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Dermatoglyphics as a Non Invasive Diagnostic Tool for Predicting Caries Risk in Specially Abled Children

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ABSTRACT

Aim: The present study was conducted to determine the dermatoglyphic configuration of specially abled and healthy children by comparing the variations that occur in these patterns and evaluating the caries experience associated with it.

Materials and Methods: This was a cross sectional study in which dermatoglyphic patterns along with deft and DMFT index was recorded in 100 children of age 6-16 years divided into two groups of 50 each (50-specially abled and 50- normal children).

Results: Statistical analysis was done using MANN-WHITNEY U test. Specially abled children showed increased number of loop configurations compared to healthy children and high caries risk children in both the groups showed increased number of arches and decrease in the number of whorls with no statistical significance (P > 0.005).

Conclusion: With further research in this field, dermatoglyphic patterns can prove to be an effective diagnostic tool in diagnosis of diseases with a genetic cause.

Keywords: Dermatoglyphics, Dental caries, Genetics.

INTRODUCTION

The term Dermatoglyphics was coined by Harold Cummins and Midlo in 1926 from the Greek Word "DERMA" meaning skin and "GLYPHIC" meaning carvings[1,2]. It is the study of palmar and plantar dermal ridge carvings of the hands and feet which are genetically determined and remain constant throughout the life[2]. These epidermal ridges as well as the facial structures such as the lip, alveolus, teeth and palate are formed from the same embryonic tissue (ectoderm), during the same embryonic period (6-9 weeks in utero)[3]. During this period certain mound shaped elevations of the mesenchymal tissue called the volar pads are formed above the proximal end of the most distal metacarpal bone on each digit and these volar pads to a large extent are responsible for the different types of configurations. Based on this in the year 1892, Sir Francis Galton has classified these configurations into arch, whorl and loop types. As

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the formation (6 to 9 weeks) and completion (12 to 14 weeks gestation) of these volar pads coincide with the development of facial structures, the genetic message contained in the genome- normal or abnormal is deciphered during this period and is also reflected by the change in dermatoglyphic patterns[4]. Hence, dermatoglyphics can be considered as an essential diagnostic tool for various forms of diseases such as dental caries, genetic disorders like Downs syndrome, intellectual disability, head and neck oncology, cleft lip and palate cases and many other systemic disorders.

The present study was done to determine the dermatoglyphic patterns of specially abled and healthy children and evaluating the caries experience associated with it.

MATERIALS AND METHODS

The cross sectional study was carried out on 100 children of age group 6 to 16 years, who were divided into 2 groups of 50 each. The first group comprised of 50 specially abled children and the second group comprised of 50 healthy children who reported to the Department of Pedodontics and Preventive Dentistry. Each group was further divided into two sub-groups that is high caries risk group of 25 children and low caries risk group of 25 children based on AAPD guidelines for caries risk assessment 2013. Before conducting the study an informed consent was obtained from the Director of the special school along with the consent from the parents of the children participating in the study and ethical clearance was obtained from the institutional ethical clearance committee. Dermatoglyphic patterns of each child was recorded using the Canon PIXMA MP250 Inkjet photo All-in-one Printer (Figure 1). This method eliminated the problem of smudging when ink was used to record the patterns and at the same time it was easier to record the data technically in the laptop.

Every child participating in the study was made to thoroughly rinse the hands with Dettol soap and then dried with a dry towel. The hands were placed on the scanner, prints were recorded in the laptop and different types of patterns such as whorls, loops and arches were then studied. Intra-oral examination was done under the operating light using mouth mirror and probe and dental caries was recorded using the deft and DMFT index.

STATISTICAL ANALYSIS

The completely recorded data was subjected to statistical analysis and compilation of the results was done. The statistical analysis was done using the Mann Whitney U test, Wilcoxon W test, Z test and significance value (p value) of < 0.005 was considered significant.

RESULTS

Total of 30 girls and 70 boys were enrolled in the study. The mean overall age of the sample was 10.58 years with 9.44 years in the healthy children and 11.72 years in the specially abled children.

In the specially abled children the total number of loops were 337 with a mean of 6.74, whorls were 136 with a mean of 2.64 and arches were 31 with a mean of 0.62. In healthy children the total number of loops were 307 with a mean of 6.14, whorls were 155 with a mean of 3.10 and arches were 38 with a mean of 0.80. So it was concluded that loops were more in specially abled children whereas arches and whorls were more in normal children as seen on 500 digits in each group, but there was no statistically significant difference between the groups (Tables 1, 2 and 3). On comparison of caries experience in each group the mean deft was 1.88 and mean DMFT was 2.00 in specially abled children and a mean deft of 0.80 and DMFT of 4.92 was seen in healthy children (Table 4). On comparison of the dermatoglyphic patterns of high caries risk children, it was found that there was a marked increase in the number of arches and decrease in the number of whorls in the high caries risk children in both the groups when compared to low caries risk children. The number of arches being 22 with a mean of 0.88 and number of whorls being 61 with a mean of 2.44 in high caries risk specially abled children and number of arches being 26 with a mean of 1.04 and number of whorls

Fig 1: Canon PIXMA MP250 Inkjet photo All-in-one Printer with lap top connected to it to record the finger prints.

Table 1: Mean values of loops, whorls, arches among normal children.

