

# Lip Prints and Inheritance of Cleft Lip and Cleft Palate

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## ABSTRACT

**Background:** Labial mucosa has elevations and depressions forming a pattern called 'Lip Prints'. Parents of patients with cleft lip &/or palate are known to have a particular lip print pattern.

**Objectives:** Analysis of lip prints and relationship between Cheiloscopy and inheritance of cleft lip &/or cleft palate.

**Methodology:** The study included 100 subjects [study group-parents with children having cleft lip &/or cleft palate, 50 fathers and 50 mothers] and 50 subjects (control group-parents having children without cleft lip &/or cleft palate, 25 fathers and 25 mothers). The lip prints of the subjects were obtained using the

cellophane method and analysed using Suzuki & Tsuchihashi classification of lip prints. The data was subjected to Chi-Square test, Fisher Exact test and Student t-test [two tailed, independent].

**Results:** A new whorl pattern was present in the study group. The groove count was higher in the fathers' than in the mothers' prints in the upper lip and vice versa in the lower lip.

**Conclusion:** The new pattern was present in the study group in a significant number of cases. The groove count was significantly high in the study group. These two parameters can be of significant value to similar future studies.

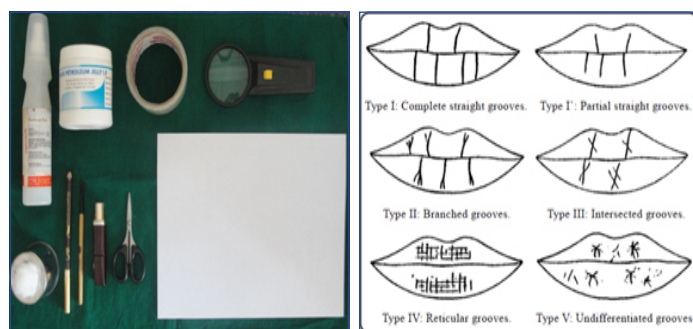
**Keywords:** Groove count, Inheritance, Lip prints, Oro-facial clefts, Whorl pattern

## INTRODUCTION

Cheiloscopy was described differently by persons carrying out research. It was thought of as a method of identification of a person based on the characteristic arrangement of lines or grooves. Lip prints are unique and do not change during the lifespan of a person [1]. It has been verified that lip prints recover after undergoing alterations like minor trauma, inflammation and diseases like herpes [2]. They are identifiable as early as the 6<sup>th</sup> week of intrauterine life and from that time on their pattern rarely changes [3]. The form of furrows does not vary with environmental factors. However, major trauma may lead to scarring, pathosis and surgical treatment rendered to correct the pathosis may affect the size and shape of the lip, thereby altering the pattern and morphology of the grooves [2].

Finger prints, bitemarks and of late DNA finger printing have been successful in personal identification [4]. Theory of uniqueness is a strong point used in the analysis of fingerprints and bitemarks, to convince the court of law. Likewise, even the lip prints of the vermillion border are unique to an individual and hence behold the potential for identification purpose [5]. Cheiloscopy techniques have an equal value in relation to the other types of forensic evidences for

personal identification [6]. Lip print is an anatomical character of the human lips. The last few decades have seen the development of the exaggerated importance of lip prints as other skin impressions, which may be useful in identification and diagnosis of congenital diseases and anomalies [7]. Numerous studies have been undertaken to evaluate the relationship between the lip print pattern to gender, its consistency over a period of time, to ascertain whether there is any hereditary pattern in lip prints among families with siblings and/or twins. Parameters such as blood group have been analysed, if they have an association with a unique lip print pattern [8]. Particular types of lip print patterns have been associated with occurrence of non-syndromic cleft lip with or without cleft palate and numerous studies are underway to establish facts [7,9].



