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Research Protocol

Dentistry Section

Assessment of Digital Dermatoglyphic Pattern Variation between Children Exhibiting Cooperative and Uncooperative Behaviour in the Dental Operatory: A Research Protocol

SHEPALI HULE[1], RAMAKRISHNA YELURI[2]

BY-NC-ND

ABSTRACT

Introduction: Understanding a child's behaviour features in different situations can assist in the treatment planning and can create an effective treatment for the child, especially during their first visit. Fingerprints are unique and constant over a lifetime. Research indicates a relationship between fingerprint type and behaviour mode of children during dental treatment Therefore, fingerprint patterns might assist to predict the extent of cooperation by children during dental procedures.

Aim: To assess the relationship between fingerprint patterns, children's behaviour, and their cooperation during dental operatory in children of Wardha region of Maharashtra.

Materials and Methods: A cross-sectional study will be conducted in the Department of Paediatric and Preventive Dentistry of Sharad Pawar Dental College and Hospital, Sawangi (Meghe), Wardha between November 2025 to August 2026. In this study, 84 children will be divided into two groups with 42 in each group. In the first visit, oral examination will be done in the dental operatory and behaviour will be assessed by Frankl's behaviour rating scale. Based on the behaviour, children will be categorised as cooperative and uncooperative. Finger prints will be collected on a digital scanner and will be classified based on Cummin's classification into loop, whorl and arch as dermatoglyphic patterns. The Chi-square test will be used to assess the association between fingerprint patterns and behavioural responses. A p-value of <0.05 will be considered statistically significant. Hence, this study aims to assess the correlation between fingerprint patterns, behaviour, and cooperation of children during dental procedures in the Wardha region, Maharashtra.

Keywords: Behaviour, Children, Digital, Fingerprints, Uncooperative

INTRODUCTION

Children's behaviour plays a crucial role in paediatric dentistry as it directly impacts the success of treatment and the overall dental experience. A cooperative child allows for smoother procedures, reducing fear and anxiety, which helps create a positive association with dental visits. Understanding a child's behaviour characteristics in different situations can help in the treatment planning and can create an efficient and effective treatment for the child, especially during their first visit [1]. Managing uncooperative behaviour can be challenging and may require specialised techniques such as positive reinforcement, distraction, and parental involvement. Fingerprints are different for each person and will stay that way for the rest of their lives. There are many genes that determine how fingerprints look, and studying fingerprints can provide important genetic and medical information about a person. It is not observed even in identical twins; therefore, studying them can help elucidate factors that may aid in diagnosis and treatment [2].

Cummins H and Midlo C coined the term dermatoglyphics in 1926 [3]. Finger prints develop during the 12th and 13th weeks of pregnancy and remain consistent throughout life. Scientific study of fingerprints is called dermatoglyphics [4]. The scientific study of fingerprint patterns has emerged as a potential tool in understanding a child's behavioural tendencies, including their level of cooperation in paediatric dentistry. Fingerprints develop during early foetal life and are influenced by both genetic and neurological factors, making them unique to each individual. Dermatoglyphics has become popular in dentistry [2]. The distinctiveness of a fingerprint over a lifespan make it an appropriate tool to identity recognition [5]. Cummins H and Midlo C classified these prints into three major groups namely loop, whorl, and arch types. A loop is the most prevalent pattern. It looks like a sequence of ridges that go from one side of the digit to the pattern region, suddenly curve back, and then leave the pattern area on the other side. The ridges in a whorl are concentrically arranged and the arch ridge pattern shows parallel ridges crossing the finger from one side to the other without recurving [6].

Some investigations have shown a connection between fingerprints and diseases in medicine and dentistry, like dermatoglyphics and chromosome abnormalities, kidney problems, high blood pressure, and breast cancer. Researchers have looked into the link between fingerprints and mouth disorders in great detail [7]. Various authors investigated the association between fingerprint type and periodontal disease [8]. Similarly, for dental caries and malocclusions study was explored [1]. However, very few studies have showcased a link between the behavioural aspects of an individual and fingerprint. A study was previously conducted in Iran to assess the relationship between fingerprint patterns and children's behaviour in the dental office, as well as their level of cooperation with the dentist [9].

Studies conducted in India showed no significant results and were confined to only a particular region [5]. However, no such studies have been carried out in the children of Wardha region, Maharashtra.

Therefore, this study aims to evaluate the correlation between fingerprint patterns, children's behaviour, and their level of

cooperation during dental operatory in children of Wardha region, Maharashtra.

Primary objectives:

- To assess fingerprint patterns (loop, whorl, and arch) in children undergoing dental treatment.
- To evaluate children's behaviour and level of cooperation in the dental office using Frankl's Behaviour Assessment Scale.
- To analyse the correlation between fingerprint patterns and children's behavioural responses in the dental setting.

Secondary objective:

- To explore the potential of dermatoglyphics as a predictive tool for assessing children's cooperation in paediatric dentistry.

