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Sex identification based on lipprint patterns: A Review

Fiqna Amalya[1], Devi A. A. Nasution[2], Myrtati D. Artaria[3], Yao-Fong Chen[4]

[1]Final year student, [2]Tutor, [3]Professor, Department of Anthropology, Faculty of Social and Political Sciences, Universitas Airlangga, 4-6 Airlangga St., Surabaya, Indonesia, [4]Associate Professor, Department of Human Development and Psychology, Tzu Chi University, 67 Jie-Ren St., Hualien 970, Taiwan, R.O.C.

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Abstract

Background: Many researchers have conducted studies oflip prints to aid in human identification. The distinctiveness of the lip print pattern will be a distinguishing feature from one person to the next.

Purpose: This study analyzes the dominant types and patterns of lips print in males and females.

Results: Most males--7 research out of 20--were type III lip print pattern, and 6 out of 20 belong to the type II lip print pattern. Femalesmainly were typed II pattern—11 out of 20, and type I pattern—7 out of 20.

Conclusion: When the patterns are type I or type III, the sex of the individual can be easily identified; however, when the pattern is type II, the individual could be either a male or a female, with a higher probability of being a female. Other forms of identification should be available to support sex identification in this circumstance.

Keywords: Crime; crime scene; lip-print; lip-print pattern; lip-print type; sex identification.

Background

Humans are large groups of living beings who exist on this planet. Genetics and environmental adaptation are to blame for the emergence of these variances.[1] Human physical variances are influenced by the environment and genetics, according to Glinka in 2008.[2] The presence of morphological variances can be utilized to determine a person's identity, for example, through the use of fingerprints, ears, retina, or lip prints. The identification process is an attempt to determine an individual's identity.

Anthropologist R. Fischer, in 1902 has described the lip print of human lips; then, this was recommended the first time for personal identification in criminal cases by the French criminologist named Edmond Locard.[3] The wrinkles and grooves in the red part of the transitional zone of the lips are referred to as *"sulci labiorum rubrorum,"* each individual has wrinkles and grooves that will not be the same because there are specific characteristics in each individual.[4] Like fingerprints, lip prints can be found or left behind because they are visualized with the help of lipstick on a glass surface, tissue, handkerchief, or on objects at the crime scene in cases of crime and murder.[5] According to Gagliardi[5]this visualization can be used as a guide at the crime scene and provide convenience to forensic personnel who play an active role in identifying a murder case.

Corresponding Author: Myrtati D. Artaria, Professor, Department of Anthropology, Faculty of Social and Political Sciences, UniversitasAirlangga, 4-6 Airlangga St., Surabaya 60286, Indonesia.

Email: myrtati.artaria@fisip.unair.ac.id

Lip prints have unique and stable characteristics, which is a strong reason why lip prints are used as objects to solve crimes and murder cases. In Poland (1985-1997), lip prints were used to identify 85 cases, and 34 cases were successfully resolved. Thus, it further strengthens why lip print is used to solve criminal cases.[2] The presence of lip prints is a supporting medium for investigation, and if the sex category is known, it will make it easier to shortlist the list of suspects with the motive for their crimes.[6] Another compelling reason is that lip print does not change from the individual's age to the sixth week of life.[7]

Qomariah et al.[8] conducted a study using lip prints to find out the dominant patterns and types of the male and female sex using the Suzuki and Tsuchihashi classification for the analysis process. It is known that the lip print of the dominant type III male is as much as 40%, then the lip print on the female sex categorytypes I' as much as 35%. In 2019 Mahampang[5] also conducted the same study,and the result was that the dominant type in men was type II, while in women, type I. The actual use of lip prints is not only a method of sex category identification, and as is the case with research conducted by Arisetiawan[9], which uses lip prints to reveal the inheritance of patterns from father and mother to child, his research shows the inheritance of lip prints from parents to children. In addition, there is an exciting study to find out the relationship between lip print patterns and ancestry, whether the descent is pure Malay ethnicity or not, in the Malay ethnic group in Riau. The results of Afandi and Mandatasari's study[10] showed no significant relationship between lip prints and ancestry.

Based on previous research or research, there are varying results regarding the type of dominant pattern in males and females. Therefore, we would like to study the type of lip prints, whether they could differentiate males from females by utilizing literature from previous studies that have been done.

