

Lip Print Pattern among Children Visiting Dental Out patient department

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ABSTRACT

Background: Lip print patterns are unique in every individual. The uniqueness of lip print pattern assists in the personal identification. The objectives of the present study were to study the different lip print patterns among the children visiting Kanti Children's Hospital, and to compare the distribution of lip print patterns based on gender and race.

Methods: A cross-sectional study was conducted among 300 children visiting the Dental Outpatient Department of Kanti Children's Hospital, Kathmandu, Nepal. Convenience sampling method was used to choose the study subjects. Digital photography method was used to record the image of lips.

Results: The study showed 'Long vertical' (Type I) as the most frequent (41%) type of lip print pattern, whereas 'Unspecified' (Type V) was the least frequent (2.7%) type. Prevalence of 'Type I' pattern was significantly higher in males as compared to females ($p=0.007$) whereas prevalence of 'Type IV' pattern was significantly higher in females as compared to males ($p=0.006$). 'Type I' pattern was the commonest lip print pattern among both Caucasians and Mongolian, whereas 'Type V' (2%) and 'Type IV' (3.7%) were the least common lip print patterns in Caucasians and Mongolian children respectively.

Conclusions: 'Long vertical' (Type I) was the most common lip print pattern among the children visiting the Dental Outpatient Department of Kanti Children's Hospital, Kathmandu, Nepal. Nevertheless, in higher or lesser numbers, all kinds of lip print patterns as described by Suzuki and Tsuchihashi were seen in the study population.

Keywords: Children; gender; lip print patterns; race.

INTRODUCTION

"Cheiloscopy" also known as lip prints is derived from the Greek word "cheilos" meaning "lips" and "e skopein" meaning "to see", which is the study of the characteristics pattern of wrinkles and grooves present on the labial mucosa (sulci laborium).^{1,2} French scientist Edmond Locard in 1932 recommended the use of lip prints in personal identification and criminalization.¹ Lip prints could be left at crime scenes on various solid objects and hard foods.³ Proper investigation of the lip prints patterns which are unique in every individual can help to identify the victims or suspects present in the crime scene.^{3,4} So, the objectives of the present study were to study the different lip print patterns among

the children visiting Kanti Children's Hospital, and to compare the distribution of lip print patterns based on gender and race.

METHODS

A cross-sectional study was conducted among 300 children visiting the Dental Outpatient Department (OPD) of Kanti Children's Hospital, Kathmandu, Nepal. Before commencing the study, ethical approval was obtained from the Institutional Review Board of Kanti Children's Hospital (29/2020-021 Ref. 854). The study was carried over a period of six months (September 1, 2020, to February 30, 2021), and convenience sampling

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method was used to choose the study subjects. Informed consent was obtained from parents or their legal guardian, and assent was obtained from the children involved in the study.

Children of age group 5-12 years visiting Dental OPD of Kanti Children's Hospital who were free from oral pathologies like inflammation, abnormalities, or deformities such as cleft lip, cut marks, surgical scars, or lesions around the lips and willing to participate in the study were included in the study. Children undergoing fixed orthodontic treatment such as braces were excluded from the study. The study population was categorized as Caucasian and Mongolian race according to Ethnicity.^{5,6} Sample size calculation was done based on the study by Timsinha and Kar (2019).¹ Taking prevalence of Class II lip print pattern, $p=75.25\%=0.7525$, $q=1-p=0.2475$ at 95% confidence interval and $d=5\%=0.05$ and using formula $n=Z^2pq/d^2$. The sample size was calculated as 286. Rounding of final sample size was 300.

Digital photography method (Sony DSC RX100) was used to record the image of lips. Participants were made to sit comfortably on a chair with the head positioned in the Frankfurt plane. Examination was done to rule out any abnormalities such as inflammation, deformity, surgical scars, ulcers, burns, and other abnormalities of the lips. From a fixed distance, lips of the subjects in 'natural condition' (without the application of lipstick, lip fillers, lip gloss or any other cosmetic product) were photographed twice using a digital camera (Sony DSC RX100, f/1.8 Lens with 3.6x Optical Zoom, focal length of 10.4-37.1 mm, 35 mm equivalent: 28-100 mm) by placing it on a tripod. The camera to the subject's lip was fixed to 0.8 meters, and the distance of the camera lens from the ground was fixed to 1.0 meter. Examination of the patient, photographic recording, and study of the lip print pattern was done by a single examiner.

