

Duration Of Reliability Of Lip Print As Physical Evidence At Scene Of A Crime

Osama R.El-Ghamry¹, Amany M. Abdullatif¹and Ayman K. Ismail^{1, 2}

1. Department of Clinical Pharmacology and Forensic Medicine, Collage of Medicine, Taif University, KSA

2. Department of Forensic Medicine and Toxicology, Suez Canal University, Ismailia, Egypt

Corresponding author email: aykam4@yahoo.com

ABSTRACT: Lip print becomes one of physical evidence that can be relied upon to know the offender if found at the crime scene on glass cups, paper napkins or cigarette butts or other. The longer the time before manipulation of lip prints is the more unsuitable for emulation it become due to the ambient conditions. In this research the duration during which the lip prints is reliable as physical evidence on different surfaces (glass & paper) and in different circumstances was studied. Other aims of this work also is to find out the percentage of different types of lip print in people of Saudi Arabia and whether there are significant differences between males and females in different lines. This research was done on 50 Saudi volunteers; 18 males and 32 females whose ages ranged between 19 and 55 years. Lip print was classified according to Tsuchihashi's classification. The duration of reliability of lip print on different surfaces and in different circumstances were observed until 12 weeks to. It was found that type I' was the predominant line in the examined lip prints (44%) to be followed by type I (30.4%), then type II (10.2%), type V (8.8%), type III (4.6%), and type IV (2%). There were no significant differences for each type of lines between males and females. It was found also that lip prints on paper are more fixed than those on glass. The duration of reliability of lip print on paper may be up to 12 weeks even if exposed to ambient conditions, but duration of reliability of lip print on glass may be up to 9th week if kept in closed container in temperature adjusted around 25 °C, but if exposed to ambient conditions it may be up to 6th week

Keywords: Lip print - Scene of crime

INTRODUCTION

Lip print or Cheiloscopy is a forensic investigation technique that deals with personal identification based on lips traces ^[1, 2 & 3]. Lip print is considered a method of personal identification as fingerprints ^[4]. Some conclusions can be obtained from examination of lip prints found at the scene of a crime as the number of people involved, sexes, cosmetics used, habits and any pathological changes of the lips ^[5]. Latent lip prints would be available at all crime scenes as the vermilion borders of lips as sebaceous glands which are associated with hair follicles are present around the edges of the lip with sweat glands that secreting oils ^[6]. In 1967 Santos was the first person to classify lip grooves into four types; (a) Straight line, (b) Curved line, (c) Angled line, & (d) Sine-shaped line ^[7]. In 1970 Suzuki and Tsuchihashi classified the natural lip marks/fissures in another method called Tsuchihashi's classification ^[8]; Type I (Vertical grooves), Type I' (Partial length across the lip grooves of type I), Type II (Branched grooves), Type III (Intersecting grooves), Type IV (Reticular grooves), and Type V (Other patterns). In a study performed by Maheswari & Gnanasundaram ^[9] they conclude that, there are no changes in lip print in different periods, no changes of lip print in different age group, no familial or genetic similarities of lip print between parents and children, no similarity of lip print between twins, and no peculiarity of lip print was established in males and females. Lip print pattern depends on whether mouth is opened or closed. In closed mouth position lip exhibits well defined grooves; where as in open position the grooves are relatively ill defined and difficult to interpret ^[10]. Williams ^[11] noted that in many occasions individual lip prints within a set cannot be identified from each other due to the flexibility of the lips, the amount of transfer medium, the movement of the lips during recording, the amount of pressure applied and the position of the lips. To solve this problem El-Ghamry ^[12] classify lines of lip grooves into primary lines which appear in all individual's lip print, and secondary lines which appear in some individual's lip print and disappear in others

This research aimed to: determine the percentage of different types of lip print among people of Saudi Arabia, find out if there are significant differences between male and female lip prints, estimate the duration of reliability of lip prints as physical evidence at scene of crime, explore whether the duration of reliability of a lip print differ according to the media on which the lip print is present and find out if the duration of reliability of a lip print can be changed by changing the ambient condition

SUBJECTS AND METHODS

Subjects

This work was performed on 50 Saudi volunteers 18 males and 32 females, their ages range between 19 and 55 years.

