Research Article

Comparative study of dermatoglyphic palmar interdigital patterns and finger ridge counts of cleft lip with or without cleft palate patients and isolated cleft palate patients with normal population

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Abstract

Introduction: Dermatoglyphic studies shows distinct variations in the patterns amongst the races, sexes, right and left hands of same individual, also mammals of different species. The main etiological factor of cleft lip and cleft palate is genetic in nature. The influences of genetic and environmental factors on early development are often reflected by the altered dermatoglyphics. **Aims and Objectives**: 1) To study the palmar dermatoglyphic patterns in cleft lip and cleft palate patients. 2) To compare the finger ridge counts of cleft lip and cleft palate patients with normal population. **Material and Methods:** The present study is a case control study carried out from Dec 2004 to Nov 2006. 86 cases of cleft lip with or without cleft palate and isolated cleft palate attending OPD of Govt. Medical College and Hospital, Miraj, Civil Hospital, Sangli, Aditya Burn and Plastic Surgery Hospital, Sangli and 100 controls with age and sex matched during the study period were included in study. The cases and controls divided in three groups: A (cleft lip with or without cleft palate); B (isolated cleft palate) and C (Controls). In this study, 'STANDARD INK METHOD' for obtaining the dermatoglyphic prints described by Cummins (1936) and Cummins and Midlo (1961) was used. The parameters studied among different groups were sex wise distribution, hereditary basis, Thenar, Hypothenar, interdigital patterns**,** Total finger ridge count (TFRC) and Absolute finger ridge count (AFRC). Appropriate statistical tests were applied like Mean, Standard Deviation (S.D.), standard Error (S.E.), Unpaired 't' test of significance, for quantitative data, Chi-square' test for qualitative data and 'P' value. **Observations and Results:** Out of 82 Patients, 50 Patients are having cleft lip with or without cleft palate defect, while 32 patients are having isolated cleft palate defect with female dominance. It was seen that percentage of total palmar patterns in group A was 25.4%, group B was 17.5% and in control group 'C' was 32.9%. There was significant difference in comparison of group 'A' and group 'B' TFRC with group 'C' except for females of group 'A'. The difference observed for AFRC was statistically significant in the group 'A' and group 'B' when compared with group 'C' except in females of group 'A' **Conclusion:** Hence, we conclude that the finding of the present study can be useful to explore the possibility of dermatoglyphic association with the congenital cleft lip and cleft palate defects.

Keywords: dermatoglyphic palmar.

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INTRODUCTION

Dermatoglyphics is the scientific study of epidermal ridges and their configurations on the volar aspect of palmar and plantar region.[1] There are distinct variations in the dermatoglyphic patterns amongst the races, sexes, right and left hands of same individual, also mammals of different species.[2] Abnormal dermatoglyphic patterns are known to occur with genetic disorders like Mongolism, Turner's syndrome, Klinefelter's syndrome etc.[3] Cleft lip and cleft palate are common defects that result in

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abnormal facial appearance and defective speech. It is now, generally, accepted that the main aetiological factor of cleft lip and cleft palate is genetic in nature, although in some cases a mixed genetic and environmental causation has been suggested.[4] Cases of cleft lip and palate either have a positive family history or genetic origin.[5] Most of cleft lip with or without cleft palate have polygenic mode of inheritance with sexual modification.[6] A certain proportion is associated with recognizable chromosomal aberrations[7] and rare mutant genes. Maternal teratogens (notably anticonvulsants) during pregnancy can also cause these defects. Also drugs like cortisone and hypervitaminosis 'A' can cause these defects.[8] Congenital abnormalities of the cleft lip with or without cleft palate and isolated cleft palate are developmentally as well as genetically distinct entities.[5] Cleft lip occurs more frequently in males (1:1000 live births) and cleft palate occurs more often in females (1:2500 live births).[9] Combined deformity occurs more often in males.[10] The influences of genetic and environmental factors on early development are often reflected by the altered dermatoglyphics. Therefore taking into consideration, the genetic predisposition of dermatoglyphic characteristics in cleft lip and cleft palate, the study was undertaken to find out correlation between them, so that it may prove helpful in the diagnosis of disease and its pattern of inheritance.