The images were zoomed in according to preference. A vertical line was drawn coinciding with the midline. At five mm on either side of the midline, two parallel lines were drawn. These lines demarcated the middle 10 mm of both the upper and lower lips, and these areas were studied to determine the lip print pattern. The patterns of grooves of lips were drawn in each photograph, and classification was done according to the Suzuki and Tsuchihashi classification system.⁷ (Figure 1) Suzuki and Tsuchihashi classification system includes six different types of lip prints as Type I ('Long vertical' which includes clear-cut vertical grooves that run across the lips), Type I' ('Short vertical' which includes partial length groove of type I), Type II ('Branched grooves'

which includes branching Y-shaped pattern), Type III ('Intersected grooves' which includes criss-cross/'x' pattern grooves), Type IV ('Reticular pattern' which includes grooves that forms rectangular shape) and Type V (Other / Unspecified).

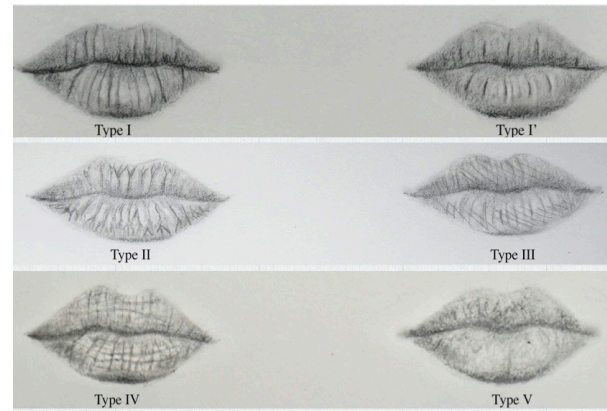


Figure 1. Schematic diagram of different types of lip print patterns.

Collected data were entered in Microsoft Excel and then transferred to Statistical Package for Social Science (SPSS) version 17. After proper cleaning of the data, analysis was done using descriptive statistics. Association between variables was done using the chi square test. Probability of significance was set at 95% confidence interval, where $p \leq 0.05$.

RESULTS

Among 300 children studied, 70.3% were male and 29.7% were female (Table 1). Race wise, 65.3% were Caucasian and 34.7% were Mongolian (Table 1).

Table 1. Distribution of study population according to gender and race.

Gender	Frequency (%)	Race	
		Caucasian	Mongolian
Male	211 (70.3)	136 (45.3%)	75 (25%)
Female	89 (29.7)	60 (20%)	29 (9.7%)
Total	300 (100)	196 (65.3)	104 (34.7)

In the present study, 'long vertical' (Type I) was the most frequent (41%) type of lip print pattern, whereas, 'unspecified' (Type V) was the least frequent (2.7%) one (Figure 2).

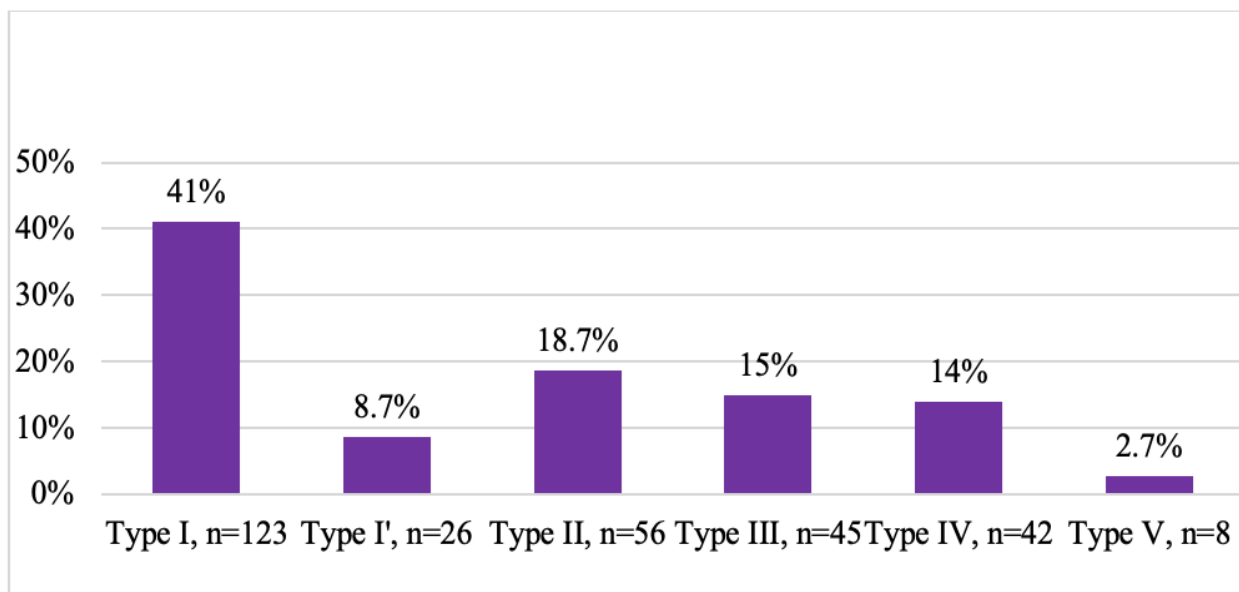


Figure 2. Distribution of lip print patterns, n=300.