METHODS

Obtaining the lip prints

Each volunteer applied thin film of a non-persistent, non-glossy lipstick onto cleaned and dried lips, left for few minutes and then the impressions of the lips were taken on ordinary white papers for his/her upper and lower lips, during recording each lip was recorded separately (i.e. not recording the upper and lower lips in one set) to minimize the movement during recording. Multiple prints were done for each lip to be compared and differentiated into primary and secondary lines.

Classifying lines of lip prints into primary and secondary lines

The lip prints of each volunteer were compared with each other to be differentiated into primary and secondary lines, as primary lines are that appear in all the volunteer's lip print and secondary lines which appear in some lip print and disappear in others (Fig. 1). Examination of lip prints was done by using a magnifying lens; a ruler was placed near each print to facilitate comparison of each area of the print separately.

Classifying lines of lip prints according to Tsuchihashi's classification

The lip prints were classified according to Tsuchihashi's classification (Fig. 2a, 2b, 2c, 2d & 2e) to find out if there are differences between male and female lip prints and the percentage of different types of lines in Saudi's lip prints.

Statistical analysis of Tsuchihashi's lines

The lines of lip prints according to Tsuchihashi's classification were statistically analyzed to find out if there are differences between male and female lip prints and the percentage of different types of lip print in people of Saudi Arabia

Recording lip prints to be examined for reliability

After classifying lines of lip print of each volunteer, each one of them recorded four lip prints as follows:

Print of group (I): recorded on glass slide and left at room temperature in open air.

Print of group (II): recorded on glass slide but was left in closed container in air conditioned room (room temperature was adjusted around 25 °C)

Print of group (III): recorded on piece of white paper and left at room temperature in open air.

Print of group (IV): recorded on piece of white paper but left in closed container in air conditioned room

Examination of the prints for duration of reliability

Prints on glasses were photographed by a digital camera, but prints on paper were scanned by a scanner, all prints were saved on a computer, each of them took a number (these are called the original prints). Every week the same prints were photographed or scanned for 12 weeks, then saved on the computer and compared with the original print

Estimation of duration of reliability

Each week after comparison the percentage of disappearance of secondary lines was recorded, once disappearance of one of the primary lines this means that this print becomes unreliable

RESULTS

Figures from (1) to (5) Show classification of lip groove into primary and secondary lines, types according to Tsuchihashi's classification and lip prints on glass and paper kept for different time elapses.

Table (1) shows the percentage of each type of lines in Saudi people according to Tsuchihashi's classification, type I' was the predominant line in the examined lip prints (44%) to be followed by type I (30.4%), then type II (10.2%), type V (8.8%), type III (4.6%), and the least percentage was type IV (2%). Statistical analysis of each type of lines showed insignificant difference between male and females, this is shown in tables (2a, 2b, 2c, 2d & 2e).

The percentages of disappearance of primary and secondary lines of the four test groups are shown in table (3), the percentage showed that both group III & IV which were lip prints on papers either left in open air or kept in closed containers are reliable to be used as physical evidence at scene of crime up to 12 weeks,

although secondary line of group III started to disappear at 11th week but still reliable as the primary lines (which are the important lines for reliability) did not disappear to the end of 12th week. The table shows also that the lip prints on glass started to be unreliable at 7th week if the prints are exposed to the ambient conditions (group I) but if the prints are kept in closed container and in a conditioned temperature around 25 °C (group II) reliability will extend as they are unreliable from the 10th week

Table (1): Percentage of each type of lines according to Tsuchihashi's classification

	Type (I)	Type (I')	Type (II)	Type (III)	Type (IV)	Type (V)
Total	30.4%	44%	10.2%	4.6%	2%	8.8%
Males	28.3%	44.2%	11.7%	4.8%	2%	9%
Females	31.5%	43.9%	9.4%	4.4%	2.1%	8.7%

