

Kannan S^{1*}, Muthu K², Muthusamy S¹, Sidhu P³

¹ Associate Professor, Faculty of Dentistry, AIMST University, Kedah, Malaysia.

² Senior Lecturer, Faculty of Dentistry, AIMST University, Kedah, Malaysia.

³ Lecturer, Faculty of Dentistry, SEGI University, Kota Damansara, Kuala Lumpur, Malaysia.

Abstract

Background: Various methods are used to collect evidence from a crime scene, and with the advancements in forensic science, most techniques are a common and necessary part of all criminal investigation. Cheiloscopy or lip print analysis is one important technique which facilitates the identification of suspects, and like finger prints, lip prints left at the crime scene may be collected and analyzed.

Highlights: This article gives an overview of cheiloscopy and its use as a vital tool in crime investigation.

Conclusion: Cheiloscopy can be used in par with other standard methods of crime investigation in future.

Keywords: Cheiloscopy; Lip Prints; Forensic Science.

*Corresponding Author:

Dr. Sathya Kannan BDS MDS (Oral Pathology) MFDS RCSEd,
Associate Professor, Faculty of Dentistry, AIMST University, Bedong
08100, Kedah, Malaysia.
Tel: +60164703646
Fax: +6044298449
E-mail: drsathyas@yahoo.com

Received: February 26, 2015

Accepted: March 24, 2015

Published: March 26, 2015

Citation: Kannan S, Muthu K, Muthusamy S, Sidhu P (2015) Cheiloscopy - A Vital Tool In Crime Investigation. *Int J Forensic Sci Pathol.* 3(3), 89-93. doi: <http://dx.doi.org/10.19070/2332-287X-1500022>

Copyright: Kannan S[©] 2015. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Introduction

Identification is of paramount importance in any forensic investigation. With the advancements in science and technology, person identification techniques have become more refined and prevalent. The techniques range from renowned methods like fingerprints analysis and DNA profiling to recent developments like retinal scanning. Different methods are used depending on the type and nature of evidence available for investigation.

Forensic investigation technique that deals with person identification based on lip prints is called cheiloscopy (derived from the Greek word 'Cheilos' which means lips and 'skopein' means to see) [1, 2]. Among other latent traces, lip prints or impressions

of the human lips can be found at a crime scene. They are often left on objects such as cups, glasses, cigarettes, windows, doors and clothing [2-5]. These lip prints can be captured and further analyzed to provide valuable evidence as like finger prints, there are no two people with identical lip prints [6, 7].

History

In 1902, the biological phenomenon of systems of furrows on the red part of human lips was first noted by an anthropologist, R Fischer [8]. Later, Edmond Locard in 1932, recommended the use of lip prints in crime investigation [1, 2]. In 1950, Le Moyne Snyder, a forensic expert suggested the concept of wrinkles in lips to identify people in his book entitled "homicide investigation". He stated that lip prints possess individual features as thumbprints. He is also called, 'The Father of Cheiloscopy' [9, 10]. In his book, he reveals a very interesting case where a woman was struck by an automobile striking her face on the left front fender of the car. The owner of the car denied the incident. On cheiloscopic examination from prints on the left front fender of the car it was concluded that the woman was hit by the alleged automobile [11].

In 1960, Dr. Martins Santos proposed that lip characteristics could be used in personal identification and proposed a system for classifying lip prints [1]. In Hungary 1961, lip traces found on a glass door at the scene of a murder led to lip print examination. At this time, the usefulness of the lip traces for criminal identification was proven [12]. In the period 1968-1971, two Japanese scientists Yasuo Tsuchihashi and Kazuo Suzuki studied the lip grooves extensively. They called these lip grooves sulci laborium rubrorum [9]. In 1971, they studied uniovular twins and concluded that no two lip prints manifested the same pattern [13, 14].

In the recent years, different aspects of the lip prints like sex determination, stability and various morphological patterns have been studied. Postmortem changes of lip prints were also analyzed to find out anthropometric measurements of the lip region before and after fixation [15-20]. All these studies concluded that cheiloscopy can be effectively used as an additional tool for person identification in crime investigation.

