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Abstract: Familiarizing with a child's usual behaviour and predicting their responses in various circumstances can dictate the level of success of dental therapy and appointments, chiefly at the child's first dental visit. Behaviour Genetics utilizes genetic means to investigate theroot of individual differences in behaviour.Fingerprints can dictate how a person feels, thinks and how one acts towards and during various circumstances.Behaviour genetics can act as an important behaviour assessment tool aiding in selection of appropriate behaviour management techniques. The current study aimed to probe extensively into potentiality of a relationship between behaviour and dermatoglyphics. **Method:** 440 subjects aged 3-6 years, who had come for their first dental appointment, were selected. Frankl's behaviour rating scale was used to assess the behaviour of subjects during oral examination. Following which, subject's thumbprints of both the hands were recorded using a digital fingerprint scanner and were analysed by an investigator trained in fingerprint analysis, to check for any correlation with the child's behaviour. Chi square test was used for inferential statistics. The mean number of different types of fingerprint patterns

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were compared across the different levels of child behaviour using one-way ANOVA/Kruskal wallis test. **Result:** Outcome values for Right & Left Thumbprint patterns and Behaviourwere statistically insignificant. **Conclusion:** No association between thumb print and behaviour of children during their first dental appointment could be observed through this study. Further in-depth studies are required to confirm such a correlation as the behaviour of pediatric patients would vary according to various dental procedures.

Keywords: Child's behaviour, Children's fingerprint, Dermatoglyphics, Behaviour Assessment Tool, Behaviour Management, Dentistry, Cooperation, Thumbprints, First dental visit.

Introduction: A thorough observation and evaluation of a child's behaviour prior to commencement of treatment is of utmost importance in the field of Pediatric Dentistry. Familiarizing with a child's usual behaviour and possessing the aptness for predicting their responses in various circumstances can dictate the level of success of dental therapy and appointments, chiefly for the child's first dental visit.Some children display a very uncooperative response in the dental office, while others remain calm, collected and very cooperative.[1]Ability to gauge behaviour is the key instrument in the hands of the dentist for carrying out the required treatment in the most pertinent manner in children.[2]

Dermatoglyphics (acquired from ancient Greek; derma = "skin", and glyph = "carving") can be explained as the discipline that focuses on analytical appraisal of finger ridges or carvings and their properties.[3] The two principal attributes of dermatoglyphic patterns are that they are exclusive to a person and continue to remain unchanged throughout the life.[4]Multiple genes have been observed to control fingerprint development and by studying fingerprint formations, considerable genetic, psychological and medical information can be gained about an individual.[5]

Behaviour Genetics is the area of research that utilizes genetic means to investigate the nature and root of individual differences in behaviour. Use of dermatoglyphics as a research technique in the science of behaviour genetics is a new area of exploration in psychological sciences.[6]Fingerprints can dictate how a person perceives, feels, thinks, gets motivated and most importantly how one acts towards and during various circumstances.[3]

Using dermatoglyphics for identification of a person or for various criminal investigations, is an extensively used method in forensic science, but in dentistry use of dermatoglyphics is still an upcoming and relatively unexplored research method. Various investigations have established a relationship between dermatoglyphics and age as well as gender, and even correlation of dental caries and malocclusion with it.[7],[8],[9]Few have even correlated personality or character of a person with fingerprints.[10]Still there's paucity of literature which establishes a correlation between dermatoglyphics and behaviour of a person in various situations.[1]

Behaviour genetics can act as an important behaviour assessment tool in Pediatric Dentistry. The current study aims to probe extensively into potentiality of a relationship between behaviour and

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dermatoglyphics. The results can be helpful in predicting the extent of children's cooperation before commencing dental treatment and can also help to adopt proper behavioural management technique, especially during the first dental visit which may aid in instilling a positive dental attitude in the child.The aim of the present study was to evaluate use of digital thumb prints as a parameter for predicting behaviour of children aged 3-6 years in a dental office.

Methodology:

The present study was conducted in the Department of Pediatric and Preventive Dentistry, after gaining approval from the Institutional Ethical Committee. The study subjects were selected from the visiting OPD of the department following obtainment of consent from the patients.

Inclusion Criteria:

- Age range of the patient: 3-6 years
- No previous dental experience/treatment.

