Tikrit Journal
for
Dental Sciences
https://tjo-ds.com

Classification and Identification of Individuals Using Analysis Lip Prints

Tamara A. Anai [(1)]
Muthenna Sh. Rajab [(2)]
Sukaina Makki Mohammed [(3)]
Malak Fadel Jasem [(4)]

[1]Department of Basic Science, College of Dentistry, Tikrit University, Iraq.
[2]Department of Conservative, College of Dentistry, Tikrit University, Iraq.
[3,4]College of Dentistry, Tikrit University, Tikrit, Iraq.

Article Info:
-Article History:
-Received: 3/1/2022
-Accepted: 8/6/2022
-Available Online:
Jun, 2022

Keywords: lip prints, Lip anatomy, Cheiloscopy, Forensic identification, forensic dentistry.

Corresponding Author:
Name: Tamara Afif Anai
E-mail:
tamsamka@tu.edu.iq
Tel: 07707328026
Affiliation:
Asst. Lec., Department of Basic Science, College of Dentistry, Tikrit University, Tikrit, Iraq.

Abstract

Identifying individuals is a major challenge for forensic investigators, as DNA and fingerprints are highly valuable, but are not always readily available at crime scenes. Lip prints could be used in this context since they are unique to each individual. Lip-print study (***Cheiloscopy***) is a reliable biometric technology and is considered a unique parameter for identification. This study was determined lip print patterns among samples of the Salah El-Din population in Iraq and distribution their pattern type of lip print by using a program in MATLAB. In this study, it was established that there are significant differences between populations, countries, and genders when it comes to the distribution of lip prints.
Materials and Methods: A total of participants was 100 (50 females & 50 males) their ages more than 10 years old. The lip print was divided into six quadrants on white copy paper then examined with technology using the program in MATLAB to determine the classification of lip print types for pattern distribution. Lip print was recorded by the usage of red natural color and healthy, white copy papers, and tissue paper, the obtained prints were first examined and later analyzed and interpreted.
Results: This study discovered that no two samples from the same family have identical lip-print patterns. Females had the greatest recorded pattern of groove type I (long vertical grooves), whereas males had the highest recorded pattern of groove type II (branched grooves). This pattern was most observed in the lower middle region. The present study proved that lip prints of males and females are different types in different countries.
Conclusion: lip prints are unique for every individual even in between the family. Hence, Lip prints play a vital role as a supplementary tool in the personal identification of suspects or unknown identity.

Introduction:

Any criminal investigation relies heavily on identification. It is nearly always not possible to collect DNA and fingerprints at the crime scene even though these methods have been proven time and time again. During such circumstances, different techniques are required. Researchers are using wrinkles on the lips to detect crimes. The imprints produced by the lip are termed “lip print”. These are less commonly used in forensic studies but have significant value in crime investigations.

"Cheiloscopy" is defined as the scientific study of the various patterns of wrinkles and grooves visible on the labial mucosa, and it is derived from the Greek phrase wrinkles and grooves, these are the cells that are located between the inner labial mucosa and the outer ectodermal tissue of the lip [1-3]. The purpose of forensic dentistry is to include objective scientific data in legal proceedings by analyzing, reviewing, and evaluating dental evidence. Moreover, forensic dentists must have knowledge of several disciplines, since dental records can be used to identify an individual or to prove neglect, fraud, or abuse by the authorities. Three types of dental identification exist [4,5]:

(a) Comparative identification, where one compares antemortem with postmortem dental records to determine whether they belong to the same person.

(b) The use of dental data to narrow down the search for a deceased individual when antemortem records and other records pertaining to the subject's identity are unavailable.

(c) Identification of victims after catastrophes or mass disasters.

Research has shown that lip prints can identify individuals and that humans can be identified by their lips [6-9].

Identification of lip prints goes back to 1902 when Fischer, an anthropologist described them as the furrows on the red part of human lips. Later in 1932, lip prints were recommended for personal identification and criminal investigations by famous Edmond Locard, a French criminologist [1]. In 1970, Suzuki K. and Tsuchihashi Y. studied lip print patterns in 107 families and gave a classification to identify different lip print patterns. It has been observed that lip prints can be identified as early as the sixth week of intrauterine life and they do not change during the life of an individual. Even after trauma, inflammation, and diseases like herpes they recover and can be identified without any defect. Like fingerprints, lip prints are unique to every individual [1,2,4,5,9,10]. Two Japanese scientists, Tsuchihashi and Suzuki, discovered that each person has a unique lip. They also suggested a lip print classification, which is currently the most commonly used classification in the literature [11]. Modern techniques of crime detection have made criminals aware that they should take precautions, such as gloves. Criminals cannot be positively identified with such accurate methods as fingerprint analysis. Investigators may use cheiloscopy as supporting evidence in some cases [12] and a study of patterns of grooves among males and females could also help to determine gender [13]. In this study, we specific lip print patterns for human identification, its uniqueness among males and females, and can be uses in crime scenes. Technology and its accuracy were integrated into this study instead of using estimation, microscopy, and enlarging the image using the magnifying glass, so the use of technology results in better results. In this study is determined the classification of lip print patterns Salah El-Din population in Iraq and comparative analysis with other countries with high accuracy by using computer science to analyzation images.

