

## COMPARATIVE STUDY OF DERMATOGLYPHIC FINGERTIP PATTERNS AND 'atd' ANGLE IN PATIENTS OF CLEFT LIP WITH OR WITHOUT CLEFT PALATE AND ISOLATED CLEFT PALATE WITH NORMAL POPULATION

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**ABSTRACT:** Dermatoglyphics is the scientific study of epidermal ridges and their configurations on the volar aspect of palmar and plantar region. 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 & OBJECTIVES:** To study the fingertip dermatoglyphic patterns in cleft lip and cleft palate patients. To compare the dermatoglyphic 'atd' angle of cleft lip and cleft palate patients with normal population. **MATERIAL & 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 & 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, analysis of Fingertip Patterns and analysis of dermatoglyphic 'atd' angle. 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 & 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. The difference observed in percentage distribution of whorls and arches was statically significant in group A and C. The percentage distribution of loops was statically significant only in males of group A as compared with group C. The test of significance for 'atd' angle in group 'A' and group 'B' when compared with group 'C' was statistically significant difference. i.e. wide 'atd' angle in group 'A' and group 'B'. **CONCLUSION:** Hence, we conclude that the finding of present study reveals statistically significant differences between congenital cleft lip with or without cleft palate and isolated cleft palate patients and the normal population and indicates to a genetic difference between them.

**KEYWORDS:** Dermatoglyphics, Fingertip Patterns, Loops, Arches, Whorls, Digital triradius, Axial triradius, 'Atd' Angle, Cleft Lip, Cleft Palate, Heredity, Genetic Predisposition.

**INTRODUCTION:** Dermatoglyphics is the scientific study of epidermal ridges and their configurations on the volar aspect of palmar and plantar region.<sup>1</sup> There are distinct variations in the dermatoglyphic patterns amongst the races, sexes, right & left hands of same individual, also mammals of different species.<sup>2</sup>

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Abnormal dermatoglyphic patterns are known to occur with genetic disorders like Mongolism, Turner's syndrome, Kline filter's syndrome etc.<sup>3</sup>

Cleft lip and cleft palate are common defects that result in 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.<sup>4</sup>

Cases of cleft lip and palate either have a positive family history or genetic origin.<sup>5</sup> Most of cleft lip with or without cleft palate have polygenic mode of inheritance with sexual modification.<sup>6</sup> A certain proportion is associated with recognizable chromosomal aberrations<sup>7</sup> 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.<sup>8</sup>

Congenital abnormalities of the cleft lip with or without cleft palate and isolated cleft palate are developmentally as well as genetically distinct entities.<sup>5</sup> Cleft lip occurs more frequently in males (1:1000 live births) and cleft palate occurs more often in females (1:2500 live births).<sup>9</sup> Combined deformity occurs more often in males.<sup>10</sup>

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 & OBJECTIVES:

1. To study the fingertip dermatoglyphic patterns in cleft lip and cleft palate patients.
2. To compare the dermatoglyphic 'atd' angle of cleft lip and cleft palate patients with normal population.

**MATERIAL & 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 & 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.<sup>3,11</sup>

**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.

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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.

**'atd' Angle:** It is the most widely used parameter. This angle is formed by the lines drawn from the digital triradius 'a' to the axial triradius 't' and from this axial triradius to the digital triradius 'd'. The more distal the positions of the axial triradius 't', larger the 'atd' angle.

In case of more than one axial triradius in the palm, the widest 'atd' angle i.e. the angle emanating from the distal most axial triradius, is counted.

**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 and sex.

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
3. Qualitative Analysis: Analysis of Fingertip Patterns.
4. Quantitative Analysis: Analysis of dermatoglyphic 'atd' angle – 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:** 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.

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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

**Table 1: Groups of Patients and Controls Selected for the Study**

### 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.

**Qualitative Analysis of Fingertip Patterns:** Qualitative Categories of fingerprint types are classified into elementary pattern types, as suggested by Galton (1892),<sup>12</sup> and are shown into table no.2.

Group	Sex	Total loops	Total whorls	Total Arches
A	M	178(63.57%)*	56(20.00%)*	46(16.43%)*
	F	120(54.55%)	69(31.36%)	31(14.09%)*
	M+F	298(59.60%)	125(25.00%)*	77(15.40%)*
B	M	100(83.33%) #	11(09.17%) #	09(07.50%)
	F	143(71.50%) #	23(11.50%) #	34(17.00%) #
	M+F	243(75.93%) #	34(10.62%) #	43(13.43%) #
C	M	279(55.80%)	195(39.00%)	26(05.20%)
	F	271(54.20%)	194(38.80%)	35(07.00%)
	M+F	550(55.00%)	389(38.90%)	61(6.10%)

**Table 2: Distribution of Fingertip Patterns among three groups**

\* Statistically significant difference between group A and group C

# Statistically significant difference between group B and group C

It was seen that percentage distribution of loop patterns was increased in group 'A' and group 'B' as compared to controls group 'C'. Arch pattern was also increased in group 'A' and 'B' as compared to group 'C'. The percentage of whorls was decreased in group 'A' and group 'B' as compared to group 'C'.

