ORIGINAL RESEARCH PAPER

Volume-8 | Issue-4 | April-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# DERMATOGLYPHIC PATTERNS IN CHILDREN WITH CLEFT LIP AND PALATE

Dental Science

**Dr Niharika Dubey**

**Dr Priyanka P. Niranjane***

Associate Professor, Department of Orthodontics & Dentofacial Orthopedics, Sharad Pawar Dental College & Hospital, DMIMS (Deemed to be University), Sawangi (M) Wardha, Maharashtra.*Corresponding Author

## ABSTRACT

The current study was done to assess dermatoglyphic patterns in children with non syndromic cleft lip and palate and to determine usefulness of dermatoglyphics in studying genetic etiology of cleft lip and palate anomalies. 60 children aged 5-15 years, were divided into two groups of 30 children each consisting of non-syndromic cases of cleft lip and palate and normal, healthy children. Finger and palm prints were recorded using 'ink and stamp' method and evaluated for presence of arches, whorls and loops along with angle 'atd', 'tab and 'a-b' ridge count. No statistically significant difference was found between two groups for dermatoglyphic patterns, angle 'tab' and 'a-b' ridge count on right and left hands but mean values of 'atd' angles in both groups significantly differed. Although there were slight differences in dermatoglyphic peculiarities of patients with oral clefts and normal children, most of palm and fingerprint characteristics failed to indicate any significant differences.

## KEYWORDS

## INTRODUCTION

The intricate and unique patterns in the form of valleys and ridges present on the surface of fingers, palms and soles of humans has been of humongous interest not only to researchers in medicine, but also to anthropologists, palmists and psychologists.[1] Harold Cummins and Midlo in 1926 coined the term "dermatoglyphics" which refers to the study of dermal patterns occurring naturally on the palmer and plantar surfaces of hands and feet. Cummins is well recognized as the Father of Dermatoglyphics. The fact that these patterns are exclusively distinctive to an individual makes them useful for personal identification.[2]

Characteristic dermatoglyphic patterns can be seen in cases of oral submucous fibrosis, dental caries, oral cancer, skeletal malocclusion, bruxism, dental fluorosis and oral clefts.[3] Also, a high degree of prognostic ability of some diseases has been claimed by researchers in recent years.[2,4]

Cleft lip with or without cleft palate and cleft palate are birth defects which are inherited and have a complex etiology and broad phenotype.[5] The development of primary palate along with the lip, in humans, is completed by 7$^{th}$ week of intra uterine life which is followed by the development of secondary palate by the 12$^{th}$ week of intra uterine life.[6] Concordantly, the commencement of formation of dermal patterns is related to the genesis of volar pads that form by the 6$^{th}$ week of intra uterine life and reach to maximum size between 12$^{th}$ and 13$^{th}$ weeks.[7]Once formed, these patterns do not change, throughout the life of an individual, are not altered by age or disease, and remain unaffected by any environmental or constitutional disturbances in the gestative period and beyond, with an exception of increase in size which is proportional to the growth of the individual.[9]This implies that in this period, the encoded genetic message within the genome (either normal or abnormal) is deciphered as it is and also gets reflected by dermatoglyphics.[7]The uniqueness of the palm-prints and fingerprints is influenced by the minute changes in the local fetal environment which in turn are genetically determined.[9] Several studies have reported congenital defects, syndromes and other developmental disorders associated with altered dermatoglyphic patterns based on the initial observation by Cummins in 1939 who stated that patients with Down's syndrome have an abnormal finger and palm prints.[8] A high degree of prognostic ability of some diseases has been claimed by researchers in recent years.[2,4]

Hence, this study was done in order to differentiate the dermatoglyphic patterns in children with non syndromic cleft lip with or without cleft palate and those in normal children and to discern the utility of dermatoglyphics in studying the genetic etiology of cleft lip with or without cleft palate anomalies.

## MATERIALS AND METHODS

This study was conducted in the Department of Orthodontics and Dentofacial Orthopaedics, Sharad Pawar Dental College, Datta Meghe Institute of Medical Sciences, (Deemed to be University), Wardha.

The sample size consisted of 60 patients that were divided into two groups –

Group 1 -: 30 children with non-syndromic cleft lip with or without cleft palate selected from Outpatient Department of Orthodontics and Dentofacial Orthodontics.

Group 2 -: 30 normal, healthy children without any medical or congenital anomalies selected from Outpatient Department of Pedodontics and Preventive Dentistry.

### INCLUSION CRITERIA -:

1. Children aged between 5-15 years with no differences between the sexes.
2. Presence of unilateral as well as bilateral cleft of lip and palate.
3. Absence of any systemic disorders.