AIMS AND OBJECTIVES

1. To study the palmar dermatoglyphic patterns in cleft lip and cleft palate patients.
2. To compare the finger ridge counts of cleft lip and cleft palate patients with normal population.

MATERIALS AND METHODS

The present study is a case control study carried out from Dec 2004 to Nov 2006 having 86 cases and 100 controls. All the cases of the of cleft lip with or without cleft palate and isolated cleft palate attending OPD of Govt. Medical College and Hospital, Miraj, Civil Hospital, Sangli, Aditya Burn and Plastic Surgery Hospital, Sangli during the study period were included in study. In this study, 'STANDARD INK METHOD' for obtaining the dermatoglyphic prints described by Cummins (1936) and Cummins and Midlo (1961) was used.[3,11]

Equipment used for dermatoglyphic study

Wooden table of proper height, Porcelain tile used as an inking slab, Kore's duplicating ink, Rubber roller, Wooden pad for supporting the paper, White executive bond paper of 15 x 20 cm size, Wooden rod of 30 cm Length, around which the paper is wrapped before obtaining the print on the paper, Soap and Water for washing the hands, Scale, Pencil, Pen, Magnifying hand lens, Needle with a sharp point for ridge counting, Towel for drying the cleaned hands.

Printing Method

The person (patient of cleft lip with or without cleft palate or isolated cleft palate or normal control) is asked to clean both his/her hands by washing them with soap and water. Then the hands are dried with clean towel. A small amount of duplicating ink is spread over the clean and dried porcelain tile kept on the table by means of rubber roller, to obtain, a thin, uniform film of the ink over the tile. Palmar aspects of the distal phalanges of the person's right hand [starting from the little finger] are inked by firm pressure of the finger over the tile, on which thin film of ink is obtained. An executive bond paper kept on the edge of the wooden table, is used for recording the finger print patterns from its right border to left. The fingers are rolled from side to side to obtain complete print of ridged area on the distal phalanges. The same procedure is done for recording the finger prints of left hand using a separate bond paper. To obtain the prints of the palm, the palm of the person's right hand is inked with the help of rubber roller. Then the bond paper is wrapped around the wooden rod and then placed on the table. The inked hand is horizontally pressed against the wooden rod with the fingers and palm thoroughly stretched. Then, with that inked hand, the rod was gradually rolled on the table and slight pressure on the back of the hand is applied during the process of printing or rolling. Complete palm prints are obtained satisfactorily over the bond paper. Apart from the print of the palm, the prints obtained by this technique, also obtain the prints of fingers including the palmar aspect of the terminal phalanges. The same procedure is then followed to print the left palm by using a separate bond paper. The printed sheets are coded with name, age, sex, family history and all other essential details. Each print is immediately examined for detail dermatoglyphic analysis, with the help of magnifying hand lens and sharp needle for ridge counting, and care is taken to note details of all the findings.

Finger Ridge Counting

The counting is done along a straight line connecting the triradial point to the point of core. All the ridges which cross the line (except the ridges forming the triradii and core) are counted in finger ridge counting. In whorls, which show two triradii and one point of core, two different counts are made. The two counts are specified as, first radial and then ulnar to which it belongs, with an oblique line in between the two counts. Usually the ridge counts are recorded in an order, beginning with the little finger of the left hand and counting to the thumb that means from ulnar to radial side. While, digits of the right hand are subjected to finger ridge count starting from the

thumb and continued up to little finger that means in the radio-ulnar direction. Simple and tented arches have zero count. The ridge counts also express the pattern type. [12] Finger ridge count can be expressed in two forms.

Total Finger Ridge Count (TFRC)

TFRC represents the sum of ridge counts of all the ten digits, where only the larger count is used on the digits with more than one possible ridge counts. It reflects the size of the pattern.

Absolute Finger Ridge Count (AFRC)

AFRC represent the sum of ridge counts from all the separate triradii on the finger. It reflects the pattern size as well as pattern density, which depends on the pattern type.