[Table/Fig-1]: Armamentarium [Table/Fig-2]: Suzuki & Tsuchihashi classification of lip prints

| Age in years  | Control group   |       | Study group     |       |
|---------------|-----------------|-------|-----------------|-------|
|               | No              | %     | No              | %     |
| <1 year       | 1               | 4.0   | 9               | 36.0  |
| 1-5 years     | 9               | 36.0  | 29              | 58.0  |
| 5-10 years    | 5               | 20.0  | 3               | 6.0   |
| >10 years     | 10              | 40.0  | 9               | 36.0  |
| Total         | 25              | 100.0 | 50              | 100.0 |
| Mean $\pm$ SD | 9.46 $\pm$ 8.33 |       | 4.32 $\pm$ 5.58 |       |

[Table/Fig-3]: Age distribution of patients with CL/CP and controls

| Gender | Control group |       | Study group |       |
|--------|---------------|-------|-------------|-------|
|        | No            | %     | No          | %     |
| Male   | 14            | 56.0  | 28          | 56.0  |
| Female | 11            | 44.0  | 22          | 44.0  |
| Total  | 25            | 100.0 | 50          | 100.0 |

[Table/Fig-4]: Gender distribution

| Consanguineous marriage | Control group |     | Study group |     |
|-------------------------|---------------|-----|-------------|-----|
|                         | No            | %   | No          | %   |
| Yes                     | 0             | 0   | 21          | 42  |
| No                      | 25            | 100 | 29          | 58  |
| Total                   | 25            | 100 | 50          | 100 |

[Table/Fig-5]: Consanguineous marriage

| AFM   | Control group |     | Study group |     |
|-------|---------------|-----|-------------|-----|
|       | No            | %   | No          | %   |
| No    | 25            | 100 | 45          | 90  |
| Yes   | 0             | 0   | 5           | 10  |
| Total | 25            | 100 | 50          | 100 |

[Table/Fig-6]: Incidence of affected family members

| Diagnosis    | Number of patients | %     |
|--------------|--------------------|-------|
| CL only      | 9                  | 18.0  |
| CP only      | 7                  | 14.0  |
| Both CL & CP | 34                 | 68.0  |
| Total        | 50                 | 100.0 |

[Table/Fig-7]: Diagnosis in the study group

|       | Group   | Type I  | Type I' | Type II | Type III | Type IV | Type V | New type | p-value |
|-------|---------|---------|---------|---------|----------|---------|--------|----------|---------|
| FP UR | Control | 9(36%)  | 9(36%)  | 5(20%)  | 1(4%)    | 0(0%)   | 1(4%)  | 0(0%)    | 0.453   |
|       | Study   | 24(48%) | 13(26%) | 12(24%) | 0(0%)    | 0(0%)   | 1(2%)  | 0(0%)    |         |
| FP UM | Control | 4(16%)  | 9(36%)  | 0(0%)   | 1(4%)    | 4(16%)  | 7(28%) | 0(0%)    | 0.005** |
|       | Study   | 13(26%) | 9(18%)  | 3(6%)   | 3(6%)    | 3(6%)   | 7(14%) | 12(24%)  |         |
| FP UL | Control | 8(32%)  | 12(48%) | 1(4%)   | 3(12%)   | 0(0%)   | 1(4%)  | 0(0%)    | 0.178   |
|       | Study   | 19(38%) | 17(34%) | 5(10%)  | 1(2%)    | 1(2%)   | 3(6%)  | 4(8%)    |         |
| FP LR | Control | 8(32%)  | 8(32%)  | 6(24%)  | 1(4%)    | 0(0%)   | 2(8%)  | 0(0%)    | 0.547   |
|       | Study   | 19(38%) | 7(14%)  | 16(32%) | 3(6%)    | 0(0%)   | 4(8%)  | 1(2%)    |         |
| FP LM | Control | 11(44%) | 7(28%)  | 1(4%)   | 0(0%)    | 3(12%)  | 3(12%) | 0(0%)    | 0.230   |
|       | Study   | 20(40%) | 9(18%)  | 0(0%)   | 4(8%)    | 8(16%)  | 7(14%) | 2(4%)    |         |
| FP LL | Control | 10(40%) | 10(40%) | 5(20%)  | 0(0%)    | 0(0%)   | 0(0%)  | 0(0%)    | 0.063   |
|       | Study   | 17(34%) | 11(22%) | 14(28%) | 2(4%)    | 0(0%)   | 6(12%) | 0(0%)    |         |

[Table/Fig-8]: Comparison of fathers' lip prints in two groups of subjects

| FGC | Control group | Study group | p-value  |
|-----|---------------|-------------|----------|
| UL  | 57.72±15.13   | 68.02±16.23 | 0.010*   |
| LL  | 53.60±12.51   | 65.70±12.16 | <0.001** |