### EXCLUSION CRITERIA -:

Children with syndromic cleft lip and palate. Approval from the ethical committee was taken prior to the conduction of this study. A written informed consent form was obtained from the parents of all the patients after explaining them the intended procedure of this study in their vernacular language before the study began.

### Dermatoglyphic pattern recording –

The data was collected using ink and stamp method. (Fig-1).The right and left hand of each child was thoroughly washed with soap and water to eradicate any dirt and oil from the ridged skin and air dried to improve the quality of finger and palm prints. The dried palms and fingers of the left and right hands, one by one, were pressed firmly on a blue ink pad and the ink was uniformly spread using a small rolling paint brush after lifting hands from the ink pad. Each hand was then placed carefully on a white A-4 size bond paper (which was firmly clipped on to a hard board) with all the fingers separated and pressure was applied gently to transfer the patterns on to the paper. The thumbs were rolled from lateral to medial aspect to ensure a complete imprint of the thumb ridge pattern onto the paper. In some cases, thumb prints were taken separately. Then, the hands were gently lifted away from the paper and rinsed with rubbing alcohol. The prints were labeled by sides (right or left) and by each digit using Roman numbers (customarily, the thumb = I and the little finger = V).

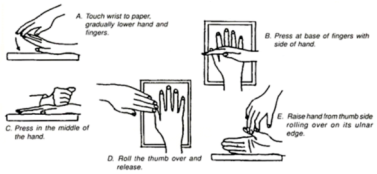



Fig. 1: Procedure for taking complete Palm Print

- **Method of reading palm and finger prints –**

The handprints obtained were then checked for their clarity with a magnifying glass and coded. The presence of core and triradii of the dermatoglyphic pattern were checked thoroughly in the handprints, for them to be included in the study.

- **Quantitative dermatoglyphic analysis – (Fig-2)**

Usually, four triradii are present on each palm, one at the base of each digit II through V and these digital triradii are traditionally labeled a, b, c and d while triradii located proximally (toward the wrist) on the palm near to the central axis of hand are named t. The 'atd' angle is a trait of palm that divulges the position of three triradii – 'a' and 'd', usually located on distal palm just inferior to 2nd and 5th fingers respectively and 't' whose location can vary on the proximal palm from just distal to the wrist, up to the centre of the palm. The atd angles are measured for each palm print by drawing two straight lines through 'a' and't' triradii and the 'd' and 't' triradii and measuring the angle between them.

Similarly, 'tab' angle revealed the position of three triradii i.e 'a' and 'b' which are located just inferior to 2nd and 3rd digits respectively and't' as mentioned above. The 'tab' angles are measured for each palm print by drawing two straight lines through't' and 'a', and 'a' and 'b' triradii and measuring the resultant angle. The atd and tab angles are compared and assessed for increase or decrease in mean frequencies between the two groups.

The third parameter is 'a-b' ridge count i.e., the total number of ridges present between the 'a' and 'b' points.[10]

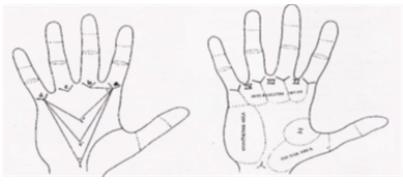


**Fig-2**

- **Qualitative dertmatoglyphic analysis –**

Types of dermatoglyphic pattern: (Fig-3-a)

An **arch** demonstrates the simplest ridge pattern, which is created by succession of one or more parallel ridges, which cross the finger from one side to the other without recurving and generally do not show the presence of triradii, except for the tented arch that will have a triradii point near the midline.[10]

A **whorl** has the feature of concentric arrangement of ridges, with two or more triradii in the latter. Depending upon the internal structure of the whorl pattern, a whorl may be spiral, symmetrical, double looped, central-pocketed or accidental.[10]

A **loop** is recorded as a series of ridges that enters the pattern area on one side of the digit, recurves abruptly and leaves the pattern area on the same side. Only a single triradius is present, which is located laterally on the fingertip, where the loop is closed.[9]


**Fig-3a**

The frequency of true patterns of arches, whorls and loops were counted on the fingertips of all the 10 digits of children with non-syndromic cleft lip and palate and normal children. They were assessed for increase or decrease in mean frequencies in both the left and the right hands.