Collection of Data

Following the above mentioned method, finger and palm prints of 82 patients were obtained. As control, prints of 50 normal males and 50 normal females were used. Both the normal controls and patients are matched for age, sex, socioeconomic status. All prints are studied and analyzed for the following parameters:

Analysis of data: The parameters observed among group **A**, **B** and **C** were as follow:

1. Sex wise distribution.
2. Hereditary basis

Qualitative analysis: Thenar, Hypothenar, interdigital patterns i.e. Th /ID_1, ID2, ID3, ID4 patterns

Quantitative analysis

Analysis of Finger ridge counts: Total finger ridge count (TFRC) and Absolute finger ridge count (AFRC). Appropriate statistical tests were applied like Mean, Standard Deviation (S.D.), standard Error (S.E.), Unpaired 't' test of significance, for quantitative data, Chi-square' test for qualitative data and 'P' value.

OBSERVATIONS AND RESULTS

Out of 82 Patients, 50 Patients are having cleft lip with or without cleft palate defect, while 32 patients are having isolated cleft palate defect. Out of 82 patients (of cleft lip with or without cleft palate and isolated cleft palate) 40 are males while 42 are females.

Table 1: Groups of Patients and Controls Selected For The Study

Groups	Clinical Diagnosis	No. of Cases		Total	Positive History Family	
		Male	Female		No.	%
A	Cleft lip with or without cleft palate	28 (56%)	22 (44%)	50	06	12.00
B	Isolated cleft palate	12 (37.5%)	20 (62.5%)	32	06	18.75
C	Controls	50 (50%)	50 (50%)	100	00	00

It was observed that 56% patients were male and 44% were female in Cleft lip with or without cleft palate group. In Isolated cleft Palate group female predominance was more (62.5%). Control male and female proportion taken was similar.

Total number of subjects: - 182

Group A: 50 patients – 28 Males, 22 Females

Group B: 32 patients – 12 Males, 20 Females

Group C: 100 Controls - 50 Males, 50 Females

In Group A: 06 patients have positive family history.

Group B: 06 patients have positive family history

The dermatoglyphic patterns are analysed in the following manner: They are subjected to nonparametric statistical tests to evaluate significant patterns of identifiable differences between the cleft lip with or without cleft palate, isolated cleft palate and controls.

Table 2: Qualitative Analysis of palmar pattern showing the frequency distribution of palmar interdigital area pattern types as classified by Galton (1982).[13]

Group	Sex	Th/ ID_1	ID_2	ID_3	ID_4	Hypo-thenar	Total Patterns
A	M	18 (6.42%)*	02 (0.71%)	20 (7.14%)	10 (3.57%)*	12 (4.28%)*	62 (22.14%)
	F	08 (3.63%)*	00	26 (11.81%)	16 (7.27%)	15 (6.81%)*	65 (29.54%)
	M+F	26 (5.2%)*	02 (0.4%)	46 (9.2%)	26 (5.2%)*	27 (5.4%)*	127 (25.4%)
B	M	13 (10.83%) #	00	10 (16.66%)	01 (0.83%) #	03 (2.5%) #	27 (22.5%)
	F	07 (3.5%) #	00	11 (5.5%)	09 (4.5%) #	02 (01%) #	29 (14.5%)
	M+F	20	00	21	10	05	56

		(6.25%) #		(6.56%)	(3.12%) #	(1.56%) #	(17.5%)
	M	02	07	32	42	74	157
		(0.4%)	(1.4%)	(6.4%)	(8.4%)	(14.8%)	(31.4%)
C	F	03	03	39	57	70	172
		(0.6%)	(0.6%)	(7.8%)	(11.4%)	(14.0%)	(34.4%)
	M+F	05	10	71	99	144	329
		(0.5%)	(1.0%)	(7.1%)	(9.9%)	(14.4%)	(32.9%)

* Statistically significant difference between group A and group C
\# Statistically significant difference between group B and group C

It was seen that that percentage of total palmar patterns in group A male was 22.14% while in group A female was 29.54%. In group B males, it was 22.50% while in group B females, it was 14.50%, in control group 'C' it was 31.4% and in males and 34.4% in females.