Exclusion Criteria:

- Children with special healthcare needs.
- History of penetrating trauma or burning that might have affected the dermatoglyphic pattern of the palms and digits.
- Children with missing digits.
- Children with conditions/abnormalities that did not allow accurate reading of fingerprints.
- Children experiencing dental pain.
- ➢ For recording behaviour:
  The child was asked to sit on the dental chair comfortably and demographic data including age, sex and education was noted. General examination and proper medical and dental histories of the child were recorded.
  A thorough oral examination was performed after explaining the examination procedure to the subject using "Tell-Show-Do" method, following which behaviour of child was assessed using Frankl's Behaviour Rating Scale (1962) by the principal investigator.
  The children were then divided into two categories based on scoring from Frankl's Behaviour Rating Scale:
  a. The Score 1 (Definitely Negative) and score 2 (Negative) were considered as **Uncooperative** behaviour.
  b. The score 3 (Positive) and score 4 (Definitely Positive) were considered as **Cooperative** behaviour.
- ➢ For recording thumbprints:
  After the completion of oral examination, the subject was asked if they were willing to play a "game" where a "light will be used to take photograph of their thumbs".
  On receiving assent from the subject, thumbprints of both left and right hands were recorded using a digital fingerprint scanner sensor (MFS100 Biometric Fingerprint

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Scanner, Mantra, India) attached to a computer system, the images were immediately transferred into storage data, for analysis.

➢ Examination of thumbprints:

The recorded thumbprints were later analysed by a second investigator trained andcertified in fingerprint analysis by International Forensic Science Institute, India.

The assessment of the recorded thumbprints was done using classification of fingerprints given by Galton (1892) which classifies fingerprints into three groups;

i) Loop, ii) Whorl and iii) Arch.

➢ The child's behaviour was then correlated to the recorded and analysed thumbprints.

Statistical Analysis:

Data was analysed using Statistical Package for Social Sciences (SPSS) version 21. Chi square test was used for inferential statistics. The mean number of different types of fingerprint patterns were compared across the different levels of child behaviour using one-way ANOVA/Kruskal

wallis test. The level of statistical significance was set at 0.05.

Result:

A total of 440 children form the visiting OPD of the department were selected as study subjects.

A total of 178 participants were females out of which 78% showed positive behaviour during oral examination and 21.9% displayed a negative behaviour. The total number of male participants in the study were 262, out of which 82.4% displayed a positive behaviour during oral examination and 17.5% showed a negative behaviour.

Loop was seen to be the more predominant pattern amongst both males and females. The Right Thumb in Females showed 62.92% Loop, 31.46% Whorl, 5.62% Arch patterns. The Left Thumb in Females showed 60.11% Loop, 34.27% Whorl, 5.62% Arch patterns. In Males the Right Thumb showed 59.16% Loop, 39.31% Whorl, 1.53% Arch patterns. The Left Thumb in Males showed 71.75% Loop, 25.95% Whorl, 2.29% Arch patterns.

The outcome values of Goodness of Fit Test (Chi Square Test) between Thumbprint patterns and Behaviour are statistically insignificant (p > 0.05) (Table No.1).

	Right Thumbprint		Left Thumbprint	
	Pearson's Chi-Square	N	Pearson's Chi-Square	N
Behaviour	1.968[a]	440	.237[b]	440

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.09.
b. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 2.70.

Table No. 1: Goodness of Fit of Thumbprints and Behaviour

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One-way ANOVA Test of Right and Left Thumbprint Patterns with Behaviour shows statistically insignificant (p > 0.05) variation among the three thumbprint patterns and their relation with behaviour (Table No. 2).

Thumbprint Patterns	Right Thumb			Left Thumb		
	M	SD	F(439)	M	SD	F(439)
Loop	1.19	.395	.982	1.20	.397	.118
Whorl	1.21	.408		1.19	.396	
Arch	1.06	.250		1.14	.363	

ANOVA: F value- .982 (Right Thumb), .118 (Left Thumb), p = >.05

Table No. 2: Comparison of Mean Observed Score between Thumbprint Patterns and Behaviour

The findings of the Kruskal-Wallis Test corroborate those of the One-way ANOVA Test. The findings are statistically insignificant (p > 0.05) (Table No.3).

	Fingerprint Patterns	N	Mean Rank	Kruskal-Wallis H
Right thumb	Loop	295	220.51	1.964
	Whorl	129	224.05	
	Arch	16	191.75	
Left thumb	Loop	266	221.01	.236

Table No. 3: Kruskal-Wallis Test for Right and Left Thumbprints and Behaviour

Discussion:

Dental anxiety is a highly prevalent phenomenon that comes in the top ranks of the most commonly feared circumstances and is a frequent cause of stress and anxiety in children receiving dental treatment. Dental anxiety can arise even when there's lack of exposure to dental setting at all, thus children can be expected to have a Negative behaviour even before commencement of any treatment at their first dental visit. The dentists have a major role in predicting and successfully handling the child's anxiety, specifically at the first dental visit. Not properly managing the child's dental fear might create a profound roadblock in their lives to

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receive dental care as it would result in a deep-seated anxiety which may very well extend into adulthood. Multiple schools of thoughts in psychology concur that anxiety is an individualized personality trait, and so is its resultant behaviour.[11]