Aim:

We determined the lip print patterns among samples of the Salah El-Din population in Iraq and their distribution of pattern types using MATLAB.

- The prime objective of the present study was to classify the type of lip print for the Salah El-Din population in Iraq and determine the different types of lip prints between gender of the population.

- Also, we can identify individuals from lip print due to the lip print unique for everyone as any biometric as fingerprint, DNA, and others.

Materials and Methods:

Samples:

The study included 100 healthy individuals (50 males and 50 females) from the Salah El-Din population in Iraq, all of whom were over the age of ten. All the samples gave their informed consent.

Inclusion Criteria:

Only healthy samples were included in the study, which was free of diseases, soreness, oddity, or deformities. The study was conducted after approval from Dentistry/Tikrit University.

A Guide to Recording Lip Prints:

Individuals were provided with good status for recording lip prints, as illustrated in Fig. 1. Before the treatment, the participants' lips were wiped using tissue paper. Fig.1-A shows the materials that are used to take lip prints, dark-colored healthy) (White Lian) is a food color for foods) like rouge was put evenly using the brush. The sticky side of a 15 cm transparent cellophane strip was placed over the lips as indicated in Fig. 1-B and 1- C. The impression was formed by compressing softly from the middle to the corners of the lips while in the normal resting position. Later, we removed the imprint and put it onto a white paper for recording Fig. 1-D. We used a survey table sheet for each individual information as Fig. 1-E. After that, we collected all lip prints in the computer after scanner it to analyze, the final lip print as shown in Fig.1-F.

An Analysis of The Lip Print:

Fig. 2 shows the lip prints divided into six quadrants for analysis. UR is the upper right quadrant, UM is the upper middle quadrant, UL is the upper left quadrant, LL is the lower left quadrant, LM is the lower middle quadrant, and LR is the lower right quadrant. The computer studied the acquired prints first to select the best clear full print where the groove types could be observed and assessed. The bottom part was looked at independently to see whether there was a common pattern to the grooves. The numerical supremacy of the patterns determines the print analysis [14]. Furthermore, the type that was repeated the most was called a lip print type. These data were independently entered into a software program called MATLAB, which describes how to analyze a person's lip print and identify them. Lip print patterns were classified according to Suzuki and Tsuchihashi's work [15,16].

Classification of Patterns:

Fig. 3 represented the classification of lines on lip print proposed by Suzuki and Tsuchihashi [15,16].

Software:

The lip print was examined using a program in a computer using MATLAB to reach for high accuracy and perfect classification by using the middle region of the lower lip (20 mm) because this portion is seen in most of the traces [17]. We were dependent on classification based on Suzuki and Tsuchihashi studies as shown in Fig. 4. with the following steps:

Step 1: Begin
Step 2: For i=1 to 100 // *i=the number of images.*
Step 3: Input image
Step 4: Segmentation image into 6 parts as shown in Fig.2
Step 5: Selection of the middle-lower part of the lip (20 mm)
Step 6: Changes the image to a gray level
Step 7: Smoothing image // to delete the noise from the image using the Gaussian algorithm for smoothing the image.
Step 8: Applied threshold algorithm // to delete the background for an image
Step 9: Applied the Skeleton algorithm for image // procedure to select the features of grooves using the following mask= [1 0 0 -1 -1 0 0 1].
Step 10: Classification Lip print // using the type of classification for Suzuki and Tsuchihashi.
Step 11: Output image // Type (I, I', II, III, IV, V). As shown in Fig. 5 the classification lip print using the above steps.
Step 12: END.

Statistical Analysis

It is decided to use the statistical package for social sciences (SPSS). A chi-square test and a t-test were administered for detailed analysis of the data.
Fig. 6 Diagrammatic representations of the common classification types.

Results:

The generality of common lip patterns in the Salah El-Din population, in Iraq, was the type I (42%) followed by type I' (20%), type II & V (14%), type III (10%), and IV (0%), in females as shown in Fig. 7. Type II accounts for (32%) of males, after type in I (28%), I' (18%), V (12%), III (10%) and IV (0%) as shown in Fig. 8. Using the Chi-square test to determine gender dimorphism among the Salah El-Din population. It appears there is a difference between female lip prints and male lip prints, and that the common types of lip prints in the Salah El-Din population are "type I and type I', and type II", but type IV does not exist. As shown in Fig. 9. Table 1 shows the Chi-square test for data. Table 2 distribution gender * age Crosstabulation. Table 3: shows the independent samples test.

Discussion:

Patterning civilization has become increasingly concerned with human identification. Individuals are classified into characteristic groups based on their age, gender, and race. Using the unique features of the teeth and jaws to identify humans goes back to Roman times [(9)].

In forensic dentistry, dental evidence is examined, and dental findings are presented in the interest of justice [(18)]. ***Cheiloscopy*** is an adjunct investigation for the detection of criminals [(19)].

Each lip pattern has a unique morphology [(18,20)]. These are considered the most important form of evidence and are analogous to fingerprints [(19,21)]. Cheiloscopes in forensic dentistry is rare in the literature.

Vahanwala et al. (2005) according to researchers from India, males with type III lips are the most common [(22)].

