

## Association Between Dermatoglyphics and Dental Caries Among Children

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**Vasanthan RM, Intern,**

Tagore Dental College and Hospital.

**Dr. Soundarya S.P**

Assistant Professor, Department of Public Health Dentistry, Tagore Dental College and Hospital

**Dr. Vaishnavi.S**

Associate Professor, Department of Public Health Dentistry, Tagore Dental College and Hospital

**Dr. Kumara Raja B**

Associate Professor, Department of Public Health Dentistry, Tagore Dental College and Hospital

**Vethika K, Intern,**

Tagore Dental College and Hospital.

**Corresponding Author: Dr. Soundarya S.P,**

Assistant Professor, Department of Public Health Dentistry, Tagore Dental College and Hospital,  
email id: surasoundaryaprabhakar@gmail.com

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### Abstract

**Introduction:** Dental caries is considered to bear a multi-etiological basis wherein both environment and genetics play an important part. Dermatoglyphics is the "study of dermal ridge patterns volar surfaces of fingers, palms, and soles." Formation of ridges initiates in 13th week of prenatal life, while the formation of patterns is completed by 19th weeks of development. The formation of ridge is influenced by neurovascular bundles present between epidermis and dermis during prenatal development while the ridge patterns are influenced by inadequate oxygenation, unusual sweat gland distribution, and epidermal growth alterations. It was proposed that a link between dermatoglyphic and dental caries may be compared since dental caries may have a hereditary component.

**MATERIALS AND METHODS:** A case control study was carried out on 162 children visiting Paediatric Departments of Dental Colleges in Chennai City aged between of 6-14 years. The obtained data were subjected to statistical analysis using chi-square test. P value less than 0.05 was considered as statistically significant.

**RESULTS:** The results showed that the mean DMFT index was  $4.36 \pm 1.83$ . The most common type of finger print was plain loop and followed by plain whorl. The central pocket loop type of finger print had more caries prevalence when compared to others. The p value was 0.00 which was statistically significant.

**CONCLUSION:** The most common type of finger print was plain loop and followed by plain whorl. The central pocket loop type of finger print had more caries prevalence when compared to others.

### 1. Introduction:

Dental caries is considered to bear a multi-etiological basis wherein both environment and genetics play an important part.<sup>1</sup> Cummins and Midlo in 1926 coined the term "Dermatoglyphics" It originated from two Greek words "Derma" which means skin and "Glyphics" which means carving.<sup>2</sup> In ancient India, ridge pattern study was called "Samudra Shastra" and

the whorls, loops, and arches visible on the ridges were, respectively, called as Chakra, Shankya, and Padma. The first study on dermatoglyphics was carried out by Grew in Western World in 1684 while in India the earliest study was carried out by William Herschel in 1880.<sup>3</sup>

Dermatoglyphics is the "study of dermal ridge patterns on volar surfaces of fingers, palms, and

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soles.” Formation of ridges initiates in 13th week of prenatal life, while the formation of patterns is completed by 19th weeks of development. The formation of ridge is influenced by neurovascular bundles present between epidermis and dermis during prenatal development while the ridge patterns are influenced by inadequate oxygenation, unusual sweat gland distribution, and epidermal growth alterations. These ridges are indicators of intrauterine dental abnormalities in sixth to seventh week of development.<sup>4</sup>

Dermatoglyphics is considered for genetic correlation with dental caries as the epithelium of primary palate, and finger buds are both ectodermal in origin. As enamel and the finger buds develop during the same time, factors affecting dental caries might cause peculiarities in dermal ridge patterns. Therefore, hereditary and environmental factors leading to dental caries may also affect the fingerprint patterns.<sup>5</sup>

Individuals with plain loop, double loop, whorled arch, tented arch, and central pocket loop have demonstrated dental caries susceptibility. Any deviation in dermatoglyphic patterns is indicative of dental caries susceptibility.<sup>4</sup>