Null Hypothesis (H_0): There is no significant association between fingerprint patterns (loop, whorl, arch) and children's behaviour (cooperative vs uncooperative) in the dental operatory. Fingerprint pattern distribution is independent of behavioural category.

Alternate Hypothesis (H_1): There is a significant association between fingerprint patterns (loop, whorl, arch) and children's behaviour (cooperative vs uncooperative) in the dental operatory. Fingerprint pattern distribution depends on the behavioural category.

REVIEW OF LITERATURE

According to Meera AK et al., this study explored the relationship between fingerprint patterns and children's cooperation in paediatric dentistry [1]. A total of 80 children (aged 4-7 years) were assessed during their first dental visit. Behaviour was recorded using Frankl's scale and categorised as cooperative or uncooperative, while fingerprints were collected separately. Statistical analysis (Chi-square test, $p<0.05$) revealed a significant correlation. Among cooperative children, the loop fingerprint pattern was most common, whereas uncooperative children predominantly had the whorl pattern ($p<0.01$). The findings suggest that fingerprint patterns may help predict children's behaviour during dental procedures, aiding in better behaviour management.

According to Subramanian EM and Janiani P, the study assessed the correlation between fingerprint patterns and children's behaviour during dental treatment [5]. Thirty children (aged 4-8 years) requiring restorations without local anaesthesia were evaluated. Behaviour was recorded using Frankl's rating scale, and fingerprints were collected. Analysis using SPSS (Chi-squared test, $p<0.05$) showed that the loop fingerprint pattern was most common and associated with cooperative behaviour, while the whorl pattern was linked to uncooperative behaviour. The findings suggest a positive correlation between fingerprint type and dental behaviour, highlighting the potential of dactyloscopy in predicting and managing children's cooperation in dentistry.

According to Kamatchi M et al., this study investigated the association between fingerprint patterns and children's behaviour during tooth extraction under local anaesthesia [10]. Fifty children (aged 4-9 years) participated after parental consent. Their behaviour was recorded during extraction, and fingerprints were collected using thumb impressions. Statistical analysis using the Chi-square test examined the correlation. Results showed that most children with loop patterns exhibited positive behaviour, but no significant relationship was found between fingerprint patterns and cooperation ($p>0.05$). While fingerprints may offer insights into behavioural tendencies, they cannot reliably predict cooperation during dental procedures. Identifying children's behaviour remains crucial for selecting appropriate behaviour management techniques in paediatric dentistry.

According to Kiran DPS et al., (2022), this study explored the link between fingerprint patterns and Frankl's behaviour rating scale in children aged 6-12 years [4]. A total of 52 participants underwent dental procedures, and their behaviour was assessed. Fingerprints were scanned using a biometric scanner and categorised into three groups: whorl, loop, and arch. Results showed that 46.4% of non-cooperative children had loop fingerprint patterns, while 58.3% of cooperative children had whorl patterns. The study concluded that children with loop fingerprints were more likely to exhibit negative behaviour, whereas those with whorl patterns were more likely to be cooperative during dental treatment.

According to Mokhtari S et al., (2021), a total of 51 children aged 3-6 years were examined [9]. After meeting inclusion criteria, they underwent a dental procedure, during which their behaviour was assessed using the Frankl scale. Inter-examiner agreement was ensured through random evaluations. Based on the Frankl questionnaire, children were categorised as cooperative (31) or uncooperative (20). Fingerprint analysis, conducted using SPSS 21 (chi-squared test, $p<0.05$), revealed that the whorl pattern was predominant in uncooperative children, while the loop pattern was more common in cooperative children ($p=0.01$). The arch pattern had the lowest frequency and showed no significant difference between groups. These findings suggest a potential link between fingerprint type and children's behaviour during dental treatment, which may help predict cooperation levels.

MATERIALS AND METHODS

A cross-sectional study will be the research design for the study. A total of 84 children will be divided into two groups 42 children in each group, based on Frankl behaviour rating scale.

The present study will be carried out in the Department of Paediatric and Preventive Dentistry of Sharad Pawar Dental College and Hospital, Sawangi (Meghe), Wardha. The study will be conducted between November 2025 to August 2026. The institutional ethics committee of Datta Meghe Institute of Higher Education and Research (Deemed to be University) approved the research (ref. no: DMIHER (DU)/IEC/2025/742). (IEC) Institutional Ethical Committee Date of approval: April 21, 2025.The Clinical Trials Registry of India has registered number CTRI/2025/07/089917. Throughout the study, the registration guarantees transparency, accountability, and adherence to moral principles.

