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RELATION BETWEEN DERMATOGLYPHICSAND EARLY CHILDHOOD CARIES IN A GROUP OF EGYPTIAN CHILDREN

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ABSTRACT

Dental caries is a multifactorial disease with genetic base. Early prediction for high caries risk children can help in postulating an effective caries preventive measure. Dermatoglyphics is a promising valuable tool for preliminary examination in conditions with a speculated hereditary base. The aim of the investigation was to decide whether fingerprints as a genetic marker could be involved in the occurrence of dental caries. Sixty children aged between 36 to 71 months, divided into two groups of 30 children each. They were chosen from the outpatient clinic of the pediatric dentistry department at Pharos University. They were divided into two groups according to dental caries incidence: caries-free children and children with ECC and dmfs score > 5.

The handprints of every child were taken and the type of dermatoglyphic pattern on fingertip of every digit was noted. The dmfs scores were recorded. SPSS software and test of proportions were used for the analysis. It was found that fingerprints of caries-free children demonstrated mostly loops pattern while whorls pattern was prevailing in the caries group.

The difference in atd angle (angle is a part of the palm denoting the relative position of three triradii) revealed a significant difference between the two groups where caries group had the most minimal mean atd angle and the least total ridge count (TRC). This could be a cost-effective tool, that could be used in many field studies.

INTRODUCTION

Through decades, fingerprints have been perceived as a valuable tool in understanding basics in biology, anthropology, evolution, and personal identification in addition for being the best and most broadly utilized strategy for the diagnosis of psychological, medical and genetic conditions. Cummins and Midlo introduced the term ‘dermatoglyphics’ in 1926. (1) It is the blend of two words ‘derma’ which is the skin and ‘glyphe’ which is a curve. Once the dermal patterns of the skin are formed, they remain throughout life. Dermatoglyphics is considered as an informative way of the skin surface, ridges and their arrangements. Thus, the term ‘dermatoglyphics’ is applied to the study of naturally occurring patterns of the surface of either the hands or feet. (2)

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It additionally denotes the friction ridge formations which is seen on the palms of hands and soles of feet. Dermatoglyphic examination is an exquisite valuable tool for early diagnosis concerning conditions with a speculated genetic ground. [3] In the recent decades, a considerable improvement has been achieved in correlating the types of pattern of lines, namely whorl, loop and arches patterns, on the fingers and some individual disorders and it has been documented in medicine as a method of diagnosis. [4] Investigations have been done into the dermatoglyphic patterns of inherent heart illness, leukemia, malignant tumors, celiac or intestinal diseases, schizophrenia and in addition to different types of psychological disorder. Moreover, it is considered as a sensitive indicator of intrauterine anomalies. This makes a perfect tool to illustrate and anticipate the risks for medical cases. [5]

Dental caries is considered as the most widely chronic disease in childhood. It is a multifactorial disease with multi-etiological factors. It is apparent in the hard tissues of the teeth and of a bacterial cause. It is evident by demineralization of the calcified parts and destruction of the organic substance of the tooth. The caries risk factors mostly are genetically determined such as; saliva (its content and flow), the immune response of the body with the reduction in the bacterial clearance. [6] It was revealed that the caries pattern is similar in family members over several generations, hereafter, inheritance is suspected. [7,8] Nevertheless, environmental factors, such as diet, oral hygiene habits also play a large role in causing caries and there is interrelation between genes and environment to the level that the environment affects the appearance or magnitude of heritability. [9]

It is known that the epidermal ridges of fingers, palms, lip, alveolus, palate and tooth buds are all formed from the ectomesenchyme during the 6-9 weeks of embryonic period. [10] Dermatoglyphics show the reflection of the genome's genetic message. [11] Thus, the dental caries susceptibility due to genetic factors such as structural anomaly in the tooth enamel, tooth morphology, eruption may be reflected by the dermatoglyphics. [9,12, 13]

The genetic role in the pathogenesis of caries have been revealed by investigating the caries incidence in twins. [9] Bordoni found that there is a solid genetic component in primary teeth which influences the frequency of caries. [8, 13] This study was designed to assess the dermatoglyphic patterns in patients with early childhood caries in a group of Egyptian children and to investigate the likelihood of considering dermatoglypic pattern as genetic marker for dental caries.

MATERIALS AND METHODS

The study sample comprised of 60 children aged between 36 to 71 months, divided into two groups of 30 children each. They were chosen from the outpatient clinic of the pediatric dentistry department at Pharos University. Control group (group I) comprised of children with dmfs score 0 while experimental group (group II) consisted of children with ECC and dmfs score > 5.