Gallon in 1892 classified ridge patterns of distal phalanges into three basic types: whorls, loops, and arches. A) Arch pattern: This constitutes the simplest form of pattern. Types of arch patterns include: i) Simple or plain arch pattern: This comprises of ridges crossing fingertips from one to another side without curving; ii) Tented arch pattern: This pattern is characterized by a point of confluence termed as “triradius” as the ridges radiate from this point to three directions. This triradius is localized near midline axis of distal phalanx; B) Loop pattern: It is the most common ridge pattern. In this, ridges enter on one side, undergo abrupt recurve, and leave on the same side. If the ridge opening is on ulnar side, the loop is called “ulnar loop”; if it opens on a radial side, it is called “radial loop.” The triradius is laterally located on one side where loop has closed end. These may

## 2. Methods and Materials:

After approval from the Institutional Ethics Committee, the study was conducted on patients attending the Outpatient Department of Paediatric and Preventive Dentistry, in various Dental College and Hospital among Chennai, over a period of 3 months.

vary in size and shape or may be plain or double loops; C) whorls: This pattern contains two or more triradii. Henry in 1973 used the “whorl” for ridged encircling core. He designated more complex patterns as “composites.” The “concentric whorl pattern” is arranged as succession of concentric elliptical rings. “Double or spiral whorl pattern” is seen as spirals around a core either in clockwise or anti-clockwise direction. Complex patterns comprised of triradii and whorls are termed as “Accidentals.” Sometimes, configurations composed of loop or whorl or triple loops can also be classified as “Arch with loop” and “Arch with whorl.”<sup>6</sup>

The dermatoglyphics also plays an important role in forensic sciences and is used to identify unknown fingerprints of individuals. Three types of fingerprints are technically studied in addition to morphological types such as plastic impressions (made in soft material like butter, soap, etc.), visible prints (prints made when fingers have been covered in blood, dirt, oil, paint, etc.), and latent prints (prints not visible to the human eye, hidden, unseen until treated).<sup>7</sup>

Dental caries is the most common disease in the field of dentistry. The factors leading to dental caries are complex and primarily affect the enamel. The etiology of dental caries has been advocated to various environmental and genetic factors. The level to which each factor contributes to the development and progression of caries is variable and changes on an individual basis. Since both enamel and dermal ridge pattern are ectodermal in origin and develop during the same time of intrauterine life, a study to correlate them might be helpful for prediction of caries at an early age.<sup>8</sup>

Therefore, dermatoglyphics might help in early prevention of caries, thereby preventing children and adults from its deleterious effects.

The study was undertaken to find an association between dermatoglyphics and dental caries prevalence in primary dentition bearing children

This was a case-control study comprising of 164 primary dentition bearing children aged between 6 to 14 years who were selected based upon the following exclusion criteria: 1) absence of digits, 2) genetic disorders, 3) subjects undergoing chemotherapy, 4) mentally or physically handicapped subjects, 5) subjects with skin disorders, 6) trauma to finger-tips,

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and 7) uncooperative children. The study protocol was approved from institutional ethical committee on 08/02/20 with an ethical clearance No IEC/TDCH/018/2023. Of these 162 children, 82 subjects belonged to case study group (with dental caries) while control group (caries-free) also comprised of 82 subjects. Prior to data collection, informed written consent was obtained after explaining the study.

Sample size is calculated using **G-power software** version 3.1.9 with level of significance=5% power = 80% with and effect size of 0.4 The total sample size is 164 which is 82 in each group. Convenience sampling method will be used to recruit the children.

Clinical oral examination was performed using mouth mirror and probe. The caries status was recorded as DMFT index score.

For recording fingerprints, the method employed by Sanghavi et al. (2016) was used.[5] Prior to recording fingerprint patterns, hands were washed using soap

#### 4.

#### Results:

The present study was done to determine an association between dermatoglyphics and dental caries prevalence in primary dentition bearing children.

This was a case-control study comprising of 162 primary dentition bearing children aged between 6 to 14 years from patients attending the Outpatient Department of Paediatric and Preventive Dentistry, in various Dental College and Hospital among Chennai, over a period of 3 months.

and water and allowed to air-dry. Following this, the fingers were pressed onto inked stamp-pad and uniform pressure was applied by using a roller. Print patterns were recorded on an A4-sized white paper. Finger-prints of all five digits were made using a stamp paper and ink on an A4-sized white sheet. These prints were studied using magnifying lens. The fingerprints were analyzed as per standard classification. Fingerprint patterns were classified as: a) whorl pattern, b) loop pattern, subclassified into i) ulnar and ii) radial loops, and c) arch pattern, which was subdivided into i) plain and ii) tented arch patterns. Other patterns were double loop whorls, central pocket whorls, and accidental whorls.