Informed written consent will be taken from the parents. The procedure includes only an oral examination with a diagnostic instrument. In this session, the parent will accompany the child to the operating room. The child will sit on the dental chair, and the examination will be done. Paediatric Dentistry postgraduate trainee (SH) will assess the children's behaviour during the oral examination using the Frankl Behaviour Rating Scale. Children displaying Frankl Behaviour Rating Scale ratings of 1 (––) and 2 (–) are classified as uncooperative, whereas those with ratings of 3 (+) and 4 (++) are classified as cooperative [10,11]. In the next stage, children's fingerprints will be collected by placing their fingers on a digital scanner. The classification and recognition of fingerprints will be done based on Cummins method of fingerprint identification into whorls, loops, and arches. Each subject's classified patterns were double-checked for any discrepancies [12]. To ensure accuracy, each fingerprint will be classified twice. Identification and categorisation of fingerprints were performed based on standard classifications by another blinded, trained dentist [13]. In case of discrepancies, another trained and calibrated dentist will re-evaluate the classification blindly to maintain consistency and reliability.

Inclusion criteria:

- Children age 4-8 years;
- Parent's consent to participate in the study;
- No previous dental experience or treatment.

Activity / months	Apr 2025	May 2025	Jun 2025	Jul 2025	Aug–Oct 2025	Nov 2025	Dec 2025	Jan 2026	Feb 2026	Mar 2026	Apr 2026	May 2026	Jun 2026	Jul 2026	Aug 2026
IEC approval	■														
CTRI registration				■											
Protocol finalisation			■	■	■	■									
Pilot calibration & training					■	■	■								
Participant recruitment & consent						■	■	■	■						
Behaviour assessment (Frankl scale)						■	■	■	■	■					
Fingerprint collection & classification						■	■	■	■	■	■				
Data entry & cleaning							■	■	■	■	■	■			
Statistical analysis									■	■	■	■	■		
Manuscript writing										■	■	■	■	■	
Submission and publication												■	■	■	■

[Table/Fig-1]: Gantt chart.

Exclusion criteria:

- History of medical, congenital, psychological and mental disorders;
- History of penetrating trauma or burning that may have changed the dermatoglyphic pattern;
- Children who have any skin disorder on their fingers where it is impossible to take fingerprints;
- Children having oral habits like thumb sucking or digit sucking or nail biting that may affect fingerprints.

Sample size calculation: Sample size calculation for comparing two proportions cooperative and uncooperative fingerprints pattern for loop.

Formula used:

$$n \geq \frac{\left[Z_{1-\alpha/2}\sqrt{(r+1)\,p(1-p)} + Z_{1-\beta}\sqrt{p_1(1-p_1)+p_2(1-p_2)}\right]^2}{r(p_2-p_1)^2}$$

Given values:

- $Z(1-\alpha/2)=1.96$ (for $\alpha=0.05$)
- $Z(1-\beta)=0.84$ (for $\beta=0.2$)

Proportion in Group-1 (p_1)=0.7234* [1]

Proportion in Group-2 (p_2)=0.4242* [1]

(*Since their paper did not give variance values, we used suitable estimates with help from a statistician)

Ratio (Group-2 / Group-1) (r)=1.

p=(0.7234+0.4242) / (1+1)=0.5738.

n={(1.96×√(2×0.5738×(1-0.5738))+0.84×√(0.7234×(1-0.7234)+0.4242×(1-0.4242)))²} / (1×(0.4242-0.7234)²)

n=42.

Primary outcomes: Distribution of fingerprint patterns (loop, whorl, arch) among cooperative and uncooperative children [1]

Behavioural assessment scores of children during dental examination using Frankl's Behaviour Rating Scale [11].

Correlation between fingerprint patterns and behavioural responses of children in the dental operatory.

Secondary outcomes: Predictive value of dermatoglyphics in determining a child's level of cooperation before dental procedures.

Identification of fingerprint patterns that may serve as potential indicators for behaviour management planning in paediatric dentistry.

STATISTICAL ANALYSIS

The Statistical Analysis Plan (SAP) includes descriptive statistics such as frequency and percentage to summarise the distribution of fingerprint patterns (loops, whorls, arches) and Frankl's behaviour ratings among the study participants. The Chi-square test will be used to assess the association between fingerprint patterns and behavioural responses. Additionally, if required, Fisher's-exact test may be applied for small sample sizes to ensure accurate association analysis. For further validation, logistic regression analysis may be employed to evaluate the predictive value of fingerprint patterns on cooperative behaviour. A p-value of <0.05 will be considered statistically significant.

Gantt chart showing the study flow is presented in [Table/Fig-1].

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PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Student, Department of Paediatric and Preventive Dentistry, Datta Meghe Institute of Higher Education, Wardha, Maharashtra, India.
2. Professor, Department of Paediatric and Preventive Dentistry, Datta Meghe Institute of Higher Education, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Shepali Hule,
Postgraduate Student, Department of Paediatric and Preventive Dentistry, Sharad Pawar Dental College and Hospital, Sawangi, Wardha-442001, Maharashtra, India.
E-mail: shepalihule3@gmail.com

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