CHEILOSCOPY AS AN ADJUNCT TO FORENSIC IDENTIFICATION: A STUDY OF 600 INDIVIDUALS

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ABSTRACT

Cheiloscopy deals with examination of system of furrows on the red part of human lips. The present study was undertaken to classify lip prints, study their variations, determine the most common pattern in the study population, evaluate differences in lip prints between males and females and between different age groups, ascertain whether there is any hereditary pattern and thereby investigate their potential role in personal identification. Lip prints of 600 individuals, including 52 families, of ages ranging from 3 to 83 years were obtained using lipstick and two kinds of adhesive tape. The lip prints were analyzed using Adobe® Photoshop® software and classified according to Tsuchihashi classification. Patterns of lip prints occurred in diverse combinations. The patterns were similar between males and females and varied among different age groups. Some hereditary resemblance was observed between parents and offspring. Lip prints have a good potential for use in criminal investigations. They have been used only occasionally despite their frequent occurrence at crime scenes. A place for cheiloscopy is recommended within the scope of forensic odontostomatology, along with other means of forensic identification.

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Keywords: cheiloscopy, lip prints, forensic identification, forensic odontology

INTRODUCTION

Dentistry's fundamental and clinical disciplines have, from time to time, shed light on questions of civil and criminal law. Civil cases range from single malpractice suits to mass disaster insurance claims. Criminal cases involve identification both of murder victims and of suspects.[1] Latent or chance impressions located on smooth surfaces are encountered in a majority of the investigations which require comparative analysis. These impressions may arise from a number of sources, the most frequently encountered being impressions of areas of skin bearing friction ridges, predominantly those from the fingers. The possibility of impressions arising from an area of the skin devoid of friction ridges has been noted. Cases in which impressions devoid of friction ridges have been used for evidential purposes, have primarily involved lip impressions.[2]

Lip prints are similar to fingerprints, palm prints and footprints in that individual characteristics are used for identification. The creases on the vermilion border of the lips, which appear as white areas in lip prints, and the raised reddish areas outlined by these creases, which appear as dark areas, are analogous to the furrows and ridges of friction ridge skin. The creases on the vermilion border are also referred to as grooves, furrows, wrinkles and valleys.[3]

Lip prints are unique and do not change during the life of a person.[4,5] It has been verified that they recover after undergoing alterations like trauma, inflammation and diseases like herpes and that the disposition and form of the furrows does not vary with environmental factors.[6,7,8] The lip prints of parents and children and those of siblings have shown some similarities.[7,9] It has also been suggested that variations in patterns among males and females could help in sex determination.[10]

Unlike fingerprints, unanimity still does not exist between investigators to accept cheiloscopy as a method of human identification. Although lip print identification may appear in the field literature, there is very little science or research to support Suzuki's theory that lip prints are individual, or to support a methodology for the collection and comparison of lip prints, which has become

Table 1: *Age and sex distribution of the study population (N = 600)*

		AGE				Total
			0 - 20 yrs	21 - 40 yrs	41 yrs and above	
SEX	MALE	Frequency	134	100	46	280
		Percentage	51.34%	40.00%	51.69%	46.67%
	FEMALE	Frequency	127	150	43	320
		Percentage	48.66%	60.00%	48.31%	53.33%
TOTAL		Frequency	261	250	89	600
		Percentage	100%	100%	100%	100%

accepted within the forensic science community. With this lack of sound scientific basis, the technique would fail to meet any standards of reliability.[11] The foundations of cheiloscopy, however, are the same as that of dactyloscopy, that is to say, lip prints are invariable, permanent and allow establishing a classification.

The present study was carried out to classify lip patterns and document common patterns and their variations in the population under investigation, to evaluate any differences between the sexes and different age groups, to ascertain whether there is any hereditary pattern in lip prints, and thereby, to investigate the potential role of lip prints in person identification.