Present study showed that ‘Type I’ pattern was the commonest and ‘Type V’ pattern was the least common lip print pattern among both males and females (Table 3). Prevalence of ‘Type I’ pattern was significantly higher in males as compared to females ($p=0.007$) whereas prevalence of ‘Type IV’ pattern was significantly higher in females as compared to males ($p=0.006$) (Table 2). Distribution of other types of lip pattern were comparable among both genders (Table 2).

Table 2. Distribution of lip print patterns according to gender.

Lip print pattern	Frequency n (%)	Gender		p-value
		Male n (%)	Female n (%)	
Type I	123 (41.0)	97 (46.0)	26 (29.2)	0.007*
Type I'	26 (8.7)	18 (8.5)	8 (9.0)	0.898
Type II	56 (18.7)	36 (17.1)	20 (22.5)	0.272
Type III	45 (15.0)	31 (14.7)	14 (15.7)	0.818
Type IV	42 (14.0)	22 (10.4)	20 (22.5)	0.006*
Type V	8 (2.6)	7 (3.3)	1 (1.1)	0.281
Total	300 (100)	211 (100)	89 (100)	

*Statistically significant

In the present study, ‘Type I’ pattern was the commonest lip print pattern among both Caucasians and Mongolian, whereas ‘Type V’ (2%) and ‘Type IV’ (3.7%) were the least common lip print patterns in Caucasians and Mongolian children respectively. There was no significant relationship between type of lip print pattern and race (Table 3).

Table 3. Distribution of lip print patterns according to race.

Lip print pattern	Frequency n (%)	Race		p-value
		Caucasian n (%)	Mongolian n (%)	
Type I	123 (41.0)	79 (40.3)	44 (42.3)	0.737
Type I'	26 (8.7)	14 (7.1)	12 (11.5)	0.198
Type II	56 (18.7)	37 (18.9)	19 (18.3)	0.898
Type III	45 (15.0)	29 (14.8)	16 (15.4)	0.892
Type IV	42 (14.0)	31 (15.8)	11 (10.6)	0.213
Type V	8 (2.6)	6 (3.1)	2 (1.9)	0.718
Total	300	196 (100)	104 (100)	

DISCUSSION

The present study showed 'Type I' and 'Type V' patterns to be the most and least common lip print patterns in the study population. The study also revealed significant gender wise variation in 'Type I' and 'Type IV' patterns. History of usage of lip prints to identify criminals' dates to 1968 where two suspects who threatened to blow up the Tokyo Metropolitan police department were arrested based on the lip print patterns present in the envelope.⁴ Fisher in 1902 was the first to take notice of the lip print pattern morphology. The pattern of grooves present in the lips do not change despite exposure to trauma, extreme temperatures.³ Clauco Martins Santos classified labial wrinkles and grooves into 'simple' and 'compound' types along with eight other subtypes. Suzuki and Tsuchihashi classified lip print patterns into 'six' types in 1971.^{4,7}

Recording the lip print patterns is very important to study the lip print patterns. There are various methods of lip print pattern recording. One of the most commonly used methods is making impressions of lip prints in white papers^{3,8,9} and glued portion of cellophane tape^{10,11,12,13} after applying lipsticks in both the upper and lower lips. There is no need for any sophisticated materials in this method, but there are some challenges while using this method like smudging or spoiling of lip prints leading to unidentifiable marks, and this method can be unhygienic if procedures are not performed meticulously.^{1,2} The amount and evenness, pressure and direction of the lipstick applied to the lips also can disturb the accuracy of the impression.¹ Chadha et al. (2022) in their study have evaluated the lip print patterns using two methods of the same lip print i.e., manual, and digital methods, and the study showed no significant differences in the two methods.¹⁴ Photography method, which has been opted by many researchers^{1,2,7,15,16}, is a desirable option

for recording lip prints considering the current scenario of Coronavirus disease of 2019 (COVID-19) pandemic as this method demands less contact time with the participants.

Lip print patterns have shown variation even among the different regions of the same lip. While recording lip print patterns, different studies have opted to follow different methods. Some authors have considered the mid portions of both the upper and lower lips^{17,18,19} and the same method was followed in the present study. Different studies have evaluated the lip print patterns dividing the upper and lower lips in quadrants^{1,3,9,15,20,21} and sextants^{13,14}.