The study was described to the children and to their parents. Written consent was attained from the parents/guardians prior to recording the children's fingerprints. Finger and palm prints were recorded utilizing the ink technique depicted by Cummins and Midlo. [1] Firstly, children's hands were washed with soap and water to remove dirt and oil then blot dried. The right and left fingers' prints of all the subjects were recorded by using black duplicating ink, which was applied using cotton swab. Then the fingers were guided and pressed firmly against a white paper.

The right and left palms' prints of all subjects were recorded again utilizing black duplicating ink, using cotton swab on the palms and pressed on a sheet of paper. A sponge was set underneath the paper, to record the deep-hollow part of the

palms to remove all unseemly interpretation of the epidermal ridge pattern. The obtained handprints were checked with a magnifying glass (×2) then coded. A total of 600 digital prints and 120 palmar prints were obtained.

The occurrence of patterns of loops, whorls, and arches was recorded on all fingertips of all the 10 digits of children in both groups. A loop (fig. 1) is a group of ridges that enter the pattern area on one side of digit, recurves suddenly and leaves the area on the same side. In this type of pattern, a solitary triradius exists which is found along the side on the fingertip, where the loop is closed. A whorl (fig. 2) is different from the loop in the part of concentric arrangement of ridges. Depending on the internal structure of the whorl, it could be spiral, symmetrical, double looped, or central-pocketed. Arches (fig. 3) demonstrate the most straightforward ridge pattern which is shaped by the progression of at least one parallel ridges, which cross the finger from one side to the next without recurving.[14]

'Atd' angle (fig. 4) is a part of the palm denoting the relative position of three triradii typically situated on distal palm just inferior to the second, fifth fingers (a&d). The last one (t) is situated on the proximal palm distal to the wrist up to the center point of the palm. Estimation of the 'atd' angle for each palm print was performed by drawing 2 straight lines through the a&ttriradii and the d&ttriradii. [15] Mean frequancies of the 'atd' angles in both groups were assessed for increment increase/decrease. A ridge count (fig. 5) made by drawing a line from

Fig. (1) loop

Fig. (2) Whorl

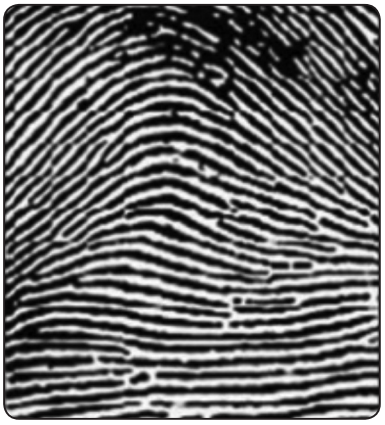

Fig. (3) Arch

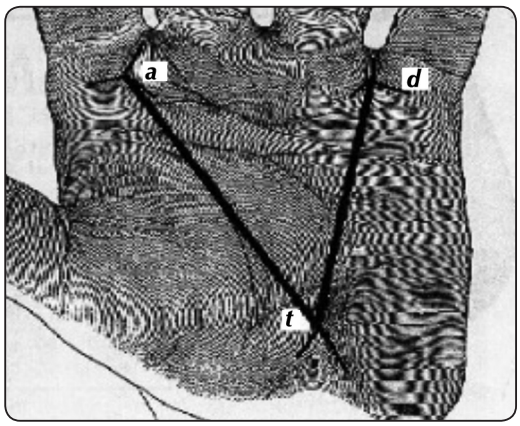

Fig. (4) atd angle

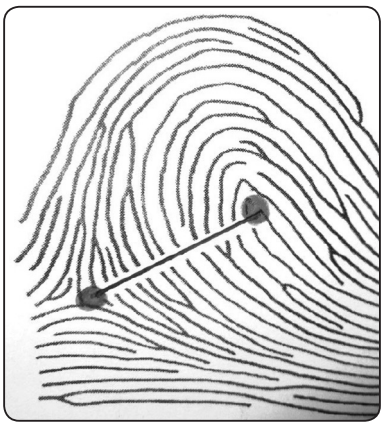

Fig. (5) A total ridge count (TRC)

the triradius to the center point of the pattern and defining the number of interconnected ridges between the 2 points. A total ridge count (TRC) is the summation of the ridge numbers for each of the 10 fingers. Mean frequancies of the (TRC) for both groups were evaluated for increment increase/ decrease. The data was calculated utilizing Mann-Whitney test with level of significance at $p < 0.05$.

RESULTS

When comparing the different patterns of fingerprints, for both groups, there was an increased significant difference of loop pattern in caries-free children (group I) while whorl pattern was more common in children with ECC (group II).