MATERIALS AND METHODS

A. Selection and grouping of patients

The subjects employed for the investigation included 600 individuals (280 males and 320 females) of rural and urban localities of Aurangabad, Maharashtra, India of ages ranging from 3 years to 83 years (mean age = 23.4 years). Of these 600 subjects there were 52 families comprising of 214 persons (121 males and 93 females) of ages ranging from 3 years to 70 years (mean age = 27.87 years). To study the variation in age groups, the entire study population was divided into three groups; group I - 20 years and below, group II - 21-40 years, and group III - 41 years and above (Table 1).

B. Method of collection of lip prints

Several methods of recording lip prints were tried before the pro forma method was finally selected. Written informed consent was taken from each of the participants. The consent for participants under the age of 18 years was taken from either of the parents. The lips of each subject were first thoroughly examined clinically for any deformity, scars or abnormality and findings were noted in a preformed pro forma.

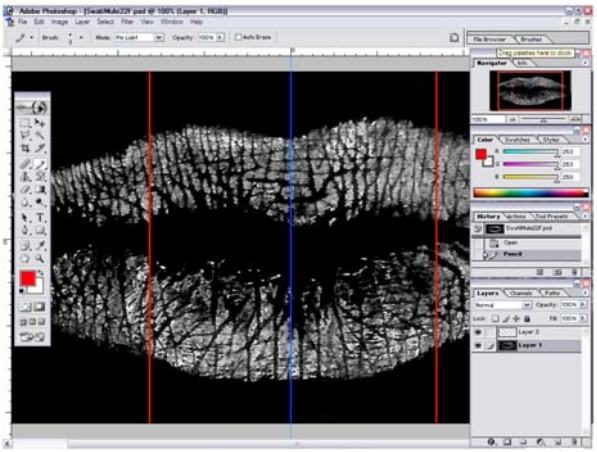
The lips of the subject were first cleaned thoroughly. The lips were then outlined using a sharp lip liner pencil. Lipstick was applied uniformly to the lips using lipstick applicator brushes starting at the midline and moving laterally. The lipstick was allowed to dry for about 2 minutes after which lip prints were taken in two ways. First, lip prints of each lip were taken separately using scotch Magic™ tape. A thin coat of lipstick was reapplied and a second lip print of both the lips together was taken using cellophane tape. These prints were stuck onto white paper in a manner similar to that described by Sivapathasundharam *et al* (2001).[4 *]

C. Method for analysis of lip prints

The lip prints of each individual were scanned using an image scanner set at a resolution of 600 ppi. The images were inverted and scanned in grayscale. They were stored as TIFF (Tagged Image File Format) files for maximum details. The most legible prints of both lips taken together on cellophane tape were cropped and vertical lines drawn to divide the left and the right sides. Each side was further divided into two equal parts using Adobe® Photoshop® 7.0 software (Fig. 1) as suggested by Bowers and Johansen (2001).[12]

* For proprietary details refer Table 2

Fig. 1: *Adobe Photoshop software used for analysis of lip prints*



I. Criteria for classification of lip prints

The lip prints were classified using the classification given by Suzuki and Tsuchihashi (1970) (Fig. 2). [13,14,15] The determination of the pattern in each segment of the lip was based on the numerical superiority of properties of the lines on the fragment. In cases where there were two dominant patterns, the second dominant pattern was noted alongside the most dominant pattern.

II. Method for comparison of lip prints in families

To ascertain the inheritance of lip prints, 52 families with 112 offspring were studied. The lip prints of each member of a family were recorded together in a separate pro forma method. Each lip of the 112 offspring was compared with the corresponding lip of his or her parents. The number of segments of each lip of the offspring that matched with those of both parents was noted and the higher resemblance of the two was recorded. Comparisons of all the other offspring in the family with their parents were made. Similarly, both the lips of each sibling were compared with the corresponding lip of one of his or her other siblings. Similar comparisons were made with all the other siblings in the family. Resemblance was considered positive if three or more segments of a lip matched with the corresponding lip of the other individual. This suggested that there was a resemblance of 75% or above between the two lips.