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The difference observed in percentage distribution of whorls and arches was statically significant in group A and C. The percentage distribution of loops was statically significant only in males of group A as compared with group C. The difference observed in percentage of loops, whorls and arches was statically significant in group B and C.

Group	Sex	$\bar{X}$	S.D	S. E. of $\bar{X}$
A	M	49.3928	9.8473	1.3159
	F	49.909	15.8964	2.3964
	M+F	49.62	12.8668	1.2866
B	M	47.7083	5.6456	1.1524
	F	48.65	6.0437	0.9555
	M+F	48.296	5.9152	0.7394
C	M	40.97	5.4156	0.5416
	F	42.76	5.6782	0.5678
	M+F	41.865	5.6202	0.3974

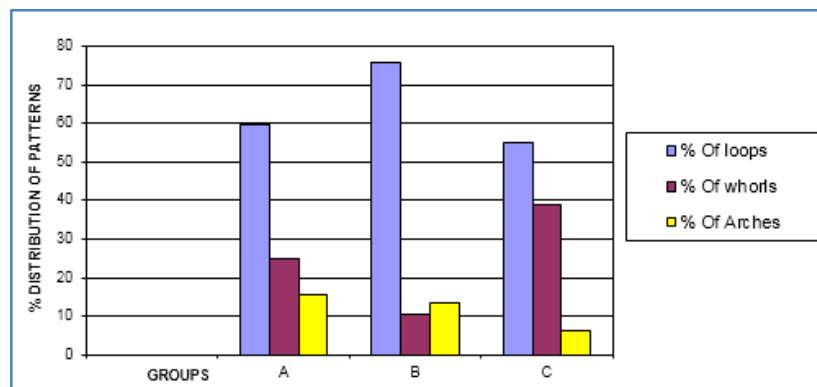
**Table 3: Statistical Calculation For 'atd' Angle**

Group	Comparison	t Value	Remark
A	CM(R+L) X AM(R+L)	6.900	Highly Significant
	CF(R+L) X AF(R+L)	3.9716	Highly Significant
	C (M+F)(R+L) X A (M+F)(R+L)	7.2591	Highly Significant
B	CM(R+L) X BM(R+L)	5.4297	Highly Significant
	CF(R+L) X BF(R+L)	5.4436	Highly Significant
	C (M+F)(R+L) X B (M+F)(R+L)	7.8677	Highly Significant

**Table 4: Test of Significance For 'atd' Angle**

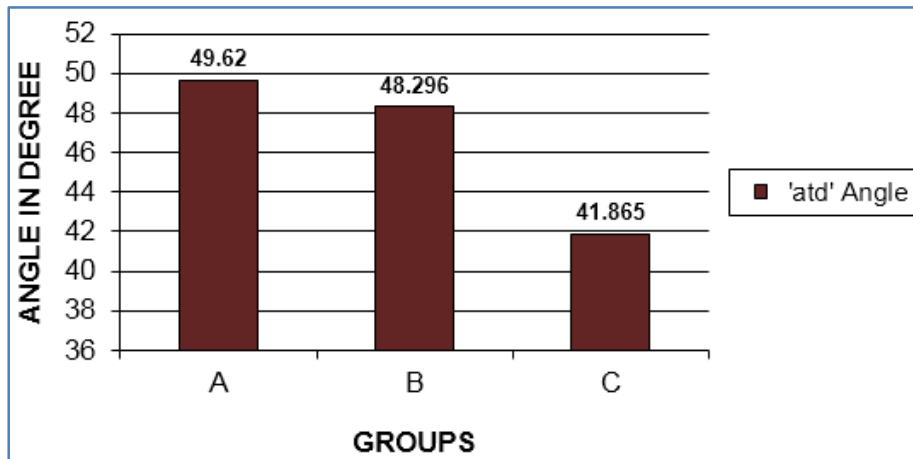
Significant- p value<0.05, highly significant- p value<0.001

Table No.4 shows the test of significance for 'atd' angle in group 'A' and group 'B' when compared with group 'C'. There is statistically significant difference i.e. wide 'atd' angle in group 'A' and group 'B'.



**Graph 1: Percentage Distribution of Loop, Whorl & Arch Pattern**

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**Graph 2: Mean Degree of 'atd' Angle of Group A, B & 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);<sup>13</sup> Theodore. H. Ingalis, Irene. E. Taube, Marcus. A. Klingberg (1964)<sup>10</sup>; Charles. M. Woolf, Robert. M. Woolf (1964);<sup>14</sup> Harry (1968);<sup>15</sup> Thomas (1968);<sup>16</sup> Burdi (1969);<sup>17</sup> Gary, Lisa and Cynthia (1991);<sup>18</sup> T.W. Sadler (1995)<sup>9</sup>

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.