#### 3. Statistical Analysis:

Data will be collected and analysed using the Statistical package of social sciences (SPSS) Version 24. T test was used to determine the association between the groups. P value of  $\leq 0.05$  is considered as statistically significant.

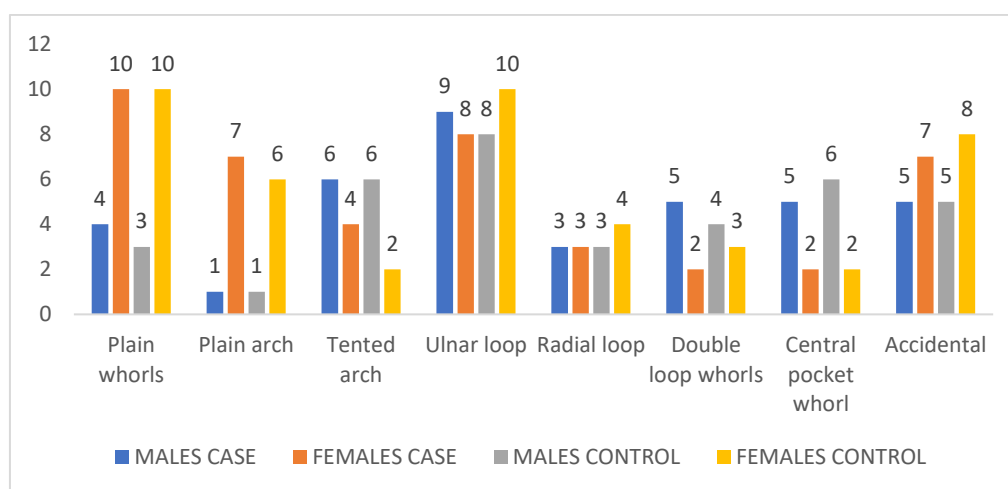
Among 164 children, 82 subjects belonged to case study group (with dental caries) while control group (caries-free) also comprised of 81 subjects.

The results showed that the mean age of the children was  $10.17 \pm 2.33$ , and mean number of decayed teeth was  $4.36 \pm 1.8$ .

**TABLE 1:** Dermatoglyphic patterns' distribution in carious and caries-free children

FINGER PRINT PATTERNS	CARIES GROUP (CASE)		CARIES-FREE GROUP (CONTROL)	
	MALES	FEMALES	MALES	FEMALES
Plain whorls	4	10	3	10
Plain arch	1	7	1	6
Tented arch	6	4	6	2
Ulnar loop	9	8	8	10

<b>Radial loop</b>	3	3	3	4
<b>Double loop whorls</b>	5	2	4	3
<b>Central pocket whorl</b>	5	2	6	2
<b>Accidental</b>	5	7	5	8
<b>p</b>	<b>0.08</b>		<b>0.09</b>	



**Graph 1:** Graph depicting dermatoglyphic pattern distribution among study and control groups

## 5. Discussion:

Dental caries is a multi-factorial oral disease which is characterized by demineralization of inorganic and destruction of organic contents of teeth.<sup>9</sup>

Fingerprints are unique to an individual because they are genetic characteristics of growth and are tailored individually.<sup>10</sup> Genetically regulated processes that influence dental caries include enamel structure, eruption, morphology of teeth, salivary composition and flow, and immune response.<sup>11</sup> The genetic basis of dental caries has been proven by twin studies on caries susceptibility and studies on inherited enamel variations.<sup>12</sup>

Metin Atasu in 1992 compared dermatoglyphic patterns between caries-free and caries affected students and found that those with caries had more whorl pattern as compared to caries-free students who had more of ulnar loop pattern.<sup>13</sup> Ahmed et al. found

ulnar loop patterns more frequently in caries-free group while the whorl pattern was most common in carious subjects.<sup>14</sup> Sharma and Somani also observed an increased frequency of ulnar loops in caries-free children.<sup>15</sup>