Narang et al. (2011) in India, many people have type III lip patterns. However, they could not find any studies showing the same results [(23)].

Gupta et al. (2011) in North India, reported males' type II the common lip pattern [(24)].

Vats et al. (2012) in Indian Brahmins, reported type I' followed by type II, type III, and type I [(25)].

Singh J et al. (2012) the population of Moradabad in India reported type I was a common pattern the type followed were III, IV, II, and V [(26)].

Girish et al. (2013) investigated whether lip prints could identify a person's identity and gender. The authors used 40 subjects, 20 males and 20 females. Lip prints were found to be unique and different; no two lip prints were identical. Type I and I' were most common among females; type IV and V were most common among males. This implies that sex and identity can be determined by lip prints [(27)].

Ghimire et al. (2014) analyzed and compared quadrant lip prints and gender in the Nepali population. A total of (100 males and 100 females) 18-25-year-old Nepalese undergraduates from BPKIHS were involved in this study. We studied only the middle 10 mm of the upper and lower lips. Cheiliscopy square tests were conducted to analyze and compare lip print patterns in each quadrant for males and females [(28)].

Peeran et al. (2015) found that Type I was the most prevalent type in the Libyan population, followed by Type II, III, IV, V, and I' [(29)]. According to Mohfegh et al. (2016), type V is the predominant of all, followed by type I, type II, type IV, and type I' [(30)].

Ganapathy et al. (2018) published a manuscript on gender identification and personal identification using ***Cheiloscopy***. In their study, they used a study by Vahanwala - Parekh to determine the gender of individuals from the following pattern: in the first pattern, clear-cut grooves, and vertically across patterns are dominant in females in the third and fourth quadrants, i.e., lower lip, while straight grooves patterns are common in males in the second quadrant, i.e., upper lip left side [(31)].

Karamustafić et al. (2020) reported that lip prints are non-invasive processes that may

assist with identification. Therefore, it would be prudent to introduce new records into standard dental procedures. According to the authors, they have validated the uniqueness of lip prints by analyzing grooves at the vermillion of lips, defining the predominant patterns among all participants, as well as identifying the individual morphological characteristics of lip prints among males and females. The researchers used 40 participants, including 20 men and 20 women. For personal identification, they are among the most important soft tissues of the oral cavity. Lip prints are among the soft tissues that can be used as evidence in criminal investigations and personal identification [32].

Tamara et al. (2021) according to the survey, the identification of living or dead individuals. A cornerstone of forensic dentistry is using the unique features of the mouth and teeth to identify individuals [33].

There was no study that matched exactly our pattern in the present study. Our results seem to be different, however. There was gender differentiation, which was type II followed by type I in males, and type I followed by type I' in females.

Conclusion:

- This study confirmed the uniqueness of lip print patterns even between family relatives. There may be a role for Cheiloscopy in the identification process, both in civil and criminal matters.
- The lip print pattern among the Salah El-Din population in Iraq showed significant gender dimorphism.
- The study discovered type I is (42%) in females and Type II (32%) in males were the most and there is no type IV (0%) in females and males among the population of the Salah El-Din in Iraq.

There is an urgent need for further research on different population groups to analyze the differences and to establish a database that can be used by criminal investigators as a reference along with the provision of technical and financial support for a detailed analysis of the relationship between lip prints and ABO blood groups.

Consent

This study was published with the consent of the patient (or other approved parties).