[Table/Fig-9]: Comparison of groove count/centimeter in fathers in the two groups studied

|       | Group   | Type I  | Type I' | Type II | Type III | Type IV | Type V  | New type | p-value  |
|-------|---------|---------|---------|---------|----------|---------|---------|----------|----------|
| MP UR | Control | 4(16%)  | 14(56%) | 3(12%)  | 2(8%)    | 1(4%)   | 1(4%)   | 0(0%)    | 0.004**  |
|       | Study   | 25(50%) | 8(16%)  | 13(26%) | 1(2%)    | 2(4%)   | 1(2%)   | 0(0%)    |          |
| MP UM | Control | 4(16%)  | 12(48%) | 0(0%)   | 1(4%)    | 6(24%)  | 2(8%)   | 0(0%)    | 0.006**  |
|       | Study   | 8(16%)  | 9(18%)  | 5(10%)  | 6(12%)   | 4(8%)   | 8(16%)  | 10(20%)  |          |
| MP UL | Control | 4(16%)  | 12(48%) | 5(20%)  | 2(8%)    | 2(8%)   | 0(0%)   | 0(0%)    | 0.020*   |
|       | Study   | 21(42%) | 12(24%) | 7(14%)  | 3(6%)    | 1(2%)   | 6(12%)  | 0(0%)    |          |
| MP LR | Control | 1(4%)   | 6(24%)  | 18(72%) | 0(0%)    | 0(0%)   | 0(0%)   | 0(0%)    | 0.002**  |
|       | Study   | 20(40%) | 10(20%) | 15(30%) | 1(2%)    | 1(2%)   | 1(2%)   | 2(4%)    |          |
| MP LM | Control | 12(48%) | 10(40%) | 1(4%)   | 0(0%)    | 0(0%)   | 0(0%)   | 0(0%)    | 0.003**  |
|       | Study   | 27(54%) | 3(6%)   | 1(2%)   | 1(2%)    | 6(12%)  | 10(20%) | 2(4%)    |          |
| MP LL | Control | 2(8%)   | 4(16%)  | 16(64%) | 2(8%)    | 0(0%)   | 1(4%)   | 0(0%)    | <0.001** |
|       | Study   | 16(32%) | 13(26%) | 7(14%)  | 3(6%)    | 0(0%)   | 9(18%)  | 2(4%)    |          |

[Table/Fig-10]: Comparison of mothers' lip prints in two groups of subjects

| MGC | Control group | Study group | p-value  |
|-----|---------------|-------------|----------|
| UL  | 55.00±17.90   | 73.88±18.49 | <0.001** |
| LL  | 51.08±10.35   | 62.84±11.47 | <0.001** |

[Table/Fig-11]: Comparison of groove count per centimetre in mothers' prints in the two groups studied

Parents of patients affected with cleft lip &/or palate have been shown to have a particular lip print pattern. The study of lip prints in understanding the inheritance of various congenital anomalies can therefore be a useful tool. This provides a cost effective, non-invasive screening method to evaluate the occurrence of clefts in the offspring [7,9].

Cleft lip with or without cleft palate (CL/CP) is one of the most common structural birth defects. Apart from being a developmental deformity, it is one of the major issues in terms of aesthetics, phonetics, mastication, and has also got psychological and social implications. Non-syndromic CL/CP is reported to occur in approximately one in 700 newborns with the incidence varying according to parental race/ethnicity and geographic origin, the gender of the embryo, and family's socio-economic status [10].

The study of lip prints or cheiloscopy, being similar to dermatoglyphics, in light of predicting the occurrence of cleft lip and/or cleft palate can be a valuable tool in tackling the psychosocial and therapeutic approach to this common developmental deformity.

Therefore, this study was undertaken in order to verify if any relationship exists between cleft lip and cleft palate and lip prints.