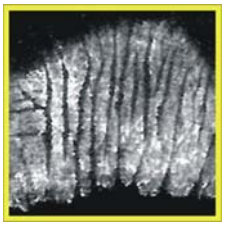
D. Statistical analysis

Comparison of lip prints was done using chi-square test. Z-test was applied to test the significance of positive resemblance of lip prints in the family.

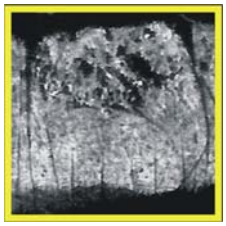
RESULTS AND DISCUSSION

Human identification has always has been of paramount importance to society.[16] Worthy of note as providing an additional tool for personal identification is the series of studies on the morphology of the lips and the pattern produced when they are impressed onto a variety of surfaces.[6] The considerable identifying possibilities of the trace of the red part of the lips determine the evidential use of it.[17]

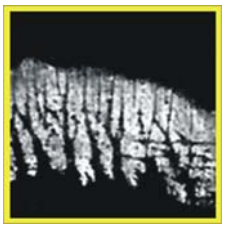
Fig. 2: *Tsuchihashi's classification of lip prints*



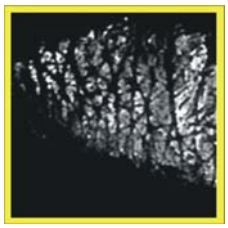
Type I: *Vertical grooves across the lip*



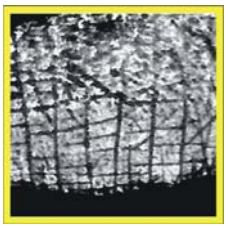
Type I': *Partial length grooves of type I*



Type II: *Branched grooves*



Type III: *Intersecting grooves*



Type IV: *Reticular grooves*

Type V: *Other patterns*

The method described by Sivapathasundharam *et al* (2001)[4] was selected for this study for the accuracy of details achieved, the ease of obtaining such details and the protection and preservation provided by the adhesive tape to the

impression once it was stuck onto the paper. Two 'sets' of lip prints were useful for confirmation of pattern in cases where details were diminished. The obtained lip prints were scanned. The scanned images could be preserved safely with minimal loss of details, divided into equal parts using the ruler in the software, adjusted for brightness and contrast and magnified as much as necessary for clear visualization of details. These images could be filed systematically and stored as a database for further use as and when necessary.

Table 2: *Proprietary details of materials used*

Material	Proprietary name	Company
Dark red coloured lipstick	Lakmé enrich lip color classics, no. 353.	Hindustan Lever Ltd., India
Lipstick applicator brush	Vega™	Tristar Products Pvt. Ltd., India
Lip liner pencil	Davis® no. 14	Davis, India
Scotch tape	Scotch Magic™ tape, 19mm width	3M India Ltd., Bangalore, India
Cellophane tape	Wondertape™, 36mm width	Wondertape, India
Software	Adobe® Photoshop® 7.0	Adobe Systems Inc., USA

The lip prints were classified using the classification proposed by Suzuki and Tsuchihashi in 1970,[6,13,14,15] also known as Tsuchihashi's classification. This is the most widely used classification in literature. It was found to have a clear description of nearly all of the commonly encountered lip patterns and was easy to interpret. Its resemblance to the dental formula was also familiar to the forensic dentist. The fact that a minimum number of type V patterns were observed in the present study was evidence to the complete coverage of patterns in this classification.

It was observed that the medial and lateral parts of the lips frequently had different patterns. A detailed observation revealed that each type never occurred singly, but in combination with other types. It was observed that type III and type IV were the most commonly superimposed patterns, which were difficult to differentiate at times.