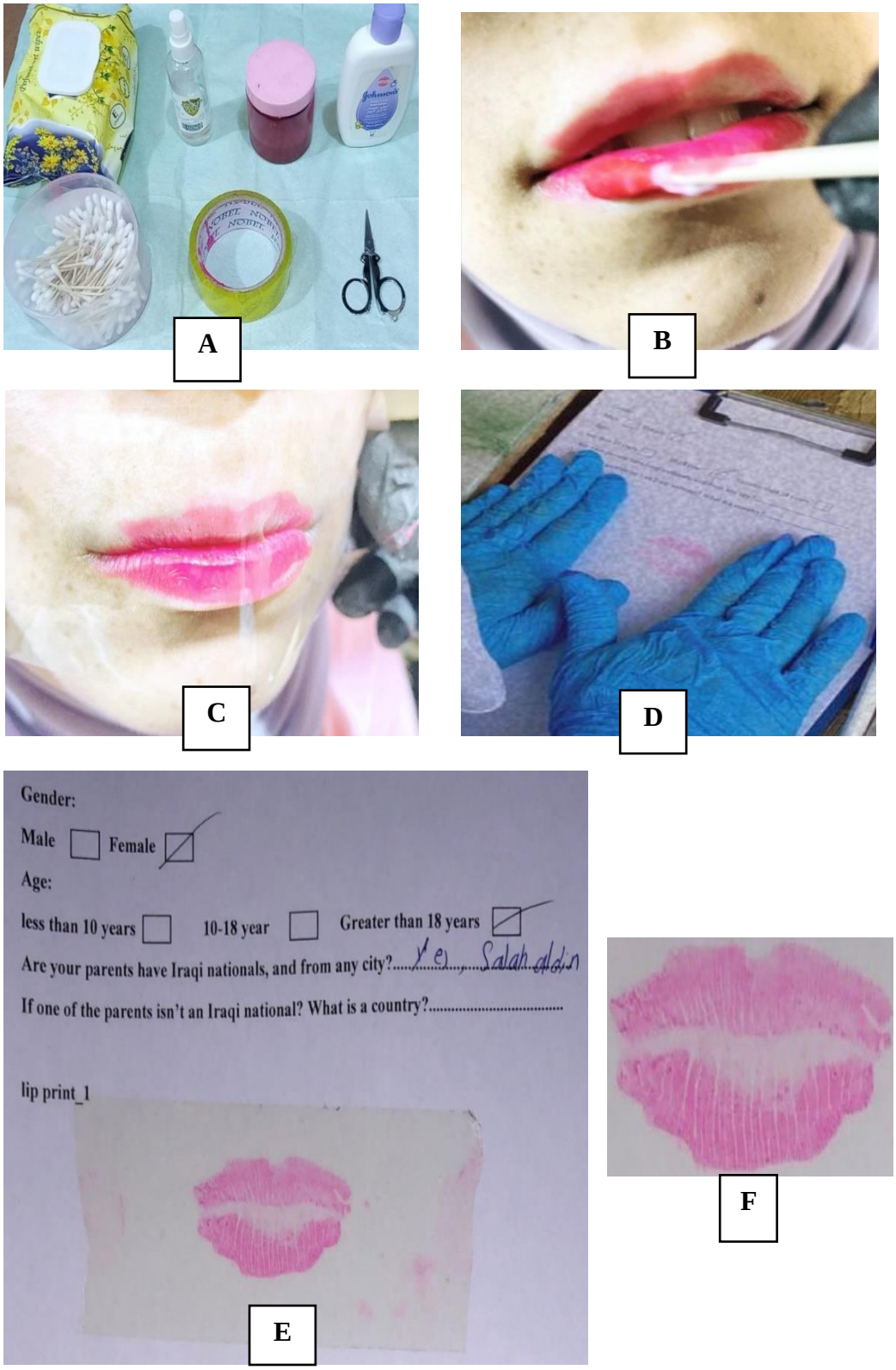

Figure 1: A -Materials used for the present study, B -Application of lipstick, C -Putting transparent strip, D-Putting lip print on white paper, E-Sheet information, and F-Final lip print- recording lip.