Sharma et al. demonstrated the prevalence of whorl pattern in caries subjects while the loop pattern was more seen in caries-free subjects. The whorl pattern showed a significant correlation with *S. mutans* ( $P = 0.4$ ) and *Lactobacilli* ( $P = 0.015$ ) counts in the caries group. It was also established by this study that more than four numbers of whorls were a moderate while less than six number of loops carried good caries prediction.<sup>16</sup>

Shetty et al. conducted a study on 168 students to evaluate the association between dermatoglyphics, dental caries, and oral hygiene status. A statistically significant association was seen between the dermatoglyphics and dental caries experience ( $P <$

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0.05). Loop pattern was associated with high DMFT score. Individuals with arch pattern were found to be caries-free. Association of dermatoglyphics with plaque index scores did not reveal statistically significant results.<sup>17</sup>

Asif et al. evaluated dermatoglyphics in 400 deaf and mute children with or without caries. They found that the arch pattern was most commonly found though it was statistically nonsignificant. Among females of both study groups, arch pattern was the most common followed by loop while among males, arch pattern was more frequent in caries-free group while in caries group, arch pattern was most commonly reported followed by loop pattern.<sup>18</sup>

Veeresh recorded the DMFT (decayed, missing, filled teeth) score of 300 female subjects within the age group of 18–25 years and accordingly divided into 3 groups of 100 each: group 1 (DMFT score =0), group 2 (DMFT score <5), and group 3 (DMFT score ≥5). The mean salivary pH was least in group 3. It was evaluated that the predominant dermatoglyphic pattern observed in groups 1 and 2 was loop pattern, whereas, in group 3, whorl pattern was predominant.<sup>19</sup>

A study conducted by Navit et al. in early childhood caries showed that the “whorl” finger-print pattern was more prevalent in caries-free children and the subjects with early childhood caries did not demonstrate a significant predilection for any one of the ridge patterns.<sup>9</sup> Thakker et al. showed a statistically significant increase in whorl frequency in children with dental caries experience.<sup>20</sup> Anitha et al. concluded that an increase in ulnar loops in caries-free and whorls in children with dental caries.<sup>21</sup>

Sengupta et al. in their study on 200 children diagnosed with dental caries and 100 without dental caries showed that among male subjects, a significant decrease in whorl pattern was seen in non-carious; however, opposite was observed among female subjects. In females, significantly less numbers of ulnar loops were seen in caries group, while no statistically significant observation was seen among male subjects.<sup>22</sup>

Archana et al. reported whorl pattern in 50.8%, ulnar loop in 45.2%, radial loop in 3.2%, and arch pattern in 0.8% in dentulous subjects, while in edentulous subjects, an overall reduction in ridge pattern was seen

as whorl (49.8%), ulnar loops (37.4%), and radial loops (2.8%) while arch pattern increased to 10%.<sup>23</sup>

Srilatha et al. showed significant as well as a positive correlation of dental caries with *S. mutans*, while ulnar loops and total ridge count demonstrated negative correlation.<sup>24</sup>

Chinmaya et al. showed a higher prevalence of dental caries in subjects with whorl pattern with comparison to other patterns, while subjects with loop pattern demonstrated lowest dental caries prevalence. This was found to be statistically significant ( $P < 0.05$ ). The whorl pattern subtypes of central pocket whorl along with terminal loop showed maximum caries prevalence.<sup>25</sup>

Erkatehy and Sheta reported an increase in whorl frequency and reduction in loop frequency in caries group on comparison with caries-free group.<sup>26</sup>

Sanghavi et al. also observed high whorl pattern numbers in carious subjects, while a greater numbers of loop pattern was seen in caries-free subjects.<sup>27</sup>

Nallanchakrava et al. in their dermatoglyphic analysis in specially-abled subjects with dental caries found a higher number of “loop patterns” when compared to control group.<sup>28</sup>

Upadhyaya et al. concluded in their study more frequency of whorls in caries group than in caries-free group. The loop and arch patterns were more frequent in caries-free subjects than in control group.<sup>29</sup> Deepti et al. reported that the loop pattern was most prevalent in subjects with dental caries followed by whorl pattern, while the ulnar loop pattern was common in both caries—positive as well as control subjects.<sup>30</sup> In addition, Sharma and Somani demonstrated a higher prevalence of loop pattern in caries-free subjects than in subjects with dental caries.