Methods

We conducted a literature review on the many forms of lip prints, which we discovered in several databases. To begin, keywords such as lip prints, cheiloscopy, sex category identification, and type of lip print patterns were identified. Scientific publications, thesis outcomes, theses, and books were all sources of data from prior study. Then, according to the study topic, we carried out a selection process.

All prior studies on sex category identification based on lip print patterns that employed Suzuki and Tsuchihashi's lip print classifications were included in this analysis. We only look at research that was published between 2009 and 2020. The lipstick method of taking lip prints was the most common.

Findings

Classifications of Lip Prints

The existence of lip print classifications such as those of Suzuki and Tsuchihashi will facilitate the analysis of sex identification. In addition, there are also other lip print classifications;however, they are not used as a reference in the analysis of this study.

According to Suzuki and Tsuchihashi's[11] classification divided into six types according to the shape and path of the grooves (Table 1).

Table 1: Classification of Lipprint Patterns According to Suzuki and Tsuchihashi[11]

Classification	Grooves Type
	Type I (Vertical complete) is a straight groove and crosses the entire width of the reddish part of the lips.
	Type I' (Vertical incomplete)is a straight groove but does not cover the entire lip.
	Type II (Branched)is a lip print whose groove is straight vertically andhas a branch at the top of the groove.
	Type III (Intersected),namely the grooves of the lips that seem to cut from one another.

Contd.. Table 1: Classification of Lipprint Patterns According to Suzuki and Tsuchihashi[11]

	Type IV (Reticular),that is, the grooves of the lips look like boxes like a net.
	Type V (Undifferentiated), the grooves do not belong to I-IV and cannot be differentiated morphologically.

Lip printsretrieval method

Lip prints at the crime scene must be identified quickly in order to determine if they belong to the criminal suspect or the victims. Lip prints can be taken and documented immediately; however, the precise approach must be used to achieve the best results.

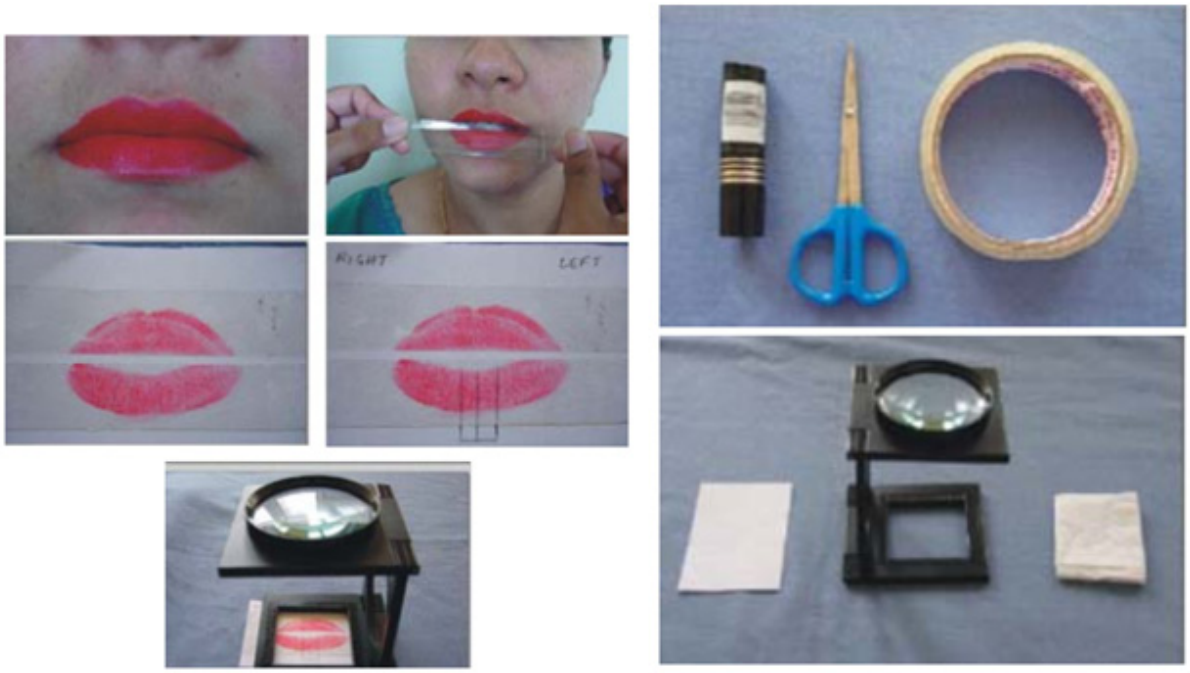

Figure 1: Tools, Materials, and Techniques Using the Lipstick Method

Source: Atmaji et al.[2]