Atd angle comparison revealed a significant difference between both groups where group II had the lowest mean atd angle. Total ridge count (TRC) was significantly higher in group I.

TABLE (1) Evaluation and correlation of patterns in children with ECC and caries-free children Mann Whitney test

	Groups	**Mean**	**SD.**	**SEM.**	**Mean diff.**	Z	P
Right hand							
Loop	**Control**	3.93	0.98	0.18	3.17	6.264 -	<0.001*
	ECC	0.77	1.10	0.20			
Whorl	**Control**	0.30	0.70	0.13	-3.50	6.548-	<0.001*
	ECC	3.80	1.24	0.23			
Arch	**Control**	0.77	0.86	0.16	0.27	1.359	0.174
	ECC	0.50	0.78	0.14			
Left hand							
Loop	**Control**	3.90	0.76	0.14	3.17	6.705-	<0.001*
	ECC	0.73	0.87	0.16			
Whorl	**Control**	*OAO*	0.67	0.12	-3.50	6.792	<0.001*
	ECC	3.90	1.09	0.20			
Arch	Control	0.70	0.70	0.13	0.23	1.426	0.154
	ECC	0.47	0.68	0.12			

: Statistically significant at p < 0.05

TABLE (2) Evaluation and correlation of atd angle in children with ECC and caries-free children in both groups Mann Whitney test

Groups	**Mean**	**SD.**	**SEM.**	**Mean diff.**	Z	P
Right hand						
Control	51.20	6.46	1.18	6.97	3.672*	<0.001*
ECC	44.23	6.36	1.16			
Left hand						
Control	50.10	7.16	**1.31**	1.70	0.859	0.390
ECC	48.40	7.33	1.34			

: Statistically significant at p < 0.05

TABLE (3) Comparison of total ridge count (TRC) Mann Whitney test

Groups	Mean	SD.	SEM.	Mean diff.	Z	P
Control	138.77	41.32	7.54	22.23	2.011 *	0.044*
ECC	116.53	36.47	6.66			

: Statistically significant at p < 0.05

DISCUSSION

Different patterns in dermatoglyphics are used a*s* valuable means in genetic studies. Chromosomal abnormalities are frequently accompanied by unusual ridge pattern formations.[16] Moreover, they have the advantage of remaining stable throughout life and therefore can be compared among individuals of different ages.

Dermatoglyphic patterns are considered as a marker for dental caries in light of the fact that both epithelium of fingers and enamel have ectodermal origin and are formed at the same period of intrauterine life. Any disturbance at this period influence*s* both epithelium of fingers and enamel [10,17] Many studies have established a strong correlation amongst dermatoglyphics and dental caries. [18,19]

Three to six years old children were chosen because at that age, they have the whole primary dentition. In this study, the fingerprints of caries-free children indicated maximum occurrence of loops followed by arches and whorls in both right and left hands, while in the ECC children, fingerprints demonstrated maximum occurrence of whorls followed by loops and arches. These findings are in accordance with the study done by Madan et al, [19] where kindergarten school children in the age group 3-6 years were examined then divided into four groups; caries-free males, caries-free females, caries males, caries females. Different dermatoglyphic patterns for each fingertip on each digit were scored. They found that handprints of caries-free children, particularly females, indicated more ulnar loops. The caries group indicated more of whorls pattern. Other studies also supported an increased recurrence of loops in caries free children and an increased recurrence of whorls in children with dental caries. Arches were the least found pattern in both groups. [18-21]

The mean recorded atd angle for the caries free group is in the vicinity of 50° and 51° and that in the ECC group was between 44° to 49°. This is in agreement with Atasu, [18] where caries free children had more atd than that of the children with multiple carious lesions. On the contrary, mean atd angle results was in disagreement to the result of the study performed by Ahmed et al. [21] who found that the atd angle was >56° in the control group while in the experimental group it was in the vicinity of 45° and 56°. This could be due to the difference in racial groups. The quantitative analysis of the total ridge count (TRC) of each of the 10 fingers in caries-free was higher against that of the ECC group. Similar results were recorded by Atasu, Madan et al. and Ahmed et al. [18,19,21]

Recording the dermatoglyphic patterns of children at an early age, during their first dental visit will enable predicting whether the child belongs to high risk group or low risk group as a part of caries risk assessment and so can aid in implementing risk reduction measures or earlier therapy and planning a definitive preventive and treatment strategy.

CONCLUSION

There is relationship amongst dermatoglyphics and dental caries because of the dissimilarity in dermatoglyphics between the children with or without caries. Specific fingerprint patterns could be considered as a valuable noninvasive tool for predicting dental caries development.

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