Table (2a): Type I * sex Crosstabulation

No of lines in each person		Sex		Total
		Male	Female	
2	NO	2	1	3
	%	11.1%	3.1%	6.0%
3	NO.	4	3	7
	%	22.2%	9.4%	14.0%
4	NO.	3	8	11
	%	16.7%	25.0%	22.0%
5	NO.	3	7	10
	%	16.7%	21.9%	20.0%
6	NO.	3	6	9
	%	16.7%	18.8%	18.0%
7	NO.	3	6	9
	%	16.7%	18.8%	18.0%
8	NO.	0	1	1
	%	.0%	3.1%	2.0%
Total	NO.	18	32	50
	%	100.0%	100.0%	100.0%

$$\chi^2 = 3.7, P=0.7 \text{ NS}$$

Table (2b): Type I' * sex Crosstabulation

No of lines in each person		Sex		Total
		Male	Female	
3	NO	1	0	1
	%	5.6%	.0%	2.0%
5	NO.	1	3	4
	%	5.6%	9.4%	8.0%
6	NO.	3	5	8
	%	16.7%	15.6%	16.0%
7	NO.	5	13	18
	%	27.8%	40.6%	36.0%
8	NO.	5	7	12
	%	27.8%	21.9%	24.0%
9	NO.	3	4	7
	%	16.7%	12.5%	14.0%
Total	NO.	18	32	50
	%	100.0%	100.0%	100.0%

$$\chi^2 = 3.1, P=0.6 \text{ NS}$$

Table (2c): Type II * sex Crosstabulation

No of lines in each person		Sex		Total
		Male	Female	
0	NO	4	8	12
	%	22.2%	25.0%	24.0%
1	NO.	2	7	9
	%	11.1%	21.9%	18.0%
2	NO.	6	11	17
	%	33.3%	34.4%	34.0%
3	NO.	4	4	8
	%	22.2%	12.5%	16.0%
4	NO.	2	2	4
	%	11.1%	6.2%	8.0%
Total	NO.	18	32	50
	%	100.0%	100.0%	100.0%

$$\chi^2 = 1.8, P=0.8 \text{ NS}$$

Table (2d): Type III * sex Crosstabulation

No of lines in each person		Sex		Total
		Male	Female	
0	NO.	9	16	25
	%	50.0%	50.0%	50.0%
1	NO.	4	9	13
	%	22.2%	28.1%	26.0%
2	NO.	5	7	12
	%	27.8%	21.9%	24.0%
Total	NO.	18	32	50
	%	100.0%	100.0%	100.0%

$\chi^2 = 0.3, P=0.8$ NS

Table (2e): Type IV * sex Crosstabulation

No of lines in each person		Sex		Total
		Male	Female	
0	NO.	13	24	37
	%	72.2%	75.0%	74.0%
1	NO.	4	5	9
	%	22.2%	15.6%	18.0%
2	NO.	1	3	4
	%	5.6%	9.4%	8.0%
Total	NO.	18	32	50
	%	100.0%	100.0%	100.0%

$\chi^2 = 0.5, P=0.7$ NS

Table (2f): Type V * sex Crosstabulation

No of lines in each person		Sex		Total
		Male	Female	
0	NO.	3	5	8
	%	16.7%	15.6%	16.0%
1	NO.	7	14	21
	%	38.9%	43.8%	42.0%
2	NO.	5	8	13
	%	27.8%	25.0%	26.0%
3	NO.	3	5	8
	%	16.7%	15.6%	16.0%
Total	NO.	18	32	50
	%	100.0%	100.0%	100.0%

$\chi^2 = 0.1, P=0.9$ NS

Table (3): Percentage of disappearance of primary and secondary lines in each group of lip prints

Groups	Group I		Group II		Group III		Group IV	
	% of primary lines	% of secondary lines	% of primary lines	% of secondary lines	% of primary lines	% of secondary lines	% of primary lines	% of secondary lines
1 st week	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
2 nd week	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
3 rd week	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
4 th week	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
5 th week	0 %	3 %	0 %	0 %	0 %	0 %	0 %	0 %
6 th week	0 %	6 %	0 %	0 %	0 %	0 %	0 %	0 %
7 th week	4 %	12 %	0 %	2 %	0 %	0 %	0 %	0 %
8 th week	4 %	25 %	0 %	5 %	0 %	0 %	0 %	0 %
9 th week	10 %	47 %	0 %	9 %	0 %	0 %	0 %	0 %
10 th week	17 %	73 %	2 %	13 %	0 %	0 %	0 %	0 %
11 th week	32 %	100 %	6 %	14 %	0 %	3 %	0 %	0 %
12 th week	38 %	100 %	8 %	18 %	0 %	7 %	0 %	0 %