Group	Loops	Whorls	Arches
Normal children N=50	307	155	38
Minimum	0	0	0
Maximum	10	10	8
Mean	6.14	3.10	.80
Median	6.00	2.50	.00
Std. Deviation	2.441	2.801	1.539
Std. Error of Mean	.345	.396	.218

Table 2: Mean values of loops, whorls, arches among specially abled children.

Group	Loops	Whorls	Arches
Specially abled children N=50	337	136	31
Minimum	0	0	0
Maximum	10	10	5
Mean	6.74	2.64	.62
Median	7.50	2.00	.00
Std. Deviation	2.586	2.716	1.292
Std. Error of Mean	.366	.384	.183

Table 3: Statistical correlation of loops, whorls, arches among specially abled and normal children.

	Loops	Whorls	Arches
Mann-Whitney U	1049.500	1133.500	1171.500
Wilcoxon W	2324.500	2408.500	2446.500
Z	-1.395	-.814	-.676
Asymp. Sig. (2-tailed)	.163	.416	.499

Table 4: Mean deft and DMFT values of specially abled and normal children.

High caries risk N=25	Mean deft	Mean DMFT
Specially abled children	1.88	2.00
Normal children	0.80	4.92

being 69 with a mean of 2.76 in high caries risk healthy children as seen on 250 digits in each group, but there was no statistically significant difference between the groups (p> 0.005)(Table 5 and 6). On considering the number of loops in high caries risk children in both the groups, there was not much change in the number of loops compared to low caries risk children.

Table 5: Mean values of arches, whorls among high caries and low caries risk children in both the groups.

High caries risk N=25 Mean	Specially abled children Arches	Whorls	Normal children Arches	Whorls
	22	61	26	69
	0.88	2.44	1.04	2.76
Low caries risk N=25 Mean	Arches	Whorls	Arches	Whorls
	7	71	11	94
	0.36	2.84	0.44	3.76

Table 6: Statistical correlation of whorls, arches among high caries risk in specially abled and normal children.

	Whorls	Arches
Mann-Whitney U	281.000	307.000
Wilcoxon W	606.000	632.000
Z	-.624	-.127
Asymp. Sig. (2-tailed)	.533	.899

DISCUSSION

Dermatoglyphics can be considered as a window of congenital abnormalities and also a sensitive indicator of intra uterine anomalies[5]. It is now beginning to prove itself as an extremely useful tool in preliminary investigation and diagnosis of conditions with a genetic base and most importantly a cost effective method. The basis for considering dermatoglyphic patterns for the diagnosis of caries is the same ectodermal origin of the finger buds and the orofacial structures and more importantly early prediction of high caries risk children with this method can help the pediatric dentist to deliver effective preventive measures to the child at the right time. There were many studies and research work by Atasu M on the dermatoglyphic patterns observed in the Ellis-Van Creveld Syndrome[6] and in dental caries[7], along with studies on hypohydrotic ectodermal dysplasia patients by Kargul et al[4] which led to vast research in this field. From then on there has been research on dermatoglyphic patterns as a diagnostic tool in various forms of diseases like dental caries by Sharma A and Somani R[3], in cleft lip and palate patients by Scott NM[8], Balgir RS[9], Mathew L et al[10].

Cancer studies were also done by Atasu M et al[5], Rosner F et al[11], Menser MA et al[12], comparing dermatoglyphic pattern among the cancer patients, and also in the field of genetic disorders; dermatoglyphic patterns of Down syndrome children were studied by Marilyn Preus et al[13], Byrant JI et al[14], Holt SB[15], Shiono H et al[16], Kiran K et al[17]. In the present study the dermatoglyphic patterns of the specially abled children were compared to healthy children and evaluated the variations that occurred in association with caries experience. The specially abled children showed an increased frequency of loops and decreased frequency of whorls and arches compared to the healthy children. These observations were similar to the study done by Holt SB[15], Shiono et al[16] and Kiran K et al[17], indicating the definitive correlation between the dermatoglyphic patterns and intellectual disability. The caries experience was evaluated using the deft and DMFT criteria. The mean deft and DMFT of high caries risk group in specially abled children was 1.88 and 2.00 respectively, where as in normal children the mean deft and DMFT was 0.80 and 4.92 respectively .The dermatoglyphic patterns in high caries risk group in both specially abled and normal children showed an increase number of arches with a mean value of 0.88 in specially abled children and 1.04 in normal children and a decreased number of whorls with a mean of 2.44 in specially abled children and 2.76 in normal children when compared to low caries risk children(deft and DMFT =0) in both the groups. These results were in contrary with the results obtained in the studies done by Atasu M[7], Sharma A and Somani R[3], Madan N[18], Padma K et al[19], where they have shown an increased number of whorls in high caries risk group. Larger sample size would have shown more accurate and statistically significant results and comparison of the dermatoglyphic patterns of siblings and the parents of the children in the study would have given better genetic correlation.

CONCLUSION

There was a significant increase in the number of loops in specially abled children when compared to normal children, but no statistically significant difference in the patterns was seen when high caries and low caries risk were compared in both the groups.

Further research in this area may lead to a new horizon in the field of dermatoglyphics in dentistry. Dermatoglyphics has moved from gloom to lightness as a diagnostic tool, it would be a boon in the preliminary diagnosis of diseases with a genetic cause.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this paper.

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