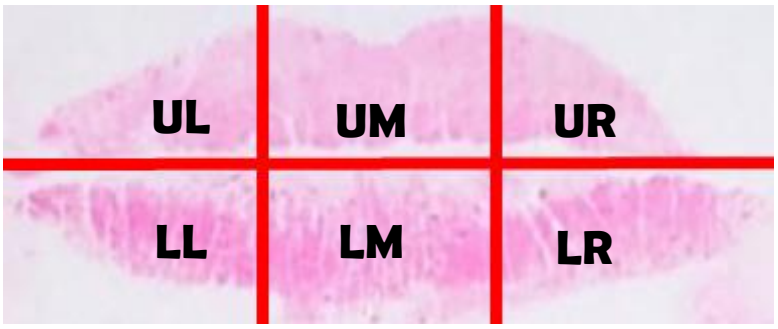

Figure 2: Lip print split into six quadrants

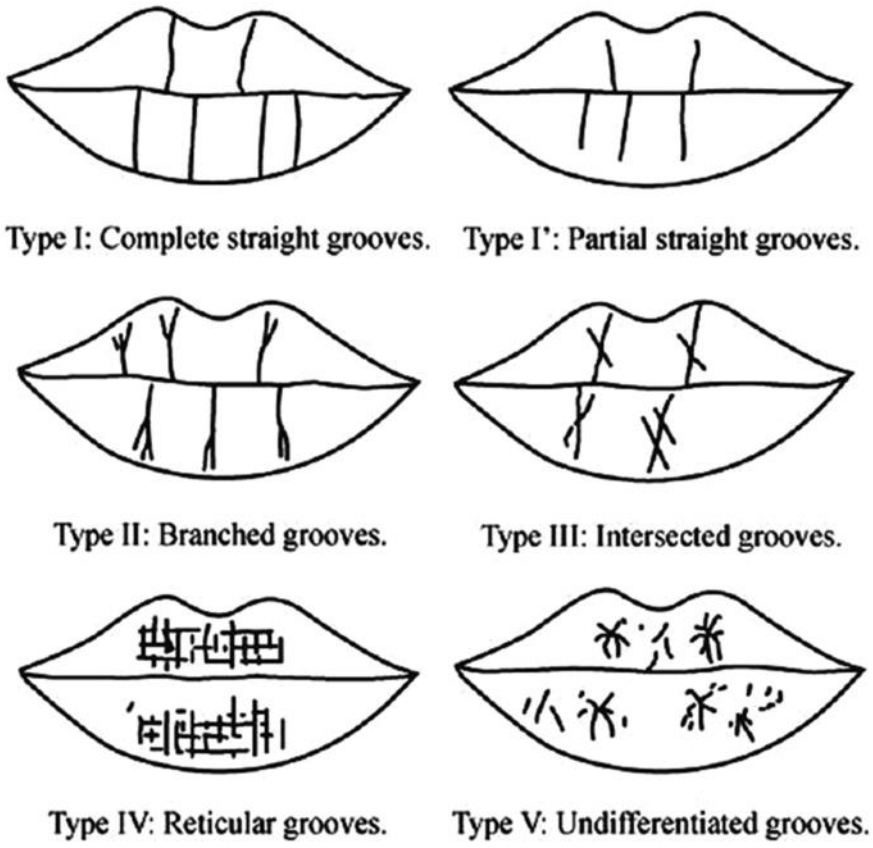

Figure 3: Classification of lip prints according to Suzuki and Tsuchihashi

Where, Type I: Long vertical (Vertical grooves that run across the lips clear cut). _ Type I': Short vertical (Groove of a partial length of type I). _ Type II: Branched grooves (Pattern shaped as branching). _ Type III: Intersected grooves (Criss-cross/'x' pattern grooves). _ Type IV: Reticular pattern (Grooves that form rectangular shape). _ Type V: Mixed/Indefinite (Grooves that don't fit into any of the following categories, have a mix of two or more patterns, and/or can't be distinguished as morphological features).