Finger and palm prints were recorded and interpretation for qualitative and quantitative dermatoglyphic patterns was done according to the method suggested by Cummins and Midlo. (Fig 3-b)

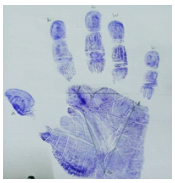


**Fig-3b**

**RESULT**

The data of palm and fingerprints obtained was analyzed using statistical software SPSS version 17.0 for descriptive analysis using Chi-square test and Student's t-test (paired). The qualitative dermatoglyphic data i.e., arch, whorl and loop were compared between the groups 1 and 2 using Chi-square test. Paired Student's t-test was used to analyze the difference in angle atd, angle tab and a-b ridge count between both groups. A p value of <0.05 was considered significant.

- Descriptive data for arch, whorl and loop of patients in both groups is shown in Table 1.1, 1.2 and 1.3. No significant difference was found between two groups in terms of their qualitative dermatoglyphic patterns.

**Table 1.1: Number of arches present in the left and right digits of two groups.**

| Number of Arches | Left | | Right | | $\chi^2$/df | P-value |
|---|---|---|---|---|---|---|
| | Subject | Control | Subject | Control | | |
| 0 | 10 | 9 | 12 | 10 | 1.10 | 0.354 |
| 1 | 8 | 10 | 14 | 15 | | |
| 2 | 8 | 5 | 3 | 1 | | |
| 3 | 3 | 2 | 1 | 1 | | |
| 4 | 1 | 3 | 0 | 2 | | |
| 5 | 0 | 1 | 0 | 1 | | |

**Table 1.2: Number of whorls present in the left and right digits of two groups.**

| Number of Arches | Left | | Right | | $\chi^2$/df | P- value |
|---|---|---|---|---|---|---|
| | Subject | Control | Subject | Control | | |
| 0 | 9 | 12 | 3 | 11 | 1.23 | 0.23 |
| 1 | 4 | 7 | 10 | 7 | | |
| 2 | 6 | 7 | 10 | 7 | | |
| 3 | 7 | 2 | 6 | 5 | | |
| 4 | 3 | 2 | 1 | 0 | | |
| 5 | 1 | 0 | 0 | 0 | | |

**Table 1.3: Number of loops present in the left and right digits of two groups.**

| Number of Arches | Left | | Right | | $\chi^2$/df | P- value |
|---|---|---|---|---|---|---|
| | Subject | Control | Subject | Control | | |
| 0 | 7 | 5 | 2 | 1 | 0.97 | 0.47 |
| 1 | 4 | 3 | 5 | 4 | | |
| 2 | 8 | 4 | 6 | 8 | | |
| 3 | 6 | 13 | 11 | 9 | | |
| 4 | 4 | 3 | 6 | 6 | | |
| 5 | 1 | 2 | 0 | 2 | | |

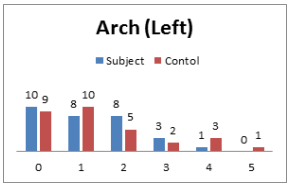
- Descriptive data for angle 'atd', 'tab' and 'a-b' ridge count of patients in both groups are shown in Table 2. A significant difference in values of angle 'atd' was found between patients of cleft and control group; whereas no significant difference was found between values of angle 'tab' and 'a-b' ridge count in both the groups.

**Table 2: Mean (standard deviation) for angle 'atd', angle 'tab' and 'a-b' ridge count.**

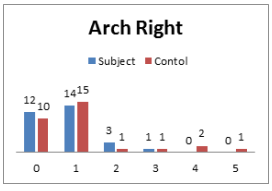
| Parameter | Side | Group | Mean ± SD | p value |
|---|---|---|---|---|
| Angle atd | Left | Subject | 45.03 ± 6.07 | 0.01 |
| | | Control | 48.78 ± 5.83 | |
| | Right | Subject | 43.63 ± 5.72 | 0.003 |
| | | Control | 48.6 ± 6.007 | |
| Angle Tab | Left | Subject | 81.56 ± 6.72 | 0.33 |
| | | Control | 83.26 ± 6.71 | |

| | | | | |
|---|---|---|---|---|
| | Right | Subject | 84.58 ± 6.83 | 0.05 |
| | | Control | 81.41 ±5.62 | |
| a-b ridge count | Left | Subject | 29.93 ± 5.78 | 0.14 |
| | | Control | 32.1 ± 5.35 | |
| | Right | Subject | 30.23 ± 6.16 | 0.15 |
| | | Control | 32.46 ± 4.82 | |