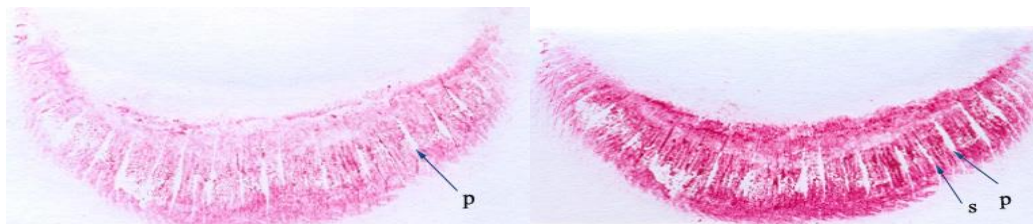


Figure (1): Shows classification of lip groove into primary and secondary lines, the two lip prints of the same person showing primary lines (P) and secondary line (S)



Figure (2a): Type I: Vertical grooves & Type I': Partial length across the lip grooves of type I

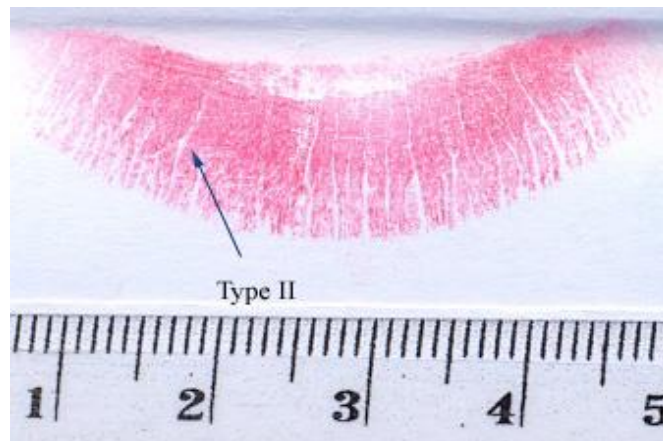


Figure (2b): Type II: Branched grooves

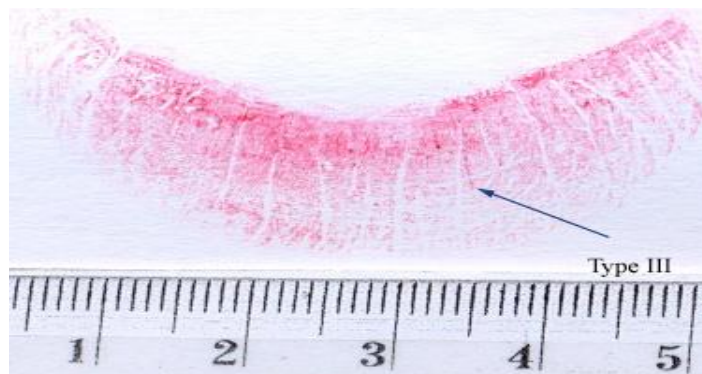


Figure (2c): Type III: Intersecting grooves

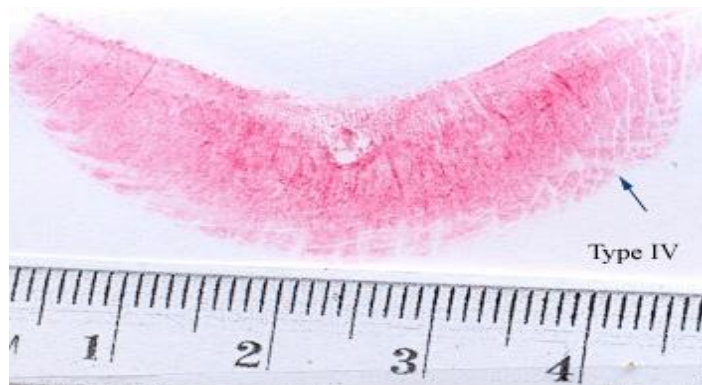


Figure (2d): Type IV: Reticular grooves



Figure (2e): Type V: Other patterns

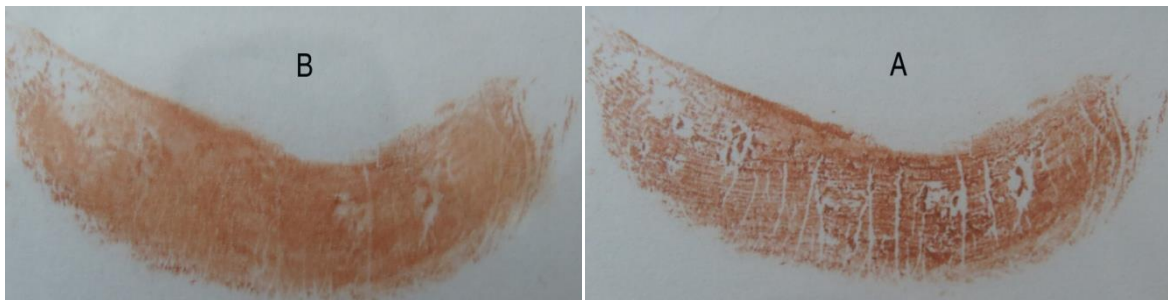


Figure (3): Lip print of group (I) on glass and was lift at room temperature in open air Figure (3A) represent the print at the beginning of the test and Figure (3B) represent the same print at the end of 12 weeks

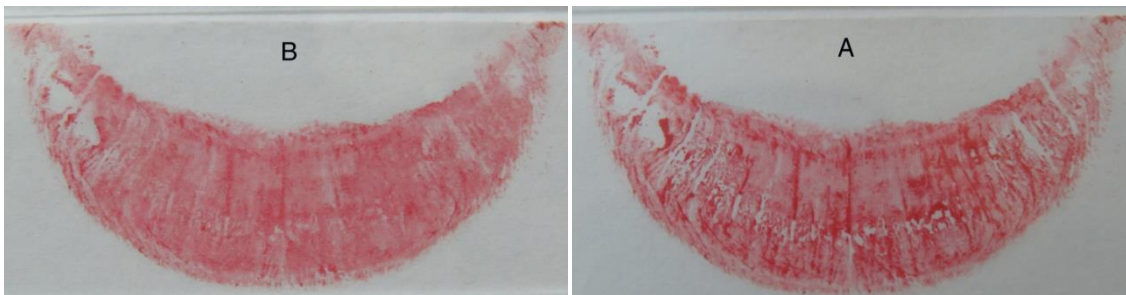


Figure (4): Lip print of group (II) on glass and kept in closed container Fig (4A) represent the print at the beginning of the test and Fig (4B) represent the same print at the end of 12 weeks



Figure (5): Lip print of group (IV) on paper and kept in closed container Fig (5A) represent the print at the beginning of the test and Fig (5B) represent the same print at the end of 12 weeks

DISCUSSION

The present study showed that the most common type of lines in Saudi people according to Tsuchihashi's classification is type (I') to be followed by type (I), this result is against that obtained by Verma et al^[13] which found in their research that the most common type of lines in the examined group was type (II), also Kumar et al^[14] reported that type (II) was the predominant in females while type (III) was the predominant in males. But our results are nearly similar to results found by Sandhu et al^[15], Ragab et al^[16] & Randhawa et al^[17] as they found that the most common type of lines was type (I), all these results prove that there are variations of types of lines in different populations as reported by koneru et al^[18].