## METHODOLOGY

This study was conducted on parents of cleft lip and/or cleft palate patients who visited the out-patient departments of Rajarajeswari Dental College and Hospital, Mysore Road, Bangalore and

| Group | Type I  | Type I' | Type II | Type III | Type IV | Type V  | New type | P value |
|-------|---------|---------|---------|----------|---------|---------|----------|---------|
| FP UR | 24(48%) | 13(26%) | 12(24%) | 0(0%)    | 0(0%)   | 1(2%)   | 0(0%)    | 0.514   |
| MP UR | 25(50%) | 8(16%)  | 13(26%) | 1(2%)    | 2(4%)   | 1(2%)   | 0(0%)    |         |
| FP UM | 13(26%) | 9(18%)  | 3(6%)   | 3(6%)    | 3(6%)   | 7(14%)  | 12(24%)  | 0.799   |
| MP UM | 8(16%)  | 9(18%)  | 5(10%)  | 6(12%)   | 4(8%)   | 8(16%)  | 10(20%)  |         |
| FP UL | 19(38%) | 17(34%) | 5(10%)  | 1(2%)    | 1(2%)   | 3(6%)   | 4(8%)    | 0.294   |
| MP UL | 21(42%) | 12(24%) | 7(14%)  | 3(6%)    | 1(2%)   | 6(12%)  | 0(0%)    |         |
| FP LR | 19(38%) | 7(14%)  | 16(32%) | 3(6%)    | 0(0%)   | 4(8%)   | 1(2%)    | 0.580   |
| MP LR | 20(40%) | 10(20%) | 15(30%) | 1(2%)    | 1(2%)   | 1(2%)   | 2(4%)    |         |
| FP LM | 20(40%) | 9(18%)  | 0(0%)   | 4(8%)    | 8(16%)  | 7(14%)  | 2(4%)    | 0.264   |
| MP LM | 27(54%) | 3(6%)   | 1(2%)   | 1(2%)    | 6(12%)  | 10(20%) | 2(4%)    |         |
| FP LL | 17(34%) | 11(22%) | 14(28%) | 2(4%)    | 0(0%)   | 6(12%)  | 0(0%)    | 0.388   |
| MP LL | 16(32%) | 13(26%) | 7(14%)  | 3(6%)    | 0(0%)   | 9(18%)  | 2(4%)    |         |

[Table/Fig-12]: Comparison of fathers' and mothers' prints in the study group

|    | FGC         | MGC         | p-value |
|----|-------------|-------------|---------|
| UL | 68.02±16.23 | 73.88±18.49 | 0.068+  |
| LL | 65.70±12.16 | 62.84±11.47 | 0.215   |

[Table/Fig-13]: Comparison of groove count per centimetre between fathers' and mothers' prints in the study group

### Materials required [Table/Fig-1]

Dark coloured lipstick, Dark coloured lip liner, Lipstick applicator brush, Petroleum jelly, Transparent cellophane tape, Scissors, Cotton wool, White coloured executive bond sheets, Magnifying glass and Disinfectant spray.

|       | Group | Type I  | Type I' | Type II | Type III | Type IV | Type V | New type |
|-------|-------|---------|---------|---------|----------|---------|--------|----------|
| FP UR | CL    | 5(10%)  | 2(4%)   | 2(4%)   | 0(0%)    | 0(0%)   | 0(0%)  | 0        |
|       | CP    | 5(10%)  | 1(2%)   | 1(2%)   | 0(0%)    | 0(0%)   | 0(0%)  | 0        |
|       | Both  | 14(28%) | 10(20%) | 9(18%)  | 0(0%)    | 0(0%)   | 1(2%)  | 0        |
| FP UM | CL    | 0(0%)   | 3(6%)   | 0(0%)   | 2(4%)    | 1(2%)   | 1(2%)  | 2(4.0%)  |
|       | CP    | 2(4%)   | 1(2%)   | 1(2%)   | 0(0%)    | 0(0%)   | 2(4%)  | 1(2.0%)  |
|       | Both  | 11(22%) | 5(10%)  | 2(4%)   | 1(2%)    | 2(4%)   | 4(8%)  | 9(18.0%) |
| FP UL | CL    | 3(6%)   | 4(8%)   | 0(0%)   | 0(0%)    | 1(2%)   | 1(2%)  | 0        |
|       | CP    | 2(4%)   | 3(6%)   | 1(2%)   | 1(2%)    | 0(0%)   | 0(0%)  | 0        |
|       | Both  | 14(28%) | 10(20%) | 4(8%)   | 0(0%)    | 0(0%)   | 2(4%)  | 4(8.0%)  |
| FP LR | CL    | 3(6%)   | 2(4%)   | 3(6%)   | 0(0%)    | 0(0%)   | 1(2%)  | 0        |
|       | CP    | 1(2%)   | 2(4%)   | 2(4%)   | 1(2%)    | 0(0%)   | 1(2%)  | 0        |
|       | Both  | 15(30%) | 3(6%)   | 11(22%) | 2(4%)    | 0(0%)   | 2(4%)  | 1(2.0%)  |
| FP LM | CL    | 3(6%)   | 3(6%)   | 0(0%)   | 1(2%)    | 0(0%)   | 2(4%)  | 0        |
|       | CP    | 2(4%)   | 2(4%)   | 0(0%)   | 1(2%)    | 1(2%)   | 1(2%)  | 0        |
|       | Both  | 15(30%) | 4(8%)   | 0(0%)   | 2(4%)    | 7(14%)  | 4(8%)  | 2(4.0%)  |
| FP LL | CL    | 2(4%)   | 3(6%)   | 3(6%)   | 0(0%)    | 0(0%)   | 1(2%)  | 0        |
|       | CP    | 3(6%)   | 2(4%)   | 1(2%)   | 0(0%)    | 0(0%)   | 1(2%)  | 0        |
|       | Both  | 12(24%) | 6(12%)  | 10(20%) | 2(4%)    | 0(0%)   | 4(8%)  | 0        |

