0.000*
	Caries free	100	6.16	2.097	.209		
Total_whorls	Caries active	100	6.07	2.061	.206	-10.32	0.000*
	Caries free	100	2.96	2.206	.220		

"*" – p< 0.05, significant

Table 4: Distribution of Loops and Whorls in caries active cases in relation to hand.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Right_loops	100	0	5	1.51	1.038
Left_loops	100	0	5	1.67	.906
Right_whorls	100	0	5	3.18	1.187
Left_whorls	100	0	5	3.01	1.050
Valid N (listwise)	100				

	Right			Left			z	p
	Sum	Mean	S.D.	Sum	Mean	S.D.		
Loops	148	1.51	1.04	164	1.67	0.91	-1.24	0.22
Whorls	312	3.18	1.19	295	3.01	1.05	-0.39	0.70

Table 5: Distribution of Loops and Whorls in caries free cases in relation to hand

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Right_loops	100	0	5	3.11	1.116
Left_loops	100	0	5	3.12	1.213
Right_whorls	100	0	5	1.48	1.158
Left_whorls	100	0	5	1.44	1.199
Valid N (listwise)	100				

	Right			Left			z	p
	Sum	Mean	S.D.	Sum	Mean	S.D.		
Loops	317	3.11	1.12	318	3.12	1.21	-1.000	0.317
Whorls	151	1.48	1.16	147	1.44	1.2	-1.000	0.317