Statistical analysis of different types of lines in this study in both males and females proved that there are no significant differences between males and females in different lines, this is similar to results obtained by Verma et al [13] & Sandhu et al [15], Ragab et al [16] as they found no significant differences between males and females in different types of lines, Randhawa et al [17] found a significant difference between lip patterns of males and females in the studied group of age between 21 and 40 years old, but there were insignificant difference in groups above and below that age. Other researchers found results against ours as they reported significant differences between males and females as Kumar et al [14], koneru et al [18] & Karki [19]. All the previous results meant that lip prints can show significant difference between males and females in some populations and show no significant difference in other populations. It was found that there are some similarities between results obtained from Saudi's lip prints in this work and Egyptian's lip prints obtained by Ragab et al [16] as both results could not differentiate between males and females and also the most common type of lines in Egyptian lip prints was type (I) and this type is the second common type in Saudi population.

Regarding to the duration of reliability of lip prints as physical evidence at scene of crime the present work shows that the lip prints on white paper are reliable for a longer time than that on glass, they are reliable up to 12 weeks or may be more, but reliability on the glass were up to the 6th week if exposed to surrounding ambient condition and up to 9th week if kept in closed container in temperature adjusted around 25 °C, the explanation of being lip prints are more stable on paper than glass may be that grease of lip prints on paper is absorbed in the fine pores of paper to be more fixed than non-porous glass, and the explanation of disappearance of lines in lip prints exposed to ambient condition is due to the effect of heat, air current, dust & other factors which affect secondary lines first which are fine lines in comparison to the prominent primary lines

RECOMMENDATIONS

It is preferred for fingerprint experts to receive training courses for examination of lip print as there are some differences between examination of fingerprints and lip print. If there is a lip print at scene of crime and the expert is not available the print must be photographed and should be saved in closed container. More researches are to be performed on reliability of lip prints on paper for a period more than 12 weeks.

