

Cheiloscopy Evaluation of Lip Print Similarities Between Same Gender and Opposite Gender Sibling Pairs

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Abstract—Cheiloscopy, the scientific study of lip prints, has emerged as a valuable adjunct in forensic identification due to the uniqueness and relative stability of lip groove patterns. This study aims to evaluate the similarity of lip print patterns among biological sibling pairs, with a specific focus on comparing same-gender and opposite-gender siblings. A cross-sectional observational study was conducted on 30 biological sibling pairs categorized into brother–brother, sister–sister, and brother–sister groups. Lip prints were collected using a standardized method involving dark-coloured lipstick and transparent cellophane tape, and subsequently analyzed by dividing each print into four quadrants. Patterns were classified using the Suzuki and Tsuchihashi classification system. The results revealed that 73.3% of sibling pairs exhibited similarity in lip print patterns, while 26.7% showed no significant similarity. Greater resemblance was observed among same-gender siblings compared to opposite-gender pairs. However, complete identity of lip prints was not found, supporting the principle of individuality. The findings highlight that while familial resemblance exists, lip prints retain distinctiveness, reinforcing their forensic applicability. This study contributes to understanding genetic influence in cheiloscopy and supports its use as a supplementary tool in forensic investigations.

Index Terms—Cheiloscopy; Lip Print Patterns; Sibling Similarity; Forensic Identification.

I. INTRODUCTION

Cheiloscopy, the scientific analysis of lip prints, has gained recognition as an auxiliary method in forensic identification. Forensic science fundamentally aims to establish the identity of individuals involved in criminal or civil investigations. Traditional identification techniques such as fingerprint analysis

and DNA profiling have long been considered reliable due to their high degree of accuracy and uniqueness. However, these methods are not always applicable in every forensic scenario. In cases where fingerprints are smudged or DNA samples are unavailable or degraded, alternative identification methods become necessary.

Lip prints, formed by grooves and wrinkles on the vermilion border of the lips, present a unique pattern that can be used for identification. These patterns are considered to be stable over time and are not easily altered under normal conditions. The uniqueness of lip prints has been compared to that of fingerprints, although cheiloscopy is still regarded as a supplementary rather than primary identification method.

The increasing relevance of cheiloscopy in forensic science is due to its practical applicability at crime scenes. Lip prints may be found on surfaces such as glass, cups, cigarette butts, and even skin. Their presence often indicates close physical contact, making them particularly useful in cases such as sexual assault, homicide, and robbery.

This study focuses on examining the similarity of lip print patterns among biological siblings. Since siblings share genetic material, it is important to understand whether hereditary factors influence lip print patterns. The research also investigates whether gender combinations—same-gender versus opposite-gender siblings—affect the degree of similarity.

By exploring these aspects, the study aims to assess the reliability of lip prints as an identification tool. Understanding familial resemblance is crucial because excessive similarity could reduce the discriminatory power of lip prints. Conversely, if individuality is

maintained despite genetic relationships, it strengthens the forensic value of cheiloscopy.

II. OVERVIEW OF FORENSIC IDENTIFICATION

Forensic identification plays a crucial role in the administration of justice by establishing the identity of individuals involved in legal cases. Over time, forensic science has evolved through the integration of multiple disciplines, including biology, chemistry, and physics, to enhance the accuracy and reliability of identification methods.

Fingerprint analysis was one of the earliest scientific techniques used for identification. The uniqueness and permanence of fingerprint patterns made them a reliable tool in criminal investigations. The classification systems developed in the early twentieth century allowed for systematic comparison and storage of fingerprint records.

The introduction of DNA profiling marked a significant advancement in forensic science. DNA analysis provides highly accurate results and is considered the gold standard for identification. However, DNA-based methods require proper biological samples and laboratory infrastructure, which may not always be available.

Other identification techniques include forensic odontology, anthropometry, and facial reconstruction. Each method has its own advantages and limitations, depending on the context of the investigation. For example, dental records are particularly useful in identifying victims of mass disasters, while anthropometric measurements are used in skeletal identification.

In situations where primary identification methods are not feasible, supplementary techniques such as cheiloscopy become important. Lip prints can provide additional evidence linking a suspect to a crime scene. Although not as widely accepted as fingerprints or DNA, cheiloscopy has shown potential in forensic investigations.