In the present study, the frequency distribution of loops (particularly ulnar loops) is increased in cleft lip with or without cleft palate and isolated cleft palate cases as compared to the control group C. The frequency distribution of arch pattern is also increased in cleft lip with or without cleft palate and isolated cleft palate cases as compared to the control group C. The frequency distribution of whorls is more in control group C than cleft lip with or without cleft palate and



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isolated cleft palate cases group. This is in accordance with Dziuba (1972).<sup>19</sup> He observed an increase in frequency of ulnar loops and arches and consequent decrease of whorls.

Balgir R. S. (1993)<sup>20</sup> observed an increased frequency of ulnar and radial loops, than arches and whorls in cleft lip with or without cleft palate patients as compared with controls. Our study is also in accordance with this study, where frequency of loops is more than that of the arches and whorls.

Mathew. L, Hegde. A, Rai. K (2005)<sup>21</sup> found an increase in the ulnar loop patterns on the distal phalanges of ten fingers. In our study also there is an increase in frequency of loops in the fingers in both cleft lip with or without cleft palate and isolated cleft palate cases.

R.N. Deshmukh, M.S. Grewal and S.S.Sidhu (1981)<sup>22</sup> found significant difference in mean values of 'atd' angles in patients with cleft lip with or without cleft palate when compared with controls. Our study goes in accordance with this study, as there is significant difference in mean values of 'atd' angles in cleft lip with or without cleft palate and isolated cleft palate cases compared to control group C.

R.S. Balgir (1993)<sup>20</sup> reported wider 'atd' angle (>30°) in cleft lip and cleft palate patients. Our study goes in accordance with this study, as there is an increase in mean values of 'atd' angles in cleft lip with or without cleft palate and isolated cleft palate cases as compared to control group C.

Mathew. L, Hegde. A, Rai. K (2005)<sup>21</sup> found an increase in atd angles in oral cleft children. Our study goes in accordance with this study, as there is an increase in mean values of 'atd' angles in cleft lip with or without cleft palate and isolated cleft palate cases as compared to control group

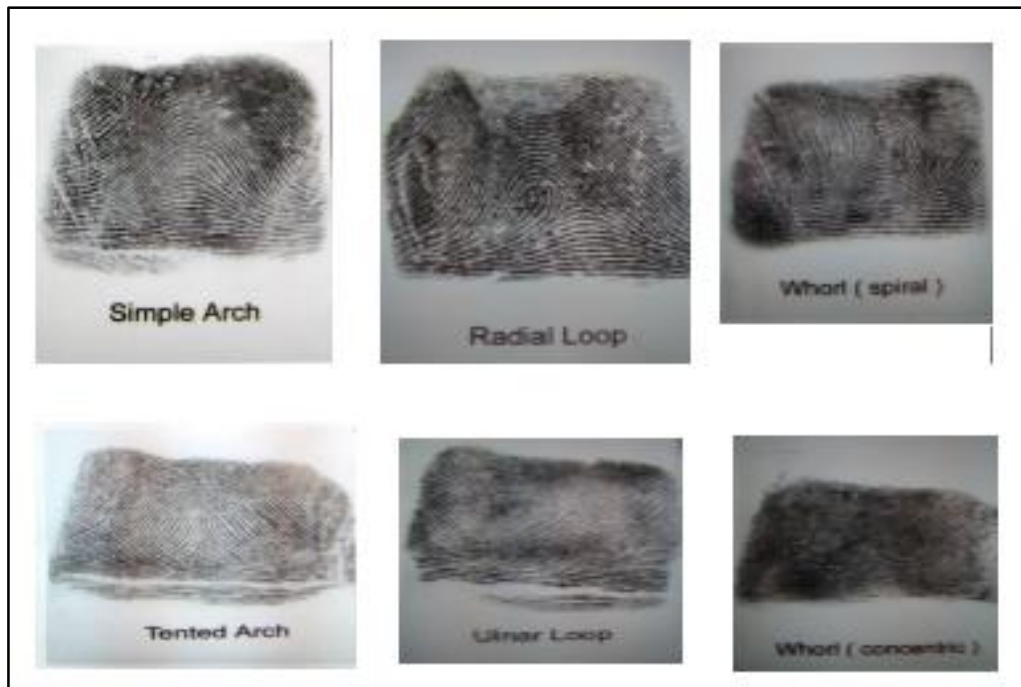
**CONCLUSION:** The finding of present study reveals statistically significant differences between congenital cleft lip with or without cleft palate and isolated cleft palate patients and the normal population and indicates to a genetic difference between them. These results are supportive of a genetic 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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## Different Fingertip Patterns Observed



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