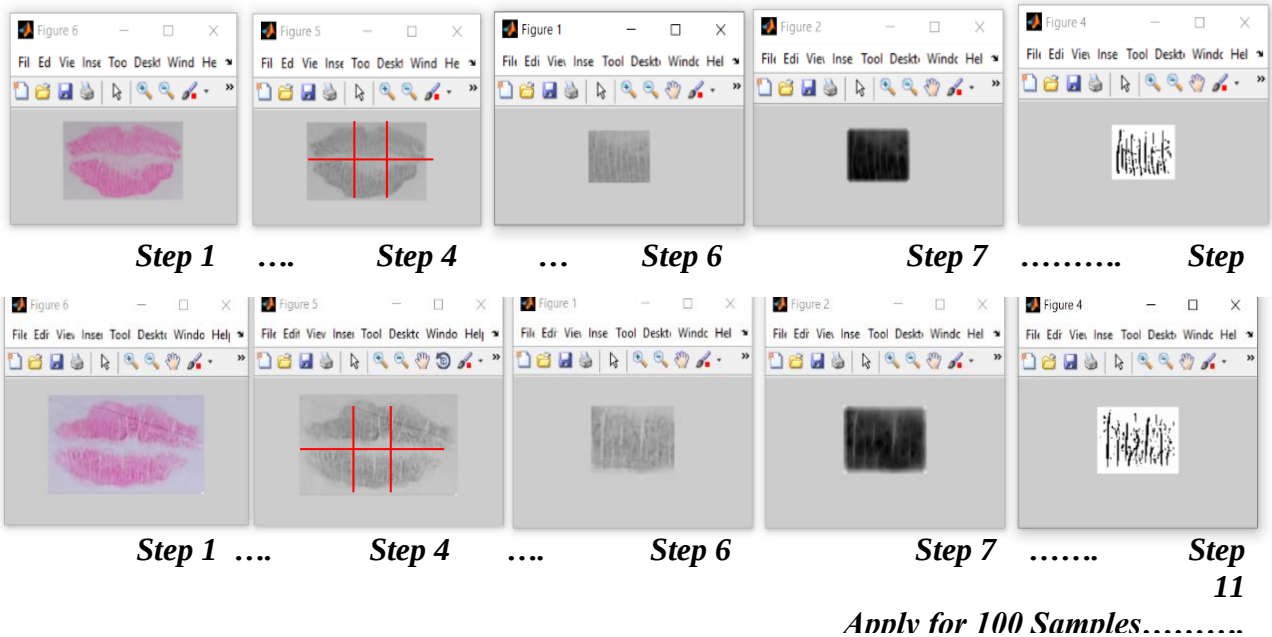

Figure 4: Software for classification types

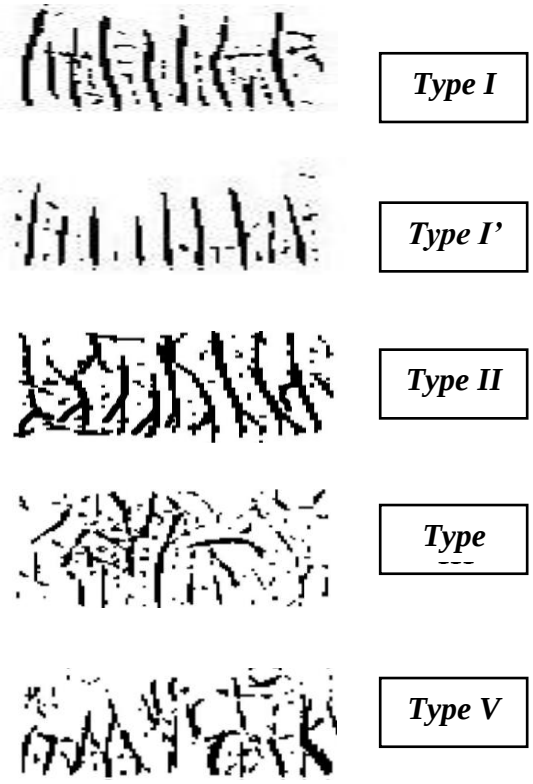

Figure. 5: The classification lip print using the software**.**

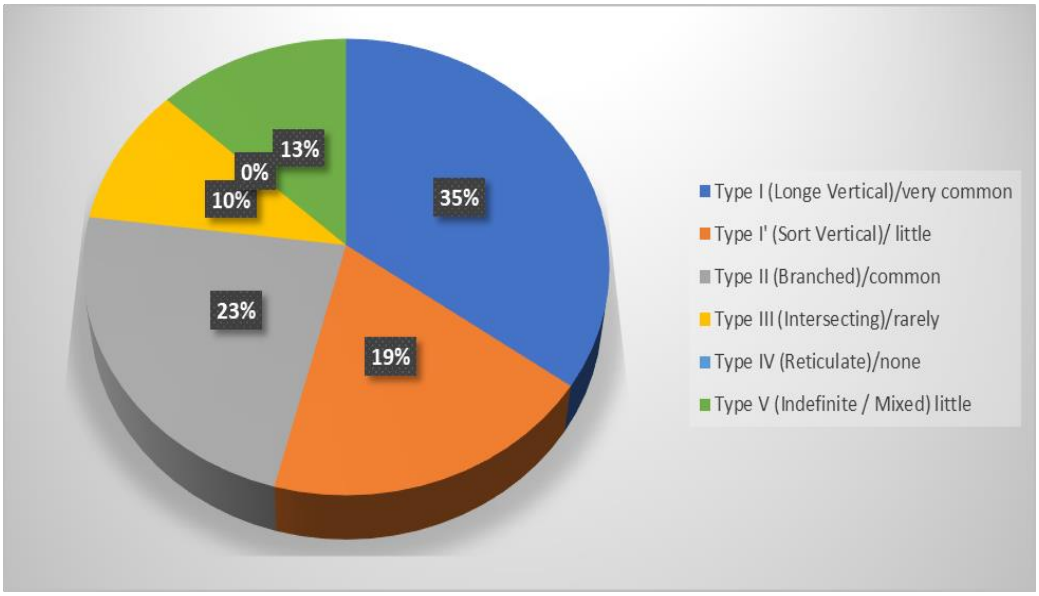

Figure 6: Diagrammatic representations of the common classification types

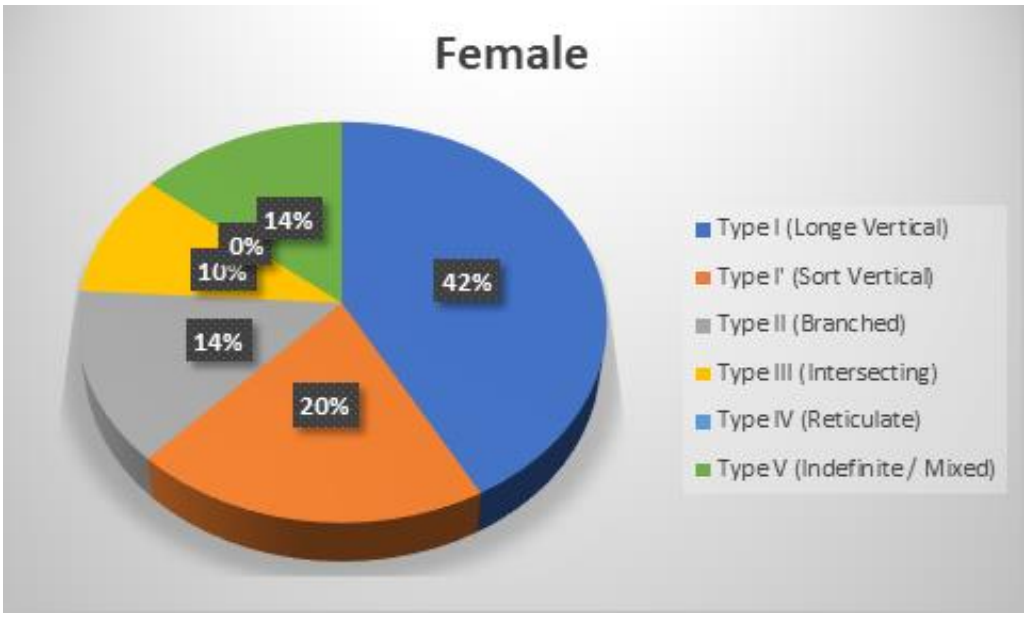

Figure 7: Classification Types for Females**.**

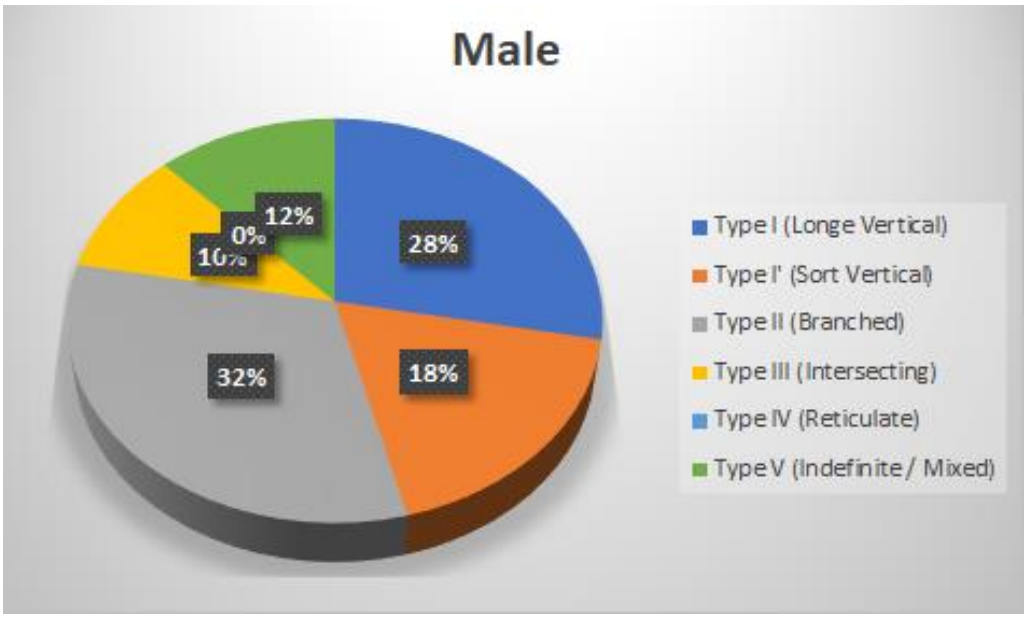

Figure 8: Classification Types for Males**.**

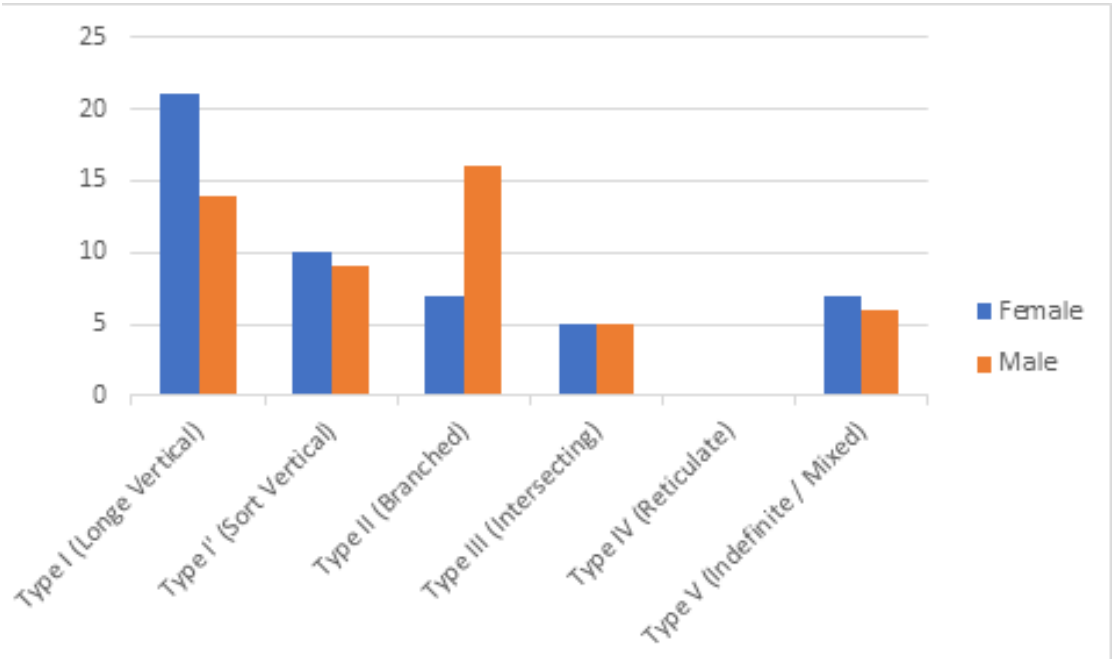

Figure 9: The Different Classification Types Between Females and Males**.**

Table 1: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.941[a]	1	.096		
Continuity Correction [b]	2.252	1	.133		
Likelihood Ratio	2.965	1	.085		
Fisher's Exact Test				.133	.066
Linear-by-Linear Association	2.912	1	.088		
N of Valid Cases	100				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.00.
b. Computed only for a 2x2 table

Table 2: gender * age Crosstabulation

			age		
			than Less 18	Greater than 18	Total
gender	Females	Count	12	38	50
		% within gender	24.0%	76.0%	100.0%
		% within age	37.5%	55.9%	50.0%
		% of Total	12.0%	38.0%	50.0%
	Males	Count	20	30	50
		% within gender	40.0%	60.0%	100.0%
		% within age	62.5%	44.1%	50.0%
		% of Total	20.0%	30.0%	50.0%
	Total	Count	32	68	100
		% within gender	32.0%	68.0%	100.0%
		% within age	100.0%	100.0%	100.0%
		% of Total	32.0%	68.0%	100.0%

Table 3: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
frequen	Equal variances assumed	63.403	.000	1.243	98	.217	1.400	1.126	-.835-	3.635
	Equal variances not assumed			1.243	81.448	.217	1.400	1.126	-.841-	3.641

References:

1-Aanchal T, Abhinav S, Rohit J, Madhvika P, Aashish K. Estimation of gender using Cheiloscopy and dermatoglyphics. Nat J Maxillo Surg.2017;8(2) :102-105.
doi: 10.4103/njms.NJMS_2_17.