In the present study, the most predominant pattern in the entire study population, taking both the upper and lower lips together, was type III which constituted 48.2% of all patterns. This was followed in order by type II (18.92%), type IV (17.44%), type I (11.10%), type I' (2.54%) and type V (1.58%). Similar results have been reported by Suzuki and Tsuchihashi in an investigation of 64 Japanese individuals. They found type III to be the most common, followed in order by type I, type II, type IV and type V. Their study, however, considered type I pattern as inclusive of type I' which they later separated in their improved classification.[6]

Hirth *et al* (1975) observed that branched pattern was more frequently present in the upper lip and simple pattern was commonly seen in the lower lip.[7] Our results show similar variations, with type II constituting 25% of all patterns on the upper lip as against 12.83% in the lower lip. On the other hand, type I and type I' collectively constituted 16.5% of all patterns in the lower lip as against 10.79% in the upper lip. Our results differed from those obtained by Vahanwala and Parekh (2000)[10] who found type I and type II to be the most common in the upper right quadrant. They considered the most predominant pattern in the entire quadrant for classification, whereas the quadrants have been divided further into two segments in our study.

In our study, the upper lip showed a predominance of type III pattern (45.17%) followed in order by type II (25%), type IV (17.5%), type I (8.79%), type I' (2%) and type V (1.54%). This pattern differed from that seen in the lower lip. While type III pattern was even more predominant in the lower lip (51.67%), it was followed by type IV (17.38%), type I (13.42%), type II (12.83%), type I' (3.08%) and type V (1.63%) in that order.

In the upper lip, both type III and type I patterns were found to be more common in the lateral segments than in the medial segments while type IV, type V and type I' were more common in the medial areas than the lateral. The lower lip, in contrast, showed a predominance of type I pattern in the medial segments as compared to the lateral. Type III pattern showed a

predominance of almost 80% in the lateral segments of the lower lip while the upper lip showed a frequency of less than 55% in this region. The medial segments of the upper lip showed a predominance of type III followed by type IV and type II patterns. The lower lip, on the other hand, showed type IV to be the most predominant in the medial segments followed by type I and type III. Type II pattern was more commonly observed in the upper lip and was evenly distributed in all segments, while in the lower lip it was found to be more common in the lateral than in the medial segments. Chi-square test results showed a statistically significant difference in pattern between the entire upper and lower lips and their medial and lateral segments.

Sivapathasundharam *et al* (2001)[4] stated that the uniqueness of patterns depended on the way the lip muscles relaxed to produce a particular pattern. Lévêque and Goubanova (2004)[9] suggested that the furrows and grooves on the lips seemed to be privileged routes for saliva to spread over the lips and maintain good hydration. They also found the upper lip to be more hydrated than the lower one. The variations in pattern between the upper and lower lip may be attributed to these factors and might have a functional significance. Lévêque and Goubanova also noted that some continuity appeared to exist between the lips and adjacent skin lines and suggested a common origin. The predominance of type III pattern, in our study, especially in the lateral segments of the lower lip, might just be a result of this continuity as the lines on the skin adjacent to the lips in these areas were often found to intersect.

A comparison of the lip print pattern between males and females showed type III pattern to be the most predominant pattern in both males and females accounting for 49.15% and 47.78 % of all patterns respectively. The next most common pattern in males and females was type II (approximately 19%) which occurs in the same percentage in both sexes. This was followed by type IV pattern which, however, was more common in females (19.15%) than in males (15.45%). Chi-square test results showed that a statistically significant difference ($P<0.001$) existed between the lip prints of males and females. Vahanwala and Parekh (2000)[10] made suggestions as to the differences in lip prints as an aid to sex determination.

Lévêque and Goubanova (2004)[9] studied lip prints of 100 women and classified them into three types: the first, corresponding to Tsuchihashi's type I, type I' and type II, which accounted for 35% of their observations, the second constituting a thin network located at the extremity of the lip, corresponding to type III, accounted for 50%, and the third corresponding to type IV, accounting for 15% of their observations. The lip prints of the women in the present study showed a similar pattern. Type I, type I' and type II taken together for women, accounted for 31.8% of all observations. Type III accounted for 47.78% and type IV accounted for 19.18% of all observations.