Classification

On the lips, the Klein’s zone is the mucosal area which is covered with wrinkles and grooves that form the characteristic lip pattern and lip prints. In 1967, Clauco Martin Santos, Professor of forensic dentistry at the Federal University of Rio de Janeiro, Brazil,

first classified lip grooves into four groups as shown in Table 1 [1, 2, 6, 14, 15, 21]. In 1970, Suzuki and Tsuchihashi proposed another classification of lip prints as shown in Table 2 and Figure 1 shows the five patterns of this classification [2, 9, 13]. French scientist Renaud [6] studied 4000 lip prints and classified them as shown in Table 3. In 1979, Afchar-Bayat lip prints classification was based on groove organization as shown in Table 4 [2]. Kasprzak [1] classified lip patterns into 23 types of individual features as shown in Table 5.

Lip anatomy and the thickness and position of lips are also analyzed in cheiloscopy, and according to the thickness, lips are classified into four as shown in Table 6 [18].

Table 1. Clauco Martin Santos lip print classification.

Simple types (formed by single element)	Composite types
Straight line	Bifurcated
Curved line	Trifurcated
Angled line	Irregular
Sine shaped line	

Table 2. Suzuki and Tsuchihashi lip print classification.

Type I: clear cut vertical grooves that run across the entire lips.
Type I': similar to type i but that do not run across the entire lip.
Type II: branched groove (branched y pattern).
Type III: intersected grooves.
Type IV: reticular grooves.
Type V: undetermined.

Figure 1. Suzuki and Tsuchihashi lip print classification.

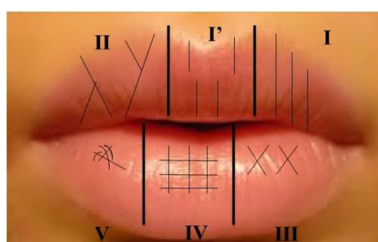


Table 3. Renaud lip print classification.

Type a – complete vertical
Type b – incomplete vertical
Type c – complete bifurcated
Type d- incomplete bifurcated
Type e- incomplete intersecting
Type f- reticular
Type h- in the form of sword
Type i – horizontal
Type j- other types

Table 4. Afchar-Bayat lip print classification.

A 1: Vertical and straight grooves, covering the whole lip.
A 2: Like the former, but not covering the whole lip.
B 1: Straight branched grooves.
B 2: Angulated branched grooves.
C: Converging grooves.
D: Reticular pattern grooves.
E: Other grooves.

Table 5. Kasprzak classification on individual features of lip pattern on lips.




















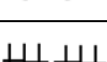

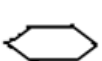

An eye		A closing bottom furcation	
A hook		A delta-like opening	
A bridge		A simple opening	
A line		A closing top bifurcation	
A dot		A pentagonal arrangement	
A rectangle like		A branch like top bifurcation	
A triangle like		A star like bifurcation	
A group of dots		A fence	
A simple top furcation		A branch like bottom bifurcation	
A simple bottom furcation		Double fence	
A double eye			
Hexagonal arrangement			
Crossing lines			

Table 6. Classification of lips based on thickness.

Thin lips (common in European Caucasian)
Medium lips (most common type)
Thick or very thick lips (seen in blacks)
Mix lips (usually seen in Orientals)

Lip Prints And Person Identification

Lip prints can be in the form of lipstick smears that are easily identifiable, which are often left as trace evidence and can link a suspect to the crime scene. However, lip prints made with smudge proof lipstick (protective lipstick or permanent or long-lasting lipstick that do not leave any visible marks) or in situations where the suspect does not wear a lipstick, latent lip prints can be located and developed for forensic evidence.

Like finger print analysis, lip printing has been tested and developed for crime scene investigation. The vermilion borders of the lips have minor salivary glands, sebaceous glands and sweat glands [15]. The natural secretion from these glands allows the transfer of prints to other surfaces. When the lip grooves or ridges come into contact with a surface that will take a print, material that is on the lips ridges such as perspiration, oil, lip stick or blood, will be transferred to the surface giving rise to lip prints.