## 6. Conclusion and Public Health Significance

Dermatoglyphics has proven to be a very useful, non-invasive, and economical tool for the preliminary diagnosis of diseases of suspected genetic origin like dental caries. An association of dermatoglyphics and dental caries may be helpful in identifying the possible genetic predisposition and early prediction of dental caries in children, so as to initiate oral health measures at an early stage.<sup>31</sup> Both dermatoglyphics

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and dental caries are genetically determined diseases; hence, studies on their correlation have been focused upon so as to ascertain it as a positive indicator of disease. This paper adds data on dental caries prevalence and dermatoglyphic pattern among pediatric subjects.<sup>32</sup> Although there is some contradictory data available, the evidence of such makes it more the reason why such studies should be carried out.

## DECLARATION OF PATIENT CONSENT

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal.

## References:

- [1] Shinkaruk-Dykovytska M, Borisenko A. Local administration-territorial specificity dermatoglyphics of men in Ukraine affected by caries at various levels of intensity. *Curr Issues Pharm Med Sci* 2015;28:51-4.
- [2] Ramani P, PR Abhilash, Sherlin HJ, Anuja N, Premkumar P, ChandrasekarT, et al. Conventional dermatoglyphics-Revived concept: A review. *Int J Pharm Bio Sci* 2011;2:446-58.
- [3] Cummins H, Midlo C. *Finger Prints, Palm and Soles: An Introduction to Dermatoglyphics*. New York: The Blakistan Co. Inc.; 1961.
- [4] Chandrasekaran S, Chellammal R, Ganaply DM. Dermatoglyphics: A tool in dentistry. *J Adv Pharm Edu Res* 2017;7:248-52.
- [5] Sharma A, Sood V, Singh P, Sharma A. Dermatoglyphics: A review on fingerprints and their changing trends of use. *Chrimed J Health Res* 2018;5:167-72.
- [6] Sanghavi PH, Soni HK, Joshi MU. Correlation of dental caries and dermatoglyphics in pediatric cases. *Ind J Dent Sci* 2016;8:131-4.
- [7] Navit S, Chadha D, Khan SB, Singh RK, Johri M, Navit P, et al. The mystery of handprints assessment and correlation of dermatoglyphics with early childhood caries: A case-control study. *J Clin Diagn Res* 2015;9:Z44-8.
- [8] Mittal M, Puri A, Gupta R, Nangia R, Sachdeva A, Guleria M. dermatoglyphics and ental caries: A comparative study in Sikhs and Non-Sikh population. *Ind J Forens Odontol* 2013;6:81-6.
- [9] Abhilash PR, Divyashree R, Patil SG, Gupta M, Chandrashekhar T, Karthikeyan R.

The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## CONFLICTS OF INTEREST

There are no conflicts of interest.

- Dermatoglyphics in patients with dental caries: A study on 1250 individuals. *J Contemp Dent Pract* 2012;13:266-74.
- [10] Somani R, Gupta MP, Jaidka S, Singh DJ, Puri V, Kumar D. Dermatoglyphics as a noninvasive tool for predicting dental caries in cerebral palsy and healthy children: An in vivo study. *Int J Cl Pediatr Dent* 2019;12:237-42.
- [11] Chand SC, Parmar HR, Patel JKL, Bathvar AK, Garasiya MK, Nisarta PK. Praiseworthiness of dermatoglyphics in determining dental caries vulnerability among Gujarati children: A cross-sectional study. *Nat J Comm Med* 2018;9:453-7.
- [12] Kaur K, Mahajan N, Singh A, bansal S, Kaur R. Dermatoglyphic patterns in children with dental caries: An in vivo study. *Ind J Dent Sci* 2018;10:16-20.
- [13] Khokar V, Tarannum G, Pathak A. dermatoglyphics interpretation of dental caries: An in vivo study. *Ind J Dent Med Res* 2015;1:54-6.
- [14] Chandrasekaran S, Chellamal R, Ganapathy DM. Dermatoglyphics: A tool in dentistry. *J Adv Pharm Edu Res* 2017;7:248-52. 14. Shetty SS, Li GSM, Babji NAB, Yusof LSBM, Yang NNJ, Jun TD, et al. Dermatoglyphics: A prediction tool for malocclusion. *J Datta Meghe Inst Med Sci Univ* 2019;14:27-30.
- [15] Thaker M, Dodiya D. Dermatoglyphics and its relation with various dental diseases. *Int J Adv Sci Engineer Tech* 2017;5:11-6.
- [16] Kaur V, Kaur TP, Sharma M, Yadav T, Malhotra A. Dermatoglyphics, the hidden potential in