Lip prints were obtained from the fissures, wrinkles, and grooves of the labiorum sulci on the labial mucosa (Figure 1). Research by Mishra et al.[12] described that lip print results were obtained from a substantially moving part of the lips and from that it would produce a different lip print even in the same individual, this was according to the direction, pressure, and method used in making the lip print. The development of odontology has contributed significantly to the emergence of cheiloscopy studies as a unique, individual, and stable identification tool. Both research[13] by Budowle et al. and Rai & Anand suggest that forensic investigations are concerned with individual identification, which combines the application of lip prints, anthropology and odontology, and DNA profiling techniques. Suzuki and Tsuchihashi[11] confirmed that each lip print is unique, and that a traumatized lip has no effect on the lip print.

According to Reddy[14], cheiloscopy studies need to be refined into a unified system for use in forensic dentistry. Lip prints as proof of personal identification and criminal investigations are the subject of limited research papers and information. It will need additional research to uncover more facts from lip prints before they can be used as valid proof.

Classification by Suzuki and Tsuchihashi[11]is divided into six types of lip prints based on shape and groove so that it is used as the standard classification of lip prints. Furthermore, this strategy provides a clear representation, making it easier to comprehend and master. Based on the aforementioned classifications, this study prefers to adopt Suzuki and Tsuchihashi's

classifications because they are used more frequently than others. Renaud's classification is considered a full classification of lip prints because there are 10 sorts of patterns, however it has only been used in a few previous investigations. Many prior research have preferred Suzuki and Tsuchihashi's more easy classifications over Renaud's because of the greater number of lip print type patterns.

A total of 20 scientific articles that have been analyzed have similarities and differences amongthem. Some of the differences included the number of research samples, the location of the study, the lip print technique--Single motion or Prabhu's method, and the method of data analysis. In addition, several scientific articles explained analysis techniques to make it easier to visualize into several divisions into 4, 6, 8, 10 quadrants on the subject's lips.

Ranjan et al.[6], Vatchala et al.[15], and Rastogi & Parida[16]performed a lip print analysis by splitting the lips into four quadrants.Unlike previous studies, Costa & Caldas[17] and Moshfeghi et al.[18] divided lip print analysis into six quadrants. Mahampang[5] conducted a lip print study by dividing the lips into eight quadrants, whereas Sunday et al.[19] between the inner labial mucosa and outer skin. Examination of this lip prints is known as cheiloscopy. Some authors have worked on lip print in the past and made some striking points on its application in forensic studies and human identification. The study was carried out to identify and compare the lip prints patterns among the Igbos. The study was done to investigate and document the characteristic cheiloscopic pattern of Igbos and to assess the distribution of lip print patterns among males and females. A total of 300 subjects were used for the study. 150 were males, 150 were females, all of which were normal subjects. Subjects were selected and identified based on an oral interview. These subjects were selected through purposive convenient sampling method. The males and females had their highest percentage distribution in type I (35.73% divided the lip quadrant into 10. Mahampang[5] also explained that accurate analysis results would be obtained using the eight quadrant observation method by showing all the variations in each individual's type of lip print pattern. As a result, researchers can employ the eight quadrant approach as a way of extensive observation, making it easier to assess and detect sex. In the analysis of cheiloscopy procedures, it can be said that there is no apparent standardization of quadrant division.

The tools used to generate the total lip print impression: lipstick and masking tape, are identical to the information gained from these scholarly studies. This tape is used to transfer the printed results so that they may be visualized and analyzed more easily. It is clear from the findings of the investigation that each person's lip print is distinct.It is also supported by Yadav's[20] study, which claims that lip prints are similar to fingerprints and bite marks in that they're unique to each person and can be easily studied using the cheiloscopy procedure.