Among the various lip print patterns, 'Type I' was the most common lip print pattern (41%) in the present study, which was similar to the study done by Gurung et al. (2019) and Poudel et al. (2019) in Nepalese population^{16,17}, but different studies have shown different results. In the studies done by Timsenha and Kar (2019)¹ in Nepalese population, Chijioke et al. (2020)¹⁸ in Nigerian population, the prevalence of 'Type II' pattern was highest whereas the studies done by Ahmed et al. (2018)³ among Egyptian population and Baral et al. (2020)¹⁰ among the Nepalese population "Type IV" was the most common pattern. The variation in the findings might be due to the variation in the race, ethnicity of the studied population. Similar to the present study, 'Type V' was the least frequently seen lip print pattern in most of the studies.^{1,8,10,16,18,21}

The present study has attempted to compare the gender wise and racial variation in the prevalence of lip print patterns. In both genders, "Type I" was the most common (male, 46% and female, 29.2%) and 'Type V' was the least common (male, 3.3% and female, 1.1%) lip print pattern. The distribution of lip print patterns

among male and female genders have shown variable results. The study conducted by Timsenha and Kar (2019) in Nepalese population, the most common type of lip prints is 'Type II' in both male and female genders and 'Type IV, V' and 'V' patterns are the least common ones in males and females respectively.¹ In the study conducted by Ashwinirani et al. (2014) in the Indian population, the most common type of lip prints were 'Type II and IV' and the least common were 'Type I' and 'I' respectively.¹⁹ In the current study, distribution of lip print patterns was comparable in both genders except that 'Type I' pattern was significantly higher in males ($p=0.007$), and 'Type IV' pattern was significantly higher in females ($p=0.006$). In contrast, a study conducted by Chijioke et al. (2020), in Nigerian population showed that 'Type I' ($p=0.004$) and 'Type II' ($p=0.000$) patterns were significantly higher in females compared to males whereas, 'Type IV' ($p=0.000$) pattern was significantly higher in females.¹⁸

Different studies have attempted to evaluate the racial variation in the prevalence of lip print patterns.^{8,9,15,22} The prevalence of "Type I" was highest (Caucasian, 40.3% and Mongolian, 42.3%) whereas 'Type V' was the least common (Caucasian, 3.1% and Mongolian, 1.9%) lip print pattern in both the races. Diksha et al. (2019) had studied the lip print patterns among Caucasian, Mongoloid and Negro races in which, the most common lip print pattern was 'Type II' among Caucasian and Mongolian population whereas 'Type IV' and 'Type IV, V' patterns were the least common types respectively, whereas in the Negroid population, the most common pattern was 'Type III' and the least common pattern was 'Type V'.⁸ The study by Haikal et al. (2014) had compared the prevalence of lip print pattern among Arab and Chinese population, which showed that the highest prevalence of lip print pattern was 'Type I' among the Arab population and 'Type I' was the commonest among the Chinese population, whereas 'Type III' was the least common lip print pattern among both the Arab and Chinese races.²¹ In the present study, there was no significant racial variation among the Caucasian and Mongolian races, but the study conducted by Haikal et al. (2014)²¹ showed that the Chinese population had significantly higher ($p=0.03$) 'Type I' lip print pattern as compared to Arab population. In the present scenario of globalization, the concept of 'pure breed' is somewhat not so practical due to inter-ethnic, inter-racial, international system of marriage and offspring to follow. The variation in results among different studies while comparing different races might also be due to the above reason.

Lip print patterns are unique among every individual.^{4,7} As compared to the adult population, very few studies have been done to study lip print patterns among children.^{12,15} To the best of the author's knowledge, there has been no research regarding the lip print patterns of Nepalese children. Apart from studying the lip print patterns based on gender and race, different authors have studied the correlation of lip print patterns with lip incompetence¹², skeletal profile²³, fingerprints,²³ blood groups¹⁹ and incidence of cleft lip and palate.²⁴ Such studies open the horizon for many more studies regarding lip prints and the other possible anthropometric studies. Detailed study of correlation of lip print patterns and the above-mentioned aspects could not be done in the present study due to the constraints in time and finances. Nevertheless, the present study has generated the baseline data in Nepalese children and the gender wise and racial variation.

CONCLUSIONS

The present study concluded that 'Long vertical' (Type I) was the most common lip print pattern among the children visiting the Dental Outpatient Department of Kanti Children's Hospital, Kathmandu, Nepal. Nevertheless, in higher or lesser numbers, all kinds of lip print patterns as described by Suzuki and Tsuchihashi were seen in the study population. Significant variation in the gender wise prevalence of 'Type I' and 'Type IV' lip print patterns were also observed in the study population. Studies about gender wise and racial variation in lip print patterns needs to be done among the larger population. Application of cheiloscopy in personal identification has been in practice for a long time and its value never seems to decrease. In the current scenario, incidence of child abuse has been in the rise, and cheiloscopy can play important role in the identification of the abuser or the victim. Cheiloscopy needs to be upgraded and utilized more frequently as one of the techniques of personal identification.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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