# Journal of Coastal Life Medicine

- dentistry- A review. *J Adv Med Dent Sci Res* 2018;6:110-3.
- [17] Jain G. "Dermatoglyphics"- The science of lines and patterns and its implications in dentistry. *Int J Contemp Med Res* 2016;3:2973-7.
- [18] Metin Atasu. Dermatoglyphic findings in dental caries: A preliminary report. *J Clin Pediatr Dent* 1998;22:147-9.
- [19] Ahmed RH, Aref MI, Hassan RM, Mudrammed NR. Dermatoglyphic study on patients with dental caries while wearing dental fillings and its correlation to apoptosis that induced by using dental fillings. *Nature Sci* 2010;8:54-7.
- [20] Sharma A, Somani R. Dermatoglyphic interpretation of dental caries and its correlation to salivary bacteria interactions: An in vivo study. *J Ind Soc Pedod Rev Dent* 2009;27:17-21.
- [21] Sharma R, Singh NN, Sreedhar G. Dermatoglyphic findings in dental caries and their correlation with salivary levels of *Streptococcus mutans* and *Lactobacillus* in school-going children in and around Moradabad. *J Oral Maxillofac Pathol* 2018;22:360-6.
- [22] Shetty SS, Saran R, Swapna BV, Shetty S. Association of dermatoglyphics with dental caries and oral hygiene status. *SRM J Res Dent Sci* 2018;9:29-31.
- [23] Asif SM, Lahig AR, Babu DBG. Dermatoglyphics: A tool in detection of dental caries. *Br J Med Med Res* 2016;12:1-5.
- [24] Veeresh T. Correlation between dermatoglyphics, dental caries and salivary pH: An in vivo study. *Ethiop J Health Sci* 2019;29:929-34.
- [25] Thakker VP, Rao A, Rastogi P, Shenoy R, Rajesh G, Mithun Rai BH. Deramtoglyphics and dental caries: A cross-sectional study among 12 years old school children in Mangalore, India. *Ind J Forens Med Path* 2014;7:19-25.
- [26] Anitha C, Konde S, Raj NS, Kumar NC, Peethamber P. Dermatoglyphics: A genetic marker of early childhood caries. *J Ind Soc Pedod Prev Dent* 2014;32:220-4.
- [27] Sengupta AB, Bazmi BA, Sarkar S, Kar S, Ghosh C, Mubtasum H. A cross-sectional study of dermatoglyphics and dental caries in Bengalee children. *J Ind Soc Pedod Prev Dent* 2013;31:245-8.
- [28] PJ Archana, B George, ST Sebastian, RR Soman, VM Mulamoottil. An assessment of relationship between dermatoglyphics and tooth loss. *Int J Forens Odontol* 2018;3:86-9.
- [29] Srilatha A, Doshi D, Kulkarni S, Reddy MP, Reddy BS, Satyanarayana D. determination and comparison of dermatoglyphic patterns and salivary streptococcus mutans counts and its correlation with dental caries among 3 to 6-year old children. *Oral Health Prev Dent* 2018;16:291-7.
- [30] Chinmaya BR, Smitha BV, Tendon S, Khurana C. Dermatoglyphics: An indicator of dental caries in humans. *J Ind Assoc Publ Health Dent* 2016;14:272-5.
- [31] Somani R, Gupta MP, Jaidka S, Singh DJ, Puri V, Kumar D. Dermatoglyphics as a noninvasive tool for predicting dental caries in cerebral palsy and healthy children: An in vivo study. *Int J Clin Pediatr Dent* 2019;12:237-42.
- [32] Bozhchenko AP, Gomom AA. The role of the combinatorial analysis in forensic medical dermatoglyphics: The possibilities and variants of its application in research and expert studies. *Sud Med Ekspert* 2018;61:17-20