[Table/Fig-14]: Comparison of fathers' prints in the study group in CL, CP &amp; CLP

Bhagwan Mahaveer Jain Hospital, Vasanth Nagar, Bangalore, India over a period of two years. The sample size of this research work comprised of 100 subjects for the study group (parents with children having cleft lip and/or cleft palate), including 50 fathers and 50 mothers. The control group comprised of parents having children without cleft lip and/or cleft palate with a sample size of 50, including 25 fathers and 25 mothers.

### Inclusion criteria

Lip prints of parents with their children having cleft lip and/or palate (for the study group) and Lip prints of parents with their children without cleft lip and/or cleft palate (for the control group)

### Exclusion criteria

Any lesion or inflammatory state of lips or previous history of surgery to lips and individuals with known hypersensitivity to lipstick.

### Method

A written informed consent was obtained from concerned authorities, patients and parents. The case history of the cleft lip and/or cleft palate patient was recorded as per the proforma. The photograph of the patient was taken for documentation purposes. First, the lips of the subject were cleaned thoroughly with sterile cotton. Petroleum jelly was applied on the lips if the lips were dry as this would hamper the uniform spread of lipstick. After about 2-3 minutes, excess petroleum jelly was wiped off the lip surface using cotton wool. The cellophane method of obtaining lip prints was used in this study. The respective consent form was also attached to this case proforma. The lips of the subject were thoroughly wiped off the lipstick colour after completion of the procedure using cotton wool. This procedure was repeated for each subject in the study and control groups. The lip prints were repeated if the ones obtained were not satisfactory. The lipstick applicator brush