Quantitative characteristics of finger Dermatoglyphics

The ridge counts which are size related numerical representative of pattern types are being considered to be of greatest significance in genetic terms. The absolute and total finger ridge counts effectively summarise the quantitative characteristics of all digits of either hand.

Table 3: Distribution according to Total Finger Ridge Count

Group	Sex	Mean	S.D.	S.E. of mean
	M	100.85	46.90	8.863
A	F	127.59	46.48	9.909
	M+F	112.62	48.112	6.804
	M	77.91	23.70	6.841
B	F	70.30	35.20	7.870
	M+F	73.15	30.70	5.428
	M	141.16	55.22	7.385
C	F	141.64	53.58	7.577
	M+F	141.40	52.9093	5.290

Group A: male Vs Group C male (Highly Significant), Group A: female Vs Group C female (Not Significant), Group A: (M+F) Vs Group C (M+F) (Significant), Group B: male Vs Group C male (Highly Significant), Group B: female Vs Group C female (Highly Significant), Group B: (M+F) Vs Group C (M+F) (Highly Significant)

It was evident from the table that there was decrease in mean values of TFRC in group 'A' and group 'B' as compared to group 'C'. These differences were subjected to unpaired 't' test for significance of observations and it was seen that there was significant difference in comparison of group 'A' and group 'B' with group 'C' except for females of group 'A' where the difference is statistically not significant though there is decrease in mean TFRC of group 'A' females in comparison with group 'C' female controls.

Table 4: Distribution according to Absolute Finger Ridge Count (AFRC)

Group	Sex	mean	S.D.	S.E. of mean
A	M	122.92	73.70	13.927
	F	171.18	90.07	19.202
	M+F	144.16	83.157	11.760
	M	88.33	35.84	10.346
B	F	78.80	50.076	11.197
	M+F	82.375	44.179	7.809
	M	191.38	90.60	12.812
C	F	187.62	90.81	12.842
	M+F	189.50	90.72	9.072

Group A male Vs Group C male (Significant), Group A female Vs Group C female (Not Significant), Group A (M+F) Vs Group C (M+F) (Significant), Group B male Vs Group C male (Highly Significant), Group B female Vs Group C female (Highly Significant), Group B (M+F) Vs Group C (M+F) (Highly Significant)

It was observed that the absolute finger ridge count was decreased in group 'A', and group 'B' as compared with group 'C'. And the difference observed was statistically significant in the group 'A' and group 'B' when compared with group 'C' except in females of group 'A' where the decrease in AFRC of females of group 'A' was statistically not significant as compared to females of group 'C'.

DISCUSSION

Dermatoglyphics, as a diagnostic tool, is well reflected in a number of diseases which have strong hereditary and genetic basis. Cleft lip and cleft palate defects have a strong genetic and hereditary basis, so that patients with these defects are expected to show some of the dermatoglyphic variations, as dermatoglyphic features are under control and influence of genetics and heredity. The present study, consisted of, **50** patients of cleft lip with or without cleft palate forming group **A**, **32** patients of isolated cleft palate forming group **B** and **100** individuals in the group **C** served as controls. The prints were obtained by the **Standard Ink Method** and were analysed to find out variations in dermatoglyphic features among the patients and controls. These observations are subjected to tests for statistical significance and findings are compared with other previous studies of dermatoglyphics in cleft lip and cleft palate defects. The sex wise **male** preponderance is observed in cases of cleft lip with or without cleft palate. In isolated cleft palate patients**, female** preponderance is observed. In cases of cleft lip with or without cleft palate, **male: female** ratio is