The reliability of any identification method depends on its ability to distinguish individuals accurately. Therefore, continuous research is necessary to validate emerging techniques such as lip print analysis and to establish standardized procedures for their application.

III. ANATOMY OF HUMAN LIPS AND LIP PRINT FORMATION

The human lips are complex anatomical structures that play an important role in speech, facial expression, and food intake. From a forensic perspective, the lips are significant because of the presence of grooves and wrinkles on the vermilion border, which form the basis of lip prints.

The lips are primarily composed of the orbicularis oris muscle, which functions as a sphincter around the mouth. This muscle is responsible for movements such as closing and puckering of the lips. The outer surface of the lips is covered by skin, while the inner surface is lined by mucous membrane. The vermilion zone, which lies between these two regions, is the area where lip print patterns are observed.

The grooves on the vermilion border, known as sulci labiorum, are formed due to variations in epithelial folding and connective tissue structure. These grooves create distinct patterns that can be classified and analyzed for identification purposes. The formation of these patterns begins during embryonic development and is influenced by both genetic and environmental factors.

For analytical purposes, lip prints are divided into four quadrants: right upper, left upper, right lower, and left lower. This division allows for systematic examination and comparison of patterns. Each quadrant may exhibit different groove patterns, contributing to the overall uniqueness of an individual's lip print.

The stability of lip print patterns over time makes them suitable for forensic analysis. Although external factors such as injuries or diseases may temporarily alter the appearance of the lips, the underlying pattern remains largely unchanged.

Understanding the anatomy and formation of lip prints is essential for accurate classification and comparison. It also provides insight into the factors that influence pattern variability, including genetic inheritance and environmental conditions.

IV. CLASSIFICATION OF LIP PRINT PATTERNS

Classification is a critical step in the analysis of lip prints, as it provides a standardized framework for identifying and comparing patterns. The most widely used classification system was proposed by Suzuki

and Tsuchihashi, which categorizes lip print patterns into six types based on the morphology of grooves.

Type I consists of clear vertical grooves that run across the entire lip, while Type I' includes incomplete vertical grooves. Type II patterns are characterized by branched grooves, whereas Type III patterns involve intersected grooves. Type IV represents reticular or net-like patterns, and Type V includes irregular or unclassified patterns.

This classification system is widely accepted due to its simplicity and reproducibility. It allows researchers to categorize lip prints systematically and facilitates comparison between individuals and groups. The use of quadrant-wise analysis further enhances the accuracy of classification by focusing on specific segments of the lip.

The recording technique plays a crucial role in obtaining clear and accurate lip prints. The application of dark, non-glossy lipstick helps in highlighting the grooves, while the use of transparent cellophane tape ensures proper transfer of the print onto a recording surface. Care must be taken to avoid distortion caused by excessive pressure or movement.

Comparative analysis involves examining the similarity of patterns between individuals. In forensic investigations, the presence of matching patterns in multiple quadrants increases the likelihood of identification. However, complete similarity across all quadrants is rare, supporting the uniqueness of lip prints.

The classification of lip prints is not only important for identification but also for studying pattern distribution within populations. It helps in understanding variations based on factors such as gender, ethnicity, and genetic relationships.

V. FAMILIAL RESEMBLANCE AND GENETIC INFLUENCE

Familial resemblance is an important aspect of forensic identification, as it provides insight into the role of genetic factors in determining physical characteristics. Biological siblings share approximately fifty percent of their genetic material, which raises the possibility of similarity in morphological traits, including lip print patterns.

Research in dermatoglyphics has shown that certain patterns, such as fingerprints, exhibit hereditary influence. Since lip prints also originate from

ectodermal tissue during embryonic development, it is reasonable to hypothesize that genetic factors may influence their formation.

Studies have reported partial similarity in lip print patterns among family members, particularly between parents and offspring. However, complete identity is rarely observed, indicating that environmental factors and developmental variations also play a role in pattern formation.

The present study extends this line of research by comparing lip print similarity between same-gender and opposite-gender siblings. Gender-related differences in lip morphology may influence pattern distribution, making it important to analyze these variations.

Understanding familial resemblance has both theoretical and practical implications. From a theoretical perspective, it contributes to the study of human development and genetics. From a forensic perspective, it helps in assessing the reliability of lip prints as an identification tool.

If lip prints exhibit high levels of similarity among siblings, their use in forensic identification may be limited. However, if individuality is maintained despite genetic relationships, it strengthens their value as a reliable identification method.