|       | Group | Type I  | Type I' | Type II | Type III | Type IV | Type V | New type |
|-------|-------|---------|---------|---------|----------|---------|--------|----------|
| MP UR | CL    | 5(10%)  | 1(2%)   | 1(2%)   | 1(2%)    | 0(0%)   | 1(2%)  | 0        |
|       | CP    | 3(6%)   | 2(4%)   | 1(2%)   | 0(0%)    | 1(2%)   | 0(0%)  | 0        |
|       | Both  | 17(34%) | 5(10%)  | 11(22%) | 0(0%)    | 1(2%)   | 0(0%)  | 0        |
| MP UM | CL    | 2(4%)   | 1(2%)   | 1(2%)   | 2(4%)    | 0(0%)   | 0(0%)  | 3(6.0%)  |
|       | CP    | 1(2%)   | 2(4%)   | 0(0%)   | 0(0%)    | 1(2%)   | 2(4%)  | 1(2.0%)  |
|       | Both  | 5(10%)  | 6(12%)  | 4(8%)   | 4(8%)    | 3(6%)   | 6(12%) | 6(12.0%) |
| MP UL | CL    | 3(6%)   | 4(8%)   | 0(0%)   | 1(2%)    | 0(0%)   | 1(2%)  | 0        |
|       | CP    | 2(4%)   | 3(6%)   | 0(0%)   | 0(0%)    | 0(0%)   | 2(4%)  | 0        |
|       | Both  | 16(32%) | 5(10%)  | 7(14%)  | 2(4%)    | 1(2%)   | 3(6%)  | 0        |
| MP LR | CL    | 3(6%)   | 2(4%)   | 2(4%)   | 1(2%)    | 0(0%)   | 0(0%)  | 1(2.0%)  |
|       | CP    | 2(4%)   | 1(2%)   | 4(8%)   | 0(0%)    | 0(0%)   | 0(0%)  | 0        |
|       | Both  | 15(30%) | 7(14%)  | 9(18%)  | 0(0%)    | 1(2%)   | 1(2%)  | 1(2.0%)  |
| MP LM | CL    | 4(8%)   | 0(0%)   | 1(2%)   | 0(0%)    | 1(2%)   | 2(4%)  | 1(2.0%)  |
|       | CP    | 4(8%)   | 0(0%)   | 0(0%)   | 1(2%)    | 1(2%)   | 1(2%)  | 0        |
|       | Both  | 19(38%) | 3(6%)   | 0(0%)   | 0(0%)    | 4(8%)   | 7(14%) | 1(2.0%)  |
| MP LL | CL    | 4(8%)   | 4(8%)   | 1(2%)   | 0(0%)    | 0(0%)   | 0(0%)  | 0        |
|       | CP    | 0(0%)   | 1(2%)   | 2(4%)   | 1(2%)    | 0(0%)   | 2(4%)  | 1(2.0%)  |
|       | Both  | 12(24%) | 8(16%)  | 4(8%)   | 2(4%)    | 0(0%)   | 7(14%) | 1(2.0%)  |

**[Table/Fig-15]:** Comparison of mothers' prints in the study group in CL, CP & CLP

| FGC | CL only     | CP only     | Both CL & CP | p-value |
|-----|-------------|-------------|--------------|---------|
| UL  | 70.33±22.76 | 60.00±16.66 | 69.06±14.10  | 0.370   |
| LL  | 66.56±11.06 | 65.71±16.5  | 65.47±11.83  | 0.973   |

**[Table/Fig-16]:** Comparison of groove count per centimetre in fathers' prints in the study group in CL, CP & CLP

| MGC | CL only     | CP only     | Both CL & CP | p-value |
|-----|-------------|-------------|--------------|---------|
| UL  | 79.44±11.73 | 60.00±30.10 | 75.30±15.99  | 0.082   |
| LL  | 68.56±16.69 | 56.29±11.89 | 62.67±9.08   | 0.102   |

**[Table/Fig-17]:** Comparison of groove count per centimetre in mothers' prints in the study 7group in CL, CP & CLP

was disinfected using a disinfectant spray in the interval of usage between consecutive subjects for hygienic purpose.

The lip prints were then visualized using a magnifying glass and analysed according to the Suzuki & Tsuchihashi lip print classification [Table/Fig-2].

## RESULTS AND OBSERVATION

The data obtained was subjected to Chi-Square Test, Fisher Exact Test & Student t-test (Two tailed, independent) and the statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, Med Calc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft Word and Excel were used to generate graphs, tables etc. The significant figures used are + suggestive significance (p-value: 0.05<p<0.10), \* moderately significant (p-value: 0.01<p ≤ 0.05) and \*\* strongly significant (p-value: p ≤ 0.01). The results obtained were as follows.

The age distribution of patients within the study and control groups is compiled in [Table/Fig-3]. The gender distribution of the cases in the study and control groups is represented in [Table/Fig-4].

A history of consanguineous marriage (CM) between the parents in both the groups was obtained as per the proforma and the results are tabulated [Table/Fig-5]. The details of the incidence of affected family members, i.e., relatives of the index case who have had cleft lip &/or cleft palate were also obtained and are presented in [Table/Fig-6].

The distribution of the cases, that is cleft lip (CL) alone, cleft palate (CP) alone and cleft lip and cleft palate (CLP) in the study group is tabulated in [Table/Fig-7]. A comparison of the fathers' prints between the two groups was done. The incidence of the different types on lip prints according to the Suzuki and Tsuchihashi

classification in the six different quadrants and the new type (type O) have been tabulated [Table/Fig-8].