Lip prints that are easily identifiable can be recorded by photographs. They can be photographed, enlarged and overlay tracings of the grooves can be made when they are readily visible at the crime scene [17]. Alternatively, latent lip prints are hidden or invisible, and have to be made visible for taking photographs. Depending on the type of surface on which the lip print has been left, different methods are used for locating and developing latent prints. A high degree of visual contrast between the lip patterns and the surface on which a lip print has been deposited is required for evaluating the prints. Conventional finger print powders (red, black and silver metallic), cyanoacrylate and reagents like ninhydrin and lysochrome (Sudan III, oil red O and Sudan black) are helpful in identifying latent lip prints. Lysochromes are particularly more effective in developing recent as well as older prints as they have the ability to stain fatty acids and are more sensitive to oils secreted from the lips. If the colour of the developer and the colour of surface on which the lip print lies is the same then fluorescent dyes can be used to detect the lip prints [22-28]. Castello et al studied luminous lip prints, where Nile red was used as a developer for latent lip prints which produced fluorescence.

On suspects, lip prints can be recorded by applying lipstick, or other suitable transfer mediums to the lips like a roller finger printer and then having the individual press his or her lips to a piece of paper or cellophane tape. Alternatively, an impression of the lips (without lipstick or other recording medium) is made against a suitable surface initially, and the prints obtained are later processed with either conventional fingerprint developing powder or with a magna brush and magnetic powder [26].

Osama et al [29] conducted a study on the duration and reliability of lip prints as physical evidence at scene of crime. They concluded that the lip prints on white paper are reliable for up to 12 weeks and on glass for up to 6 weeks if exposed to surrounding ambient condition. However on glass, lip prints are stable up to 9 weeks if kept in a closed container with temperature adjusted around 25°C. Following the collection of lip prints, the prints can be analyzed manually compared and matched. However, like finger print analysis, digital methods manipulate the images faster for rapid and reliable lip print analysis [20].

Problems With Cheiloscropy

Lip prints involve a mobile portion of the lip and a person can produce different lip prints according to pressure and direction [30]. However, the pattern of the prints will not differ but the size of the print can vary with differences in pressure and direction. Besides, conditions like chapped lips, inflammation of lips, and lip abnormalities (developmental disturbances, ulcers, infections, cysts and tumours) can also influence lip prints. Individuals with chapped or inflamed lips may not produce lip patterns; likewise persons with lip abnormalities may not produce lip prints within the normal patterns. In addition to the above mentioned problems, the most commonly faced difficulty is availability of ante mortem data for lip prints, which is extremely less when compared to finger prints.

Conclusion

Cheiloscropy in forensic science can be used as a reliable aid for human identification. Lip prints like finger prints are unique to an individual, and analysis of lip prints is very simple and inexpensive. There is continuous development in the field of cheiloscropy and in future it can be used in par with other standard methods in crime investigation. Therefore, it is recommended that lip print records should be maintained for every individual similar to finger prints. Recording of lip prints and maintaining ante mortem data can be included as a component in dental records, as it may help in future person identification. Lip prints can be considered as important evidence to identify suspects and victims and hence, these prints may be a potential investigative resource in forensic science.