In cases of sexual crimes, lip prints are generally found at the crime scene and on the victim's body--starting from the face, neck, and other body parts.[20] Kasprzak[21] stated that identifying persons based on the imprints formed by the lips is difficult since the effect of the wound on the lips might obscure the lip trace because of a stain covering the lips, but this can be exposed by thorough chemical investigation. Lip print traces discovered at a crime scene can be used to deduce details about what happened, such as the number of persons involved, the type of cosmetics used, work habits and nature, sex categorization, and the existence of specific pathologies on the lips.

According to Karki's[22] research, the outcomes of lip print prints are permanent and unique to each individual. As a result, if a suitable method cannot be developed, the lip print approach can be utilized as a substitute for other forensic investigative methods, and lip prints have the potential to be a supporting tool in identification.

This statement from Karki[22] is backed up by Abedi et al.[23], who claim that lip prints aren't the same as fingerprints because there are still flaws, such as the lack of validation and quality in defining specific lip print procedures. Lip prints, on the other hand, can sometimes help provide answers and act as extra evidence in relation to the events being investigated. More research is needed to continue developing and discovering appropriate procedures, as well as to increase the validity of lip print evidence as a tool in criminal justice delivery.The importance of attempts to undertake lip print recording on all individuals, according to Domiaty et al.[24], is to develop a database that may be utilized to provide answers to civil and criminal cases.

Another study conducted by Eldomiaty et al.[25]lower middle and lower left tried to investigate the stability of the lip print pattern. Although the

study took almost three years to complete, lip print data was collected from September 2009 to October 2012. For reasons that are frequently observed at crime scenes, this study focuses primarily on the lower lip print. The old lip print data is maintained in envelope paper for three years before being compared to the fresh lip prints. The results revealed that 89.6 percent of the old and new lip prints had identical grooves, while the remaining 10.4 percent had a comparable pattern in one or more regions.In line with Eldomiaty et al.[25] lower middle and lower left, Ludwig and Page[26] conducted a study that was designed to determine whether or not the details of lip prints with lipstick were available, and the results of lip prints were then compared to determine whether these two things could be linked between each other. It was done to see if the flow patterns of each subject were similar and to confirm the use of cheiloscopy in forensic investigations.

Conclusions

The diversity of the analysis technique in visualizing lip prints, which splits the quadrants on the lip print into different categories, including 4, 6, 8, and 10 quadrants, is revealed by a review of 20 prior scientific works. Finally, the outcomes of lip print kind and pattern are dominant for both male and female sexes. As a result of the differences and similarities in information gathered from the analysis of 20 prior scientific works, it is possible to infer that this knowledge is useful for this study.

The dominating lip print type data from each previous research sample, both male and female, were then used to create groupings. Seven out of twenty scientific publications belong to the type III lip print pattern group, which is dominated by men. There are around 11 scientific papers on the female sex category that belong to the type II lip print pattern category. Six scientific publications in male lip prints belong to the type II lip print pattern group, while seven scientific articles in female lip prints belong to the type I lip print pattern group.Suzuki and Tsuchihashi classified lip prints into six categories: type I, I', II, III, IV, V. Based on the study of the grouping of lip print results in Table II, there is one scientific publication in the type V group for both males and females. We found the type IV lip print pattern mostly in women.

The following conclusions can be taken from the findings of study and analysis conducted on 20 prior scientific studies linked to sex determination based on the type of lip print pattern belonging to Suzuki and Tsuchihashi: The type II lip print pattern is represented in six research articles. 1) Type III wrinkles and lip prints (lip prints) were the most common type and pattern of wrinkles and lip prints (lip prints) in men (Intersected). As a result, type III predominates in as many as seven of the prior twenty scholarly articles. The type I lip print group includes seven scientific articles.2) The female had the dominant type and pattern of wrinkles and lip prints, which was type II—Branched. As many as 11 of the last 20 scientific articles demonstrate the dominance of type II research.

The following conclusions can be taken from the findings of study and analysis conducted on 20 prior scientific studies linked to sex determination based on the type of lip print pattern belonging to Suzuki and Tsuchihashi: 1) Type III lip print pattern group is dominated by males, and type I lip print pattern group is dominated by females.2)As many as 11 of the last 20 scientific articles demonstrate of type II is dominated by female, but that type II is dominated by male is represented in 6 research articles. Therefore, when an individual's pattern is type II, the individual could be either a male or a female, with a higher probability of being a female.

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