Human behaviour has been known to get affected by genetic variations. Behaviour displays signs of genetic influence in ways such as how an individual experiences and deals with stressful situations in life.[12]The contemporary genetic researches in psychology had a starting point about 150 years back with the initial studies of Francis Galton.[13]Behavioural genetics is a research field that studies the influence of hereditary traits on behaviour, and thus can be seen as the point of convergence between behavioural sciences and genetics.[14]

It has long been realized that the unique property of fingerprints, i.e., its exclusivity to a person and its permanence, can be used as a valuable guide of human variations which is extensively used in various fields such as anthropology, medicine, genetics, etc.[4], [15]

Dunayev O et al.[16],researched the usage of dermatoglyphics for predicting the diverse nature of human individuality, and found that dermatoglyphic parameters may be utilized as accurate markers for psychological and behavioural identification of a person, studying individualized ways of response as well as behaviours towards various life situations. Dermatoglyphics can be regarded as a noninvasive and inexpensive diagnostic tool that can possibly be used as a marker for prevising the behaviour of children before they enter a dental office. This can be of particular help while choosing a proper behaviour management technique for pediatric patients especially during their first dental visit.[1], [17]

The present study was performed to find and confirm a correlation (if any) between behaviour of children in a dental office with their thumb print patterns. In this study, the researchers only recorded the dermatoglyphic pattern of both the thumbs to minimize the recording time and any potential stress that the child may experience during the process of obtaining the thumbprints. The process of recording the thumbprints was one following a preliminary oral examination, i.e. before commencement of any kind of dental treatment. The thumbprints were recorded using a digital scanner to get a clear image of high resolution, and also because the scanner was perceived as an exciting 'play-toy' for majority of the participants.

This study found no significant correlation between fingerprint patterns and behaviour of children during their first dental visit, as shown in Table 1, 2, & 3. Currently there is extremely limited research work that has tried to probe into existence of a link between behaviour and dermatoglyphics, especially in the dental field, therefore we could not compare our results with multiple studies. Our results could only be compared with studies done by Mokhtari S et al.,[1]and Navit S et al.[17]. The findings of this study were not in agreement with the studies done by Mokhtari S et al.[1], where they found that whorl pattern showed a significant high frequency in the uncooperative patients and loop pattern showed a significant high frequency in cooperative patients and Navit S et al.[17], where they observed that positive and definitely positive behaviour was seen in children having an arch pattern.

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Tables 2 and 3 present the mean and standard deviation values obtained in One-Way Analysis of Variance and Kruskal-Wallis tests respectively. The means obtained for individuals with different fingerprint patterns with respect to behaviour vary negligibly (<0.15) in cases of the One-Way ANOVA despite significant difference in the number of individuals in each category (thumbprint patterns). These observations corroborate the insignificance of results of the test.

The crude features of the finger ridges such as the size, shape, and spacing seem to be affected by hereditary variables. The inheritance pattern of these ridges appears to be complex due to the involvement of numerous genes.[18]Singh M. et al.[3], in their research have stated that an insight can be gained into human emotions, motivations, as well as reactions in specific situations by analyzing fingerprints, as several studies found a correlation between behaviour and personality with different fingerprint patterns.

The present study showed Loops to be the predominant fingerprint pattern in both males and females, followed by Whorl and Arch being the least common pattern(Figure no. 2). This finding was in accordance with the studies done by Bansal HD et al.[19], where they found that the most common type of pattern observed in Marathi population is ulnar loop followed by whorls in both males and females. Singla P.[20], reported similar results through their study, stating that the loop is the predominating pattern, whereas arch is the least observed pattern in the North Indian population.Navit S et al. [17],in their study population found loops to be the most predominant type of pattern, followed by whorls and then arches.

This study found no significant difference between behaviour ratings of male and female subjects. These findings were in accordance with the study by Navit S et al. [17], who observed gender to be an insignificant aspect related to the behaviour of children in a dental office. Kamran et al. [21], in their study found no significant variation in definitely negative behaviour between male and female pediatric patients. Ummat A et al. [22],in their study observed that there was no significant relationship seen between gender and dental fear in children that could affect the behaviour of child and management during their first dental visit.

This study found no association between thumb print and behaviour of children.Such results may be attributed to the fact that the behaviour was assessed at the time of oral examination which usually is regarded as a low anxiety provoking, preliminary activity by the patients. Further in-depth studies are required to confirm such a correlation as the behaviour of pediatric patients would vary while going through various dental procedures, which would give a better understanding if there's actually any link between behaviour in a dental office and dermatoglyphics.

Conclusion:

This study was carried out to find if dermatoglyphics could be utilized as a marker of behaviour pattern and could aid in assessment of behaviour of the children before they enter the dental office, as that would help the dental team to plan and prepare behaviour management techniques

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accordingly before the child's entry into the operatory. However, no association between thumb print and behaviour of children could be observed through this study.

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