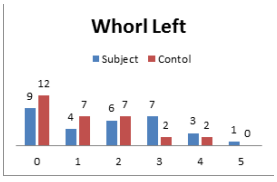
**Graph 1.1a**



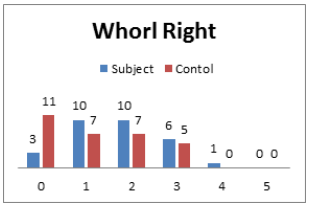

**Graph 1.1b**



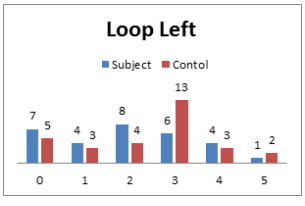

**Graph 1.2a**



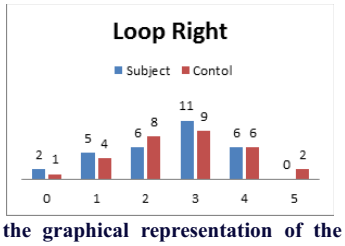

**Graph 1.2b**




**Graph 1.3a**

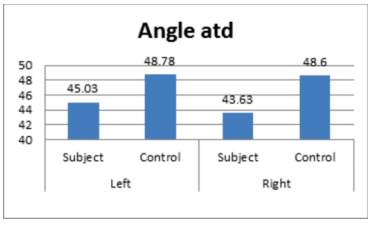



**Graph 1.3b**

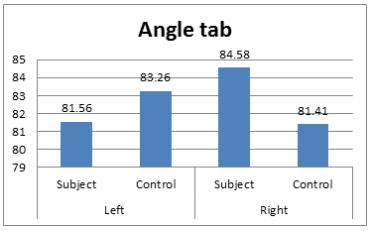



**Following is the graphical representation of the quantitative dermatoglyphic data –**

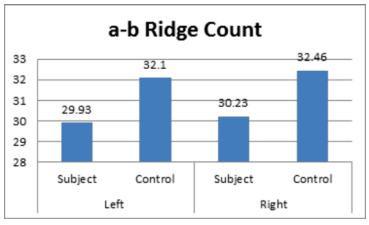
**Graph 2.1**




**Graph 2.2**




**Graph 2.3**




## DISCUSSION

Epidermal ridges of palm and fingers, as well as facial structures form from the same embryonic tissues (ectoderm), within the same embryonic period (6-9 weeks).[15] Nobaru et al stated that genetic and environmental factors that cause cleft lip and palate may also cause peculiarities in the dermatoglyphic patterns.[4] Thus dermatoglyphics being a cost-effective, non-invasive investigation, can be used as an easily accessible tool in the study of genetically-influenced diseases.

The findings of present study reveal a higher frequency of loop patterns followed by whorl patterns with lowest frequency of arch patterns in cleft patients as compared to normal children. Yamagata in (1973) compared the appearance of finger and palm prints of children with cleft lip, alveolus and palate with those of normal persons, and observed a lower frequency of whorl patterns and a higher frequency of loop patterns in children with clefts.[10] In this study, in the order of decreasing frequency (after loops), children with oral clefts had whorls and arches respectively and children in the control group had arches and whorls respectively. But this was not considered significant for the present study. These results were synonymous to the results by Silver and Neiswanger et al[14,16] in which pattern frequencies did not differ statistically between the cleft and control groups. On the contrary, Mathew et al[11] observed that the oral cleft children had a significantly higher number of loop patterns as compared with the children in the control group with higher frequency of the whorl patterns.

In this study, no significant difference was found between any of the qualitative dermatoglyphic configurations in the orofacial cleft group and the controls which possibly suggests that orofacial cleft is a congenital anomaly whose developmental basis seems to be independent of production of atypical qualitative dermatoglyphic patterns. These findings signify that although genetic factors play an important role in determining the ridge configurations, nongenetic (such as environmental) factors also exert major influence for distinguishing the same.

For the quantitative dermatoglyphic parameters, 'atd' angle was selected as one of the parameters for comparison. The study reveals statistically significant differences ($p<0.05$) only in the 'atd' angles (amongst all the quantitative dermatoglyphic data) of the oral cleft children and the control children.

On comparison of the values obtained for the 'atd' angles in right and left palms of both the groups, a statistically significant difference was found which goes in accordance with R.N. Deshmukh, M.S. Grewal and S.S. Sidhu (1981)[11] who also found significant difference in the mean values of 'atd' angles in patients with cleft lip with or without cleft palate when compared with controls. Yamagatian also observed wider 'atd' angles in the palm patterns in the patients. The interdigital area between forefinger and middle finger is exposed to intrauterine environmental pressures for a greater period of time as compared to other parts of the palm. Hence, chances for variations to occur in this area are higher which is why'a-b' ridge count was selected as a quantitative dermatoglyphic parameter for this study[12] In this study, the mean a-b ridge count of both the cleft group and the control group were in the normal range of 10 and 40 i.e., no significant difference was