VI. MATERIALS AND METHODOLOGY

The study was conducted using a cross-sectional observational design involving 30 biological sibling pairs. Participants were categorized into three groups: brother–brother, sister–sister, and brother–sister pairs. Informed consent was obtained from all participants before data collection.

The materials used for recording lip prints included dark-coloured lipstick, transparent cellophane tape, bond paper, tissue paper, water, and a magnifying glass. These materials were chosen for their simplicity and effectiveness in capturing clear lip impressions.

Before recording, participants were instructed to clean their lips to remove any contaminants. A thin layer of lipstick was applied evenly over the vermilion border. The participant was then asked to press their lips gently against the cellophane tape, which was subsequently transferred onto bond paper.

Each lip print was divided into four quadrants for analysis. The patterns in each quadrant were examined using a magnifying glass and classified according to

the Suzuki and Tsuchihashi system. The predominant pattern in each quadrant was recorded.

Similarity between sibling pairs was assessed through quadrant-wise comparison. Pairs showing matching patterns in three or four quadrants were classified as similar, while those with fewer matches were considered not similar.

Statistical analysis included percentage calculation and odds ratio to determine the strength of association between gender combination and similarity. This methodology ensured objective and reproducible results.

VII. RESULTS AND DISCUSSION

The study revealed that a majority of sibling pairs exhibited some degree of similarity in lip print patterns. Specifically, 73.3% of the pairs showed similarity, while 26.7% did not. This indicates that familial resemblance exists but is not universal.

Same-gender sibling pairs demonstrated a higher degree of similarity compared to opposite-gender pairs. This suggests that gender-related factors may influence lip print patterns. However, the absence of complete identity among siblings supports the principle of individuality.

The findings are consistent with previous studies that reported partial hereditary influence on lip print patterns. The results also highlight the importance of quadrant-wise analysis in identifying similarities and differences.

From a forensic perspective, the presence of similarity among siblings does not undermine the usefulness of lip prints. Instead, it emphasizes the need for comprehensive analysis and corroboration with other evidence.

VIII. CONCLUSION

The present study provides significant insights into the role of cheiloscopy in forensic identification by examining lip print similarities among biological sibling pairs. The findings clearly demonstrate that while familial resemblance exists, lip print patterns retain a high degree of individuality. This balance between similarity and uniqueness is crucial in determining the forensic reliability of lip prints.

One of the key outcomes of the study is the observation that 73.3% of sibling pairs showed some

level of similarity in their lip print patterns. This indicates that genetic factors do influence the formation of lip grooves. However, the absence of complete identity among any of the pairs strongly supports the principle that lip prints are unique to each individual. This uniqueness is essential for any identification method to be considered reliable in forensic science.

The study also highlights the influence of gender on lip print similarity. Same-gender sibling pairs, such as brother–brother and sister–sister, exhibited a higher degree of resemblance compared to opposite-gender pairs. This suggests that biological and morphological factors related to gender may play a role in determining lip print patterns. However, these similarities were not sufficient to compromise individual identification, as variations were still observed across different quadrants of the lip.

From a methodological perspective, the use of quadrant-wise analysis proved to be effective in identifying similarities and differences in lip print patterns. By dividing each lip print into four sections, the study ensured a detailed and systematic comparison. This approach enhances the accuracy of analysis and reduces the chances of subjective interpretation.

The findings of this study have important implications for forensic investigations. Lip prints can serve as valuable supplementary evidence, particularly in cases where primary identification methods such as fingerprints or DNA are unavailable. Their presence at crime scenes can help establish a link between a suspect and the location, thereby strengthening the overall evidence.

However, the study also acknowledges certain limitations. The sample size was relatively small, and the study was limited to a specific population. Future research should include larger and more diverse samples to validate the findings. Additionally, the use of advanced technologies such as digital imaging and automated pattern recognition could further enhance the accuracy and reliability of lip print analysis.

In conclusion, the study reaffirms that cheiloscopy is a promising tool in forensic science. While genetic influence contributes to partial similarity among siblings, the uniqueness of lip print patterns remains intact. Therefore, lip prints can be effectively used as an adjunct method of identification, provided they are analyzed systematically and in conjunction with other

forensic evidence. Continued research and standardization of techniques will further strengthen the scientific foundation of cheiloscopy and expand its applications in forensic practice.

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