References

- [1]. Kasprzak J (1990) Possibilities of cheiloscropy. *Forensic Sci Int* 46: 145-51.
- [2]. Caldas IM, Magalhães T, Afonso A (2007) Establishing identity using cheiloscropy and palatoscopy. *Forensic Sci Int* 165: 1-9.
- [3]. Augustine J, Bapande SR, Tupkari JV (2008) Cheiloscropy as an adjunct to forensic identification: A study of 600 individuals. *J Forensic Odontostomatol* 26: 44-52.
- [4]. Kavitha B, Einstein A, Sivapathasundharam B, Saraswathi TR (2009) Limitations in Forensic Odontology. *J Forensic Dent Sci* 1: 8-10.
- [5]. Williams TR (1991) Lip prints - Another means of identification. *J Forensic Ident* 41: 190-4.
- [6]. Domiaty MAE, Al-gaidi SA, Elayat AA, Safwat MDE, Galal SA (2010) Morphological patterns of lip prints in Saudi Arabia at Almadinah Almonawarah province. *Forensic Sci Int* 200: 179e1-e9.
- [7]. Gabriel M, Fonseca, Esteban Bonfigli, Mario Cantin (2014) Experimental model of developing and analysis of lip prints in atypical surface: A metallic straw (bombilla). *J Forensic Dent Sci* 6: 126-31.
- [8]. Thomas CJ, van Wyk CW (1988) The palatal rugae in identification. *J Forensic Odontostomatol* 6: 21-7.
- [9]. Suzuki K, Tsuchihashi Y (1970) New attempt of personal identification by means of lip print. *J Indian Dent Assoc* 42: 8-9.
- [10]. Sharma P, Saxena S, Rathod V (2009) Comparative reliability of cheiloscropy and palatoscopy in human identification. *Indian J Dent Res* 20: 453-7.
- [11]. Synder LM (1977) *Homicide Investigation*. 3rd edtn, Springfield, IL: Charles C. Thomas.
- [12]. Kasprzak J. Cheiloscropy. In Siegel JA, Saukko PJ, Knupfer GC (2000) *Encyclopedia of Forensic Sciences*. London: Academic Press 358-61.
- [13]. Suzuki K, Tsuchihashi Y (1971) New attempt of personal identification by means of lip prints. *Can Soc Forens Sci J* 4: 154-8.
- [14]. Tsuchihashi Y (1974) Studies on personal identification by means of lip prints. *Forensic Sci* 3: 233-48
- [15]. Ball J (2002) The current status of lip prints and their use for identification. *J Forensic Odontostomatol* 43-6.
- [16]. Costa VA, Caldas IM (2012) Morphologic patterns of lip prints in a Portuguese population: a preliminary analysis. *J Forensic Sci* 57: 1318-22.

- [17]. Utsuno H, Kanoh T, Tadokoro O, Inoue K (2005) Preliminary study of post-mortem identification using lip prints. *Forensic Sci Int* 149: 129-32.
- [18]. B.J. Adams (2003) The diversity of adult dental patterns in the United States and the implications for personal identification. *J Forensic Sci* 48: 497-503.
- [19]. Bansal N, Sheikh S, Bansal R, Pallagati S (2013) Correlation between lip prints and finger prints in sex determination and pattern predominance in 5000 subjects. *J Forensic Odontostomatol* 31: 8-14.
- [20]. Coward RC (2007) The stability of lip pattern characteristics over time. *J Forensic Odontostomatol* 25: 40-56.
- [21]. Saraswathi TR, Mishra G, Ranganathan K (2009) Study of lip prints. *J Forensic Dent Sci* 1: 28-31.
- [22]. Castelló A, Alvarez M, Verdú F (2005) Luminous lip-prints as criminal evidence. *Forensic Sci Int* 155: 185-7.
- [23]. Navarro E, Castelló A, López JA, Verdú F (2007) More about the developing of invisible lipstick-contaminated lipmarks on human skin: the usefulness of fluorescent dyes. *J Forensic Leg Med* 14: 340-2.
- [24]. Seguí MA, Feucht MM, Ponce AC, Pascual FAV (2000) Persistent lipsticks and their lip prints: new hidden evidence at the crime scene. *Forensic Sci Int* 112: 41-7.
- [25]. Andrasko J (1981) Forensic analysis of lipsticks. *Forensic Sci Int* 17: 235-51.
- [26]. Castelló A, Alvarez M, Miquel M, Verdú F (2002) Long-lasting lipsticks and latent prints. *Forensic Sci Communic* 4:2.
- [27]. Navarro E, Castelló A, López JL, Verdú F (2006) Criminalystic: effectiveness of lysochromes on the developing of invisible lipstick-contaminated lipmarks on human skin. A preliminary study. *Forensic Sci Int* 158: 9-13.
- [28]. Singh NN, Brave VR, Khanna S (2010) Natural dyes versus lysochrome dyes in cheiloscropy: a comparative evaluation. *J Forensic Dent Sci* 2: 11-7.
- [29]. Osama R, Abdullatif AM, Ismail AK (2014) Duration of reliability of lip print as physical evidence at scene of a crime. *Intl Res J Appl Basic Sci* 8: 26-33.
- [30]. Bowers CM, Bell GL (1997) *Manual of Forensic Odontology*. 3rd edtn, Colorado Springs, CO: American Society of Forensic Odontology.