found in the mean values for this parameter. According to the study conducted by Ma *et al* [13] , there was a significant increase in the mean a-b ridge count in cases where the minimum values were at the upper limit of the normal range (10-40) and the maximum values were beyond the normal range (31–52) and he concluded that this could be a good index for predicting the future risk of cleft lip with or without palate which is also an inheritable palmar trait. There was however no significant difference in the mean values of angle 'tab' in both the groups In their optimal state, genes are nearly symmetrical. Depending upon the alteration in genetic expression, asymmetry will be illustrated in many human bilateral structures such as the orofacial structures. Genetic damage takes place in phylogenic horizon in cleft patients which can be reflected in hands through dermatoglyphic asymmetry and therefore dermatoglyphic analysis can be done as a preliminary investigation in conditions with a suspected genetic base.[14]

**CONCLUSION -:**

Although, in this study, no significant difference was found between the qualitative dermatoglyphic parameters in both the groups, the frequency of the loop patterns on the distal phalanges of ten fingers was the highest in cleft patients, followed by whorls and then arches.

Thus, it can be suggested that dermatoglyphic patterns may not prove to be authentic markers in studying the genetic etiology of cleft deformities. Palmer dermatoglyphic peculiarities, i.e., angle 'atd' are a more reliable entity for studying the same. Further explorations with a much greater sample size are recommended in order to confirm the above mentioned findings.

**REFERENCES -:**


1. Naffah J. Dermatoglyphic analysis: anthropological and medical aspects. Bull N Y Acad Med. 1977 Oct;53(8):681–92.
2. Mulvihill JJ, Smith DW. The genesis of dermatoglyphics. J Pediatr. 1969 Oct;75(4):579–89.
3. Atasu M, Kuru B, Firatli E, Meriç H. Dermatoglyphic findings in periodontal diseases. Int J Anthropol. 2005 Jan 1;20(1):63–75.
4. Kanematsu N, Yoshida Y, Kishi N, Kawata K, Kaku M, Maeda K, et al. Study on abnormalities in the appearance of finger and palm prints in children with cleft lip, alveolus, and palate. J Maxillofac Surg. 1986 Jan 1;14:74–82.
5. Scott NM, Weinberg SM, Neiswanger K, Brandon CA, Daack-Hirsch S, Murray JC, et al. Dermatoglyphic fingerprint heterogeneity among individuals with nonsyndromic cleft lip with or without cleft palate and their unaffected relatives in China and the Philippines. Hum Biol. 2005 Apr;77(2):257–66.
6. Balgir RS. Congenital oral clefts and dermatoglyphics. Isr J Med Sci. 1984 Jul;20(7):622–4.
7. Mathew L, Hegde AM, Rai K. Dermatoglyphic peculiarities in children with oral clefts. J Indian Soc Pedod Prev Dent. 2005 Dec;23(4):179–82.
8. Neiswanger K, Cooper ME, Weinberg SM, Flodman P, Keglovits AB, Liu Y, et al. Cleft lip with or without cleft palate and dermatoglyphic asymmetry: evaluation of a Chinese population. Orthod Craniofac Res. 2002 Aug;5(3):140–6.
9. Ramani DP, Pr DA, Sherlin DHJ, N DA, Premkumar DP, T DC, et al. Conventional Dermatoglyphics –Revived Concept : Review. Int J Pharma Bio Sci [Internet]. 2011 Sep [cited 2019 Jan 8];Volume 2 Issue 3.
10. Yamagata Y. Dermatoglyphic study of harelip and cleft palate (Japanese). 1973 Jan 1;29:143–8.
11. Deshmukh RN, Grewal MS, Sidhu SS. Cleft lip with or without cleft palate and isolated cleft palate, as two aetiological entities- a dermatoglyphic evidence. Indian J Med Res. 1981 Apr;73:584–9.
12. Arrieta MI, Martinez B, Simon A, Salazar L, Criado B, Lostao CM. Quantitative and qualitative finger dermatoglyphics in the Basque Valley of Urola, Spain. Anthropol Anz Ber Uber Biol-Anthropol Lit. 1990 Mar;48(1):65–84.
13. Harika DJ, Sridevi E, Sai Sankar AJ, Pranitha K, Gosla SR, Kiran GB. Dermatoglyphic Analysis in Parents with Cleft Children: A Comparative Study. Contemp Clin Dent. 2018 Sep;9(Suppl 2):S291–8.
14. Livshits G, Kobyliansky E, Opitz JM, Reynolds JF. Dermatoglyphic traits as possible markers of developmental processes in humans. Am J Med Genet. 1987 Jan 1;26(1):111–22.