The upper lip of both males and females showed type III to be the most predominant pattern constituting 45.63% and 44.77% of all patterns respectively. This was followed by type II (25.63% in males and 24.45% in females), type IV (14.82% in males and 19.84% in females) and type I (10.54% in males and 7.27% in females). Type IV pattern was more common in the lateral segments of females than in males while type I was more common in the lateral segments of males than in females (Table 3). Chi-square test results revealed a statistically significant difference ($P<0.01$) between the sexes in the lateral segments while this difference was not significant ($P<0.10$) in the medial segments. The reason for this difference is not known.

The lower lip of both males and females showed type III pattern to be the most common (52.68% in males and 50.78% in females) followed by type IV (16.07% in males and 18.52% in females). In males, this was followed by type II (12.14%), type I' (2.59%) and type V (1.96%) and in females, this was followed by type II (13.44%), type I (12.42%), type I' (3.52%) and type V (1.33%) (Table 4). Chi-square test results showed that the difference between lip prints of males and females in the medial and lateral segments of the lower lip were not statistically significant ($P<0.20$ and $P<1$ respectively). Our results are in agreement with those of Rubio and Villalain (1980) [8] who did not find significant differences in lip prints based on sex, age or race.

Table 3: *Distribution of lip print patterns in different segments of the upper lip of males (N=280) and females (N=320)*

TYPE		URL	URM	ULM	ULL	TOTAL
TYPE I	Males	38	18	16	46	118
	Females	29	12	15	37	93
TYPE I'	Males	1	9	5	1	16
	Females	9	12	7	4	32
TYPE II	Males	67	73	79	68	287
	Females	77	76	87	73	313
TYPE III	Males	156	99	105	151	511
	Females	174	110	113	176	573
TYPE IV	Males	17	68	68	13	166
	Females	29	103	92	30	254
TYPE V	Males	1	13	7	1	22
	Females	2	7	6	0	15
TOTAL	Males	280	280	280	280	1120
	Females	320	320	320	320	1280

URL- Upper Right Lateral, URM- Upper Right Medial, ULM- Upper Left Medial, ULL- Upper Left Lateral

Table 4: *Distribution of lip print patterns in different segments of the lower lip of males (N = 280) and females (N=320)*

TYPE		LRL	LRM	LLM	LLL	TOTAL
TYPE I	Males	8	75	72	8	163
	Females	8	75	69	7	159
TYPE I'	Males	1	13	15	0	29
	Females	1	21	21	2	45
TYPE II	Males	39	31	22	44	136
	Females	50	31	35	56	172
TYPE III	Males	229	63	78	220	590
	Females	254	70	77	249	650
TYPE IV	Males	3	84	85	8	180
	Females	6	114	112	5	237
TYPE V	Males	0	14	8	0	22
	Females	1	9	6	1	17
TOTAL	Males	280	280	280	280	1120
	Females	320	320	320	320	1280

LRL- Lower Right Lateral, LRM- Lower Right Medial, LLM- Lower Left Medial, LLL- Lower Left Lateral

The study population was divided into three age groups: group I – aged 20 years or below, group II – aged 21 to 40 years and group III - aged above 40 years. A statistically significant difference existed between the lip prints of the upper and lower lips among these age groups. This indicates the diversity in pattern of lip prints among different persons of all age groups in the community. Thus, age groups have no relevance for any similarity of lip prints.

The present study also aimed to investigate the role of heredity in lip prints. Among lip prints of 112 offspring studied, 63% were seen to have a positive resemblance with either of the parents. Z-test was applied and this observation was found to be highly statistically significant ($z=3.89$, $P<0.01$). The lip prints of the offspring were compared with those of their siblings for resemblance in pattern. Of the 92 sibling-sibling combinations studied, 45.66% had a

positive resemblance with each other. This percentage of resemblance was not found to be statistically significant (z=1.08, P>0.1). Hence, in accordance with previous studies, our results provide further evidence to the role of heredity in lip prints. Comparison of lip prints with members of the family might give valuable indications for the identification of the suspect. However, failure of resemblance with family members might not rule out the possibility of the suspect being a member of the family and vice versa.