ACKNOWLEDGMENT

The authors gratefully acknowledge the financial support provided by Taif University, KSA, through Projects and research Deanship "Grant # 1-434-2301"

REFERENCES

- Ball, J. (2002): "The current status of lip prints and their use for identification". *J Forensic Odontostomatol.*, 20(2): 43-6
- Caldas, I.M.; Magalhães, T. & Afonso, A. (2007): "Establishing identity using cheiloscopy and palatoscopy". *Forensic Sci. Int.*, 165:1-9.
- El-Ghamry, O. (1998): "A Study of Lipprint Data". *Mansoura J. Forensic Med. Clin.Toxicol.*, 6(2): 1-13
- Karki, R.K. (2012): "Lip Print: an Identification Aid". *Kathmandu Univ Med J (KUMJ)*, 10(38):55-7
- Kasprzak, J. (2000): "Cheiloscopy". In Siegel, J.A.; Saukko, P.J. & Knupfer, G.C, eds. *Encyclopedia of forensic sciences*. Vol I. London: Academic Press, 358-61.
- koneru, A.; Surekha, R.; Nellithady, G.S.; Vanishree, M.; Ramesh, D. & Patil, R.S. (2013): "Comparison of Lip Prints in two Different Populations of India: Reflections Based on a Preliminary Examination". *J Forensic Dent Sci*, 5(1):11-5
- Kumar, G.S.; Vezhavendhan, H. & Vendhan, P. (2012): "A Study of Lip Prints Among Pondicherry Population". *J Forensic Dent Sci*, 4(2):84-7
- L Vamsi, K. R. (2011): "Lip prints: An Overview in Forensic Dentistry" *Journal of Advanced Dental Research*, 2(1):17-9.
- Maheswari, T.N.U. & Gnanasundaram, N. (2011): " Role of Lip prints in Personal Identification and criminalization". *Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicology*; Vol. 12, No. 1
- Ragab, A.R.; El-Dakroory, S.A. & Rahman, R.H. (2013): "Characteristic Patterns of Lip Prints in Egyptian Population Sample at Dakahlia Governorate". *Int J Legal Med*, 127(2):521-7
- Randhawa, K.; Narang, R.S. & Arora, P.C. (2011): "Study of the Effect of Age Changes on Lip Print Pattern and its Reliability in sex determination". *J Forensic Odontostomatol*, 29(2):45-51
- Sandhu, S.V.; Bansal, H.; Monga, P. & Bhandari, R. (2012): "Study of Lip Print Pattern in a Punjabi Population". *J Forensic Dent Sci*, 4(1):24-8
- Santos, M. (1967): "Queiloscopy : A supplementary stomatological means of identification, *International Microform*". *J. Legal Medicine*. p 2.
- Saraswathi, T.R.; Mishra, G. & Ranganathan, K. (2009): "Study of lip prints". *J Forensic Dent Sci*; 1:28-31.
- Shailesh, M. G.; Atul, I.; Shirish, D., & Rahul, B. (2009): "Cheiloscopy for sex determination". *J Forensic Dent Sci* 1(2): 56-60.
- Suzukim K. & Tsuchihashi, Y. (1970): "Personal identification by means of lip prints". *J Forensic Med*; 17: 52-7
- Vahanwalla, S.P. & Parekh, .B.K. (2000): "Study on Lip Prints as an Aid to Forensic Methodology". *J Forensic Med and Toxicol.* 17(1): 12-18.
- Verma, P.; Sachdeva, S.K.; Verma, K.G.; Saharan, S. & Sachdeva, K. (2013): "Correlation of Lip Prints with Gender, ABO Blood Groups and Intercommissural Distance". *N Am J Med Sci*, 5(7):427-31
- Williams, T.R. (1991): "Lip prints, another means of identification". *J. Forensic Ident.*, 41(3):190:4.