A comparison of the variation in the groove counts between the upper and lower lips in the study and control groups was made and the results were tabulated [Table/Fig-9].

A comparison of the mothers' prints between the two groups was done. The incidence of the different types on lip prints according to the Suzuki and Tsuchihashi classification in the six different quadrants and the new type (type O) have been tabulated [Table/Fig-10].

A comparison of groove count per centimetre in mothers' prints in the two groups of subjects was done. The results are tabulated [Table/Fig-11]. A comparison of fathers' and mothers' prints in study group was done and the results are tabulated [Table/Fig-12].

A comparison of groove count per centimetre between fathers' and mothers' prints in the study group was also done. The results have been charted in [Table/Fig-13]. A comparison of fathers' prints in the study group in relation to occurrence of cleft lip, cleft palate and both was made. The results are presented in [Table/Fig-14].

A comparison of mothers' lip prints in the study group in relation to occurrence of cleft lip, cleft palate and both was also made. The results are tabulated [Table/Fig-15]. A comparison of groove count per centimetre in the fathers' prints according to diagnosis (cleft lip, cleft palate and both) was made in the study group. The results are compiled in [Table/Fig-16].

A comparison of groove count per centimetre in the mothers' prints according to diagnosis (cleft lip, cleft palate and both) was also made in the study group. The results are tabulated [Table/Fig-17].

## DISCUSSION

Various investigators have discussed the use of lip prints in other fields like inheritance of congenital anomalies and diseases. Afaf et al., have explained the mode of inheritance of lip prints. Many authors have correlated between lip prints and fingerprints. Lip prints have also been correlated with localised juvenile periodontitis. Dermatoglyphics, which is similar to lip prints, has been associated with cleft lip, Down's syndrome, schizophrenia, Apert syndrome and diabetes [7].

Whorl lip patterns can occur on the upper and/or lower lips. An upper lip whorl is a single, circular pattern of grooves centred on the midline of the upper lip. Lower lip whorls are circular patterns

located on the left and/or right of the lower lip midline. Whorls were first noted by Hirth and his colleagues. They observed that the frequency of whorls on the lower lip increased with non-syndromic CL/P patients and their families [9]. Therefore, studying in depth and establishing further facts and truth in lip prints not only in forensic odontology but also in better understanding various congenital anomalies and diseases is necessary [11].

The study of lip prints in cleft lip and cleft palate has not been undertaken in the Indian population. This study is the first one to establish the relationship between lip prints and the groove count in the Indian context.

In the present study, a new pattern of lip prints, termed type 'O' or the 'whorl' pattern was noted higher in the fathers' prints, seen in 19 cases and 16 cases in the mothers' prints in the study group. This result is different from that obtained in a similar study conducted earlier by Saad et al., who found that the type 'O' pattern was significantly higher in the mothers than the fathers. This might be due to the inequality of the samples in their study i.e., 30 fathers and 32 mothers were included whereas an equal number of subjects (50 fathers and 50 mothers) were included in the present study. Also, the population studied was Egyptian whereas the population used in the present study is Indian. Another factor which might explain this difference in the results is the method used to obtain the lip prints. Direct digital photography of the subjects' lips was used in the study by Saad et al., whereas the cellophane method was followed in the present study. This might have had an implication in the analysis of the lip prints per se.

In our study, a history of CM was obtained between the parents of both the groups. A positive history of 42% was found in the study group which was statistically significant. This once again proves that CM and CL/CP are closely associated.

Cheiloscopy, the study of the patterns of lines and grooves on the vermilion borders of the lips has continued sporadically for a century. Whorls were first noted by Hirth et al., in Germany over thirty years ago as part of their extensive study of the variability and genetics of

lip print patterns. They observed that the frequency of whorls on the lower lip was increased in nonsyndromic CL/CP patients and their families, and speculated that the whorls they observed in families with clefts might represent a mild form of lower lip pits or fistulae. If whorl patterns are indeed more frequent in families with CL/CP, they may be part of an extended spectrum of nonsyndromic CL/CP [9].

## CONCLUSION

Although, the occurrence of the new pattern was not as common in the study group, its total absence in the control group underlines its importance as a phenotypic marker for cleft lip and/or palate in the progeny. More importantly, the significant difference in the groove count between the two groups and within the study group show that groove count may be used as an important parameter in future studies in this regard.

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