The resemblance of patterns of lip prints between mothers and offspring was found to be positive in 60.65% cases while positive resemblance between fathers and offspring was found in 65.68% of cases. Z-test applied to these observations showed them to be statistically significant (z=2.34, P<0.05 and z=3.17, P<0.001 respectively). The difference of positive resemblance between mothers and offspring and between fathers and offspring was not found to be statistically significant (z=0.75, P>0.1). This indicates that while a positive hereditary pattern does exist between parents and offspring, there does not seem to be a particular paternal or maternal influence on the pattern.

The positive resemblance of lip prints was found to be greatest between fathers and sons (69.35%) followed by that between mothers and sons (63.16%). Z-test showed these observations to be statistically significant. Father to daughter positive resemblance was found to be 60% while mother to daughter resemblance was found to be 56.52%. Z-test results showed that these observations were not statistically significant (z=1.26, P>0.1, z=0.88, P>0.1 respectively). Therefore, it was observed that sons inherited lip prints more often from their parents than daughters do. However, further studies will need to be conducted before such a conclusion may finally be drawn.

As early as 1950, Snyder suggested that the normal lines and fissures of the lips were an individual characteristic, much the same as finger ridges. [18,3,11,19,6,20] Since then, numerous studies give evidence to the fact that lip prints are unique and characteristic of an individual. However, at the initial classification stage, as in the case of fingerprints, there are similarities among the broadly classified groups of lip prints. Classification is useful in categorizing the lip prints and narrowing the range for detailed investigation. It helps in creating an organized database for retrieving information easily. It is essential as a basis for comparison, for instance, between families and the sexes. The classification in the present study did narrow down the database into small groups that could be easily compared using individual characteristics, as is done in dactyloscopy.

Further detailed examination of these lip prints would be required to establish identity, if found matching at this level. Evidences such as photographs, cigarette butts, drinking glasses, cups, letters, window panes and other items that could bear lip prints should be closely examined. A trace of this kind carries a huge amount of information which can be used in the reconstruction of the events, establishing versions, checking them and identifying suspects.[17,21]

Great strides have been made in the collection, analysis and interpretation of lip prints. Lip prints have been studied in postmortem identification.[22] Advances have been made in the techniques and dyes for developing lip prints.[23-30] Software has been developed for the analysis of lip prints.[31] However, limitations still exist in the use of lip prints. The permanent nature of lip prints requires more long term studies to be substantially documented. Advanced methods of developing lip prints at a scene of crime are still confined to research laboratories. Full utilization of lip depends to a high degree on the skill of members of law enforcement agencies. The problems involved in cheiloscopy are relatively little known and thus, so far lip prints have been used only occasionally despite their frequent occurrence at the scene of crime. The only possible solution is to place cheiloscopy within the scope of criminalistics, side by side with dactyloscopy and other means of person identification and to introduce it into the syllabus of training of forensic odontology.

The classification and observation of patterns in the population, and the investigation of heredity of the lip print have resulted in some useful data. Progress in research in this area will contribute not merely to its direct use in personal identification in forensic medicine and odontology, but will also open up a new

field that can contribute extensively to criminal investigation and identification, the establishment of parenthood and studies on human genetics.

REFERENCES

1. Sognnaes RF. Forensic science and oral biology. In: Shaw JH, Sweeney EA, Cappuccino CC, Meller SM. Textbook of oral biology. Philadelphia: WB Saunders, 1978:1123-58.

2. Dillon DJ. The identification of impressions of non friction-ridge-bearing skin. J Forensic Sci 1963; 8: 576-81.

3. Williams TR. Lip prints – Another means of identification. J Forensic Ident 1991; 41 (3): 190-4.

4. Sivapathasundharam B, Ajay Prakash P, Sivakumar G. Lip prints (Cheiloscopy). Indian J Dent Res 2001; 12: 234-7.

5. Whittaker DK, MacDonald DG. A colour atlas of forensic dentistry. London: Wolfe, 1989:55-6.

6. Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci 1974; 3: 233-48.

7. Hirth L, Göttsche H, Goedde HW. Lippenfurchen – Variabilität und genetik. Lip prints – Variability and genetics. Hum Genet 1975; 30: 47-62.