1.27: 1, in isolated cleft palate patients **male: female** ratio is **0.6:1** It means that cleft lip with or without cleft palate is more common in males and isolated cleft palate is more common in females and this is in accordance with the findings of Neel (1958)[14]; Theodore. H.Ingalis, Irene. E. Taube, Marcus. A. Klingberg (1964)[10]; Charles. M. Woolf, Robert. M. Woolf (1964)[15]; Harry (1968) [16]; Thomas (1968)[17]; Burdi (1969) [18]; Gary, Lisa and Cynthia (1991)[19]; T.W. Sadler (1995)[9] In cleft lip with or without cleft palate patients, **12%** patient had positive family history. In isolated cleft palate cases, **18.75 %** patient had positive family history. This suggest that the cleft lip and cleft palate deformities are inherited in families as a chromosomal recessive or dominant disorders or as chromosomal aberrations. Silver (1966) [20] observed no significant difference in third interdigital patterns in cleft lip, isolated cleft palate and cleft lip with cleft palate patients when compared with controls. In our study also there is no significant difference in patterns in third interdigital area in cleft lip with or without cleft palate cases and isolated cleft palate cases as compared with control group **C**. Dziuba (1972) [21] reported an increase in frequencies of thenar and first interdigital area pattern on the left palm in patients when both sexes are combined in cleft lip and cleft palate patients. In our study, the frequency distribution of patterns of thenar and Ist interdigital area is increased in both sexes and in both hands in cleft lip with or without cleft palate cases as well as isolated cleft palate cases as compared with control group **C**, which is in accordance with the above study. R.N. Deshmukh, M.S. Grewal and S.S. Sidhu (1981)[22] observed significant differences in the frequencies of patterns in hypothenar areas of both hands and pattern in third interdigital area in right palm of females of cleft lip with or without cleft palate and isolated cleft palate, when compared with controls. In our study, difference is statistically significant for the pattern in hypothenar area, in both sexes, in both cleft lip with or without cleft palate cases and isolated cleft palate cases. The difference for pattern in third interdigital area is not significant in both the groups of cases. R.N. Deshmukh, M.S. Grewal and S.S.Sidhu (1981)[22] reported that males showed significant difference only for the frequencies of pattern in fourth interdigital area of right hand. In our study difference is significant in **males** of cleft lip with or without cleft palate but the **females** individually do not show any significant difference for the patterns in fourth interdigital area. But the difference is significant in **combined (males + females)** in cleft lip with or without cleft palate cases. In isolated cleft palate cases, the difference is significant in both **males** and **females**. Balgir R S (1993) [23] reported that interdigital patterns were less frequent in cleft lip with or without cleft palate patients. In our study, there is also decrease in interdigital patterns in both cleft lip with or without cleft palate cases as well as isolated cleft palate cases as compared to controls. Dziuba (1972)[21]; Van Biervliet J.P, Van Hemel J. O (1975)[24] reported low total finger ridge count (TFRC) in patients than in controls. In our study also, there is decrease in mean values of total finger ridge count (TFRC) and absolute finger ridge count in case of cleft lip with of without cleft palate group and isolated cleft palate group as compared to control group **C** except for **females** of cleft lip with of without cleft palate group**,** where the decrease in TFRC and AFRC is statistically insignificant. R.N.Deshmukh, M.S.Grewal and S.S.Sidhu (1981)[22] observed statistically significant difference in TFRC for **combined** values for **(R + L hands)** in case of **males** separately, for **right, left** as well as for **combined values of (R + L) hands** for **females**. Our study is in accordance with this as we found statistically significant difference in TFRC as well as AFRC in **males** and **females** and in **both the hands** except for **females** of cleft lip with of without cleft palate group**.** It means that pattern size as well as pattern intensity is decreased in patients as compared to controls.

CONCLUSION

The utility of the dermatoglyphics in aetiological studies is a recent matter of study with very less available information and literature of it. So the present study has been undertaken to explore the possibility of dermatoglyphic association with the congenital cleft lip and cleft palate defects. The findings of present study reveal statistically significant differences between congenital cleft lip with or without cleft palate and isolated cleft palate patients and the normal population and indicate to a genetic difference between them. These results are supportive of a genetic aetiology in cleft lip with or without cleft palate and isolated cleft palate anomalies and likelihood of the manifestations of chromosomal aberrations.

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