8. Muñoz MCN. Nuevas aportaciones al Procesado de huellas labiales: Los lisochromos en queiloscopia. Tesis Doctoral. Universitat de Valencia, Spain, 2004 (June): 23.

9. Lévêque JL, Goubanova E. Influence of age on the lips and perioral skin. Dermatology 2004; 208: 307-13.

10. Vahanwala SP, Parekh BK. Study of lip prints as an aid to forensic methodology. J Forensic Med Toxicol 2000; 17: 12-8.

11. Ball J. The current status of lip prints and their use for identification. J Forensic Odontostomatol 2002; 20: 43-6.

12. Bowers CM, Johansen RJ. Digital analysis of bite marks and human identification. Dent Clin North Am 2001; 45: 327-42.

13. Suzuki K, Tsuchihashi Y. New attempt of personal identification by means of lip prints. J Indian Dent Assoc 1970; 42: 8-9.

14. Suzuki K, Tsuchihashi Y. New attempt of personal identification by means of lip prints. Can Soc Forens Sci J 1971; 4:154-58.

15. Suzuki K, Tsuchihashi Y. Personal identification by means of lip prints. J Forensic Med 1970; 17: 52-7.

16. Rothwell BR. Principles of dental identification. Dent Clin North Am 2001; 45: 253-69.

17. Kasprzak J. Possibilities of cheiloscopy. Forensic Sci Int 1990; 46: 145 – 151.

18. Snyder LM. Homicide Investigation, 2nd edn. Springfield: Charles C. Thomas, 1967:65.

19. Burns RW. A kiss for the prosecution. Identification News 1981; 31:3-5, 15.

20. Aggrawal A. The importance of lip prints. Web Mystery Magazine 2004; Vol.II No. 2, http://lifeloom.com//II2Aggrawal.htm Visited 06 – 09 - 2005.

21. Kasprzak J. Cheiloscopy. In Siegel JA, Saukko PJ, Knupfer GC, eds. Encyclopedia of forensic sciences. Vol I. London: Academic Press, 2000: 358-61.

22. Utsuno H, Kanoh T, Tadokoro O, Inoue K. Preliminary study of post mortem identification using lip prints. Forensic Sci Int 2005; 149: 129-132.

23. Navarro E, Castello A, Lopez JL, Verdu F. Criminalystic: Effectiveness of lysochromes on the developing of invisible lipstick-contaminated lipmarks on human skin. A preliminary study. Forensic Sci Int 2006; 158: 9-13.

24. Castello A, Alvarez M, Marcos M, Verdu F. Long-lasting lipsticks and latent prints. Forensic Sci Commun 2002; 4 (2) http://www.fbi.gov/programs/lab/fsc/past/verdu.htm

25. Castello A, Alvarez M, Verdu F. A new chemical aid for criminal investigation: dyes and latent prints. Color Technol 2002; 6: 316-8.

26. Castello A, Alvarez M, Verdu F. Just lip prints? No: there could be something else. FASEB J 2004; 18: 615-6.

27. Castello A, Alvarez M, Verdu F. Luminous lip-prints as criminal evidence. Forensic Sci Int 2005; 155:185-7.

28. Castello A, Alvarez M, Verdu F. Use of fluorescent dyes for developing latent prints. Color Technol 2004; 120: 184-7.

29. Castello Ponce A, Alvarez Segui M, Negre Muñoz MC, Verdu Pascual FA. Revelado de

huellas labiales invisibles con reactivos fluorescentes. Development of latent lip prints with fluorescent powders. Cuadernos de Medicina Forense 2003; 34: 43-7.

30. Segui MA, Feucht MM, Ponce AC, Pascual FAV. Persistent lipsticks and their lip prints: new hidden evidence at the crime scene. Forensic Sci Int 2000; 112: 41-7.

31. Patiño J, Patiño E, Mora I, Casas A. Queilosoft – Huellas Labiales. UDES Dia MATLAB Seminario Gratis 2005; (Nov) Ponencia #5:1-4.

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