2-Sivapathasundharam B, Prakash P.A, Sivakumar G. Lip prints (Cheiloscopy). Indian Dent. Res.2001; 12:234–237.

3-Shafer, Hine, Levy. Shafer's Textbook of Oral Pathology, sixth ed. Elsevier, Noida, India. 2009; 871–897.

4- Sukul B, Deb U, Ghosh S. Why a "dental surgeon" for identification in forensic science? Journal of the Indian Medical Association. 2010; 108(11): 769-775.

5- Sweet D, DiZinno JA. Personal identification through dental evidence tooth fragments to DNA. J Calif Dent Assoc.1996; 24:35-42.

6-Venkatesh, R., David, M.P. Cheiloscopy: an aid for ersonal identification. J. Forensic Dent. Sci. 2011;3: 67–70.

7-Prabhu, R.V., Dinkar, A., Prabhu, V. A study of lip print pattern in Goan dental students – a digital approach. J. Forensic Legal Med.2012; 19: 390–395.

8-Prabhu, R.V., Dinkar, A., Prabhu, V. Digital method for lip print analysis: a new approach. J. Forensic Dent. Sci.2013; 5: 96–105.

9-Dwivedi, N., Agarwal, A., Kashyap, B., Raj, V., Chandra, S. Latent lip print development and its role in suspect identification. J. Forensic Dent. Sci.2013;5(1): 22–27.

10-Richa Gaba, Junaid Ahmed, Ravikiran Ongole, Ceena Denny E, Nandita Shenoy and Almas Binnal. Scope of Cheiloscopy in gender identification. Int J Biomed Res. 2014;5(6). doi.org/10.7439/ijbr. v5i6.

11-Jaishankar S, Jaishankar N, Shanmugam S. Lip prints in personal dentification. J Indian Aca Dent Spec. 2010; 1:23–26.

12-Prabhu RV, Dinkar AD, Prabhu VD, Rao PK. Cheiloscopy: Revisited. J Forensic Dent Sci. 2012 Jan-Jun; 4(1): 47–52.

13-Ghimire N, Nepal P, Upadhyay S, Subba A , Kharel B, et al. Lip print pattern: An Identification tool. Health Renaissance.2013; 11(3): 229-233.

14-Dina A, Naglaa F, Mostafa M. A Study of Morphological Patterns of Lip Prints in Relation to Gender and Blood Groups Among Egyptian Population. Egypt J. Forensic Sci. Appli. Toxicol. 2017; 17 (1):232-236.

15-Suzuki K, Tsuchihashi Y. A new attempt of personal identification by means of lip print. Can. Soc. Forensic Sci. J. 1971; 4:154–158.

16-Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci. Int. 1974; 3:233–248.

17-Sharma P, Saxena S, Rathod V. Cheiloscopy: the study of lip prints in sex identification. J Forensic Dent Sci. 2009 Jan;1(1):24-27.

18- Gondivkar SM, Indurkar A, Degwekar S,Bhowate R. Cheiloscopy for sex determination. Journal of Forensic Dental Sciences. 2009;1(2):56- 60.

19-El Domiaty MA, Al-Gaidi SA, Elayat AA, Safwat MDE, Galal SA. Morphological patterns of lip prints in Saudi Arabia at Almadinah Almonawarah province. Forensic Science International. 2010; 200(1): 179.e1–179.e9.

20- Padmavathi B, Makkad RS, Rajan S, Kolli GK. Gender determination using Cheiloscopy. Journal of Forensic Dental Sciences. 2013;5(2):123-128.

21-Navarro E, Castelló A, López JL, Verdú F.Criminalystic: Effectiveness of lysochromes on the developing of invisible lipstick-contaminated lipmarks on human skin: A preliminary study. Forensic Science International. 2006;158(1):9-13.

22- Vahanwala S, Nayak C, Pagare S. Study of lip prints as aid for sex determination. Medico-Legal Update. 2005;5(3):93-98.
23- Narang RS, Arora PC, Randhawa K. Cheiloscopy as an aid to forensic methodology. Indian Journal of Comprehensive Dental Care (IJCDC). 2011;1(1).
24-Gupta S, Gupta K, Gupta O. A study of morphological patterns of lip prints in relation to gender of North Indian population. Journal of Oral Biology and Craniofacial Research. 2011;1(1):12-16.
25-Vats Y, Dhall JK, Kapoor A. Gender variation in morphological patterns of lip prints among some north Indian populations. Journal of Forensic Dental Sciences. 2012;4(1):19-23.
26- Singh J, Gupta KD, Sardana V, Balappanavar AY, Malhotra G. Sex determination using Cheiloscopy and mandibular canine index as a tool in forensic dentistry. Journal of Forensic Dental Sciences. 2012;4(2):70-74.
27-Girish R, Rahul R, Shirish S, Cheiloscopy-Method of Person Identification and Sex Determination, Open Access Scientific Reports. 2013; 2(1):1-4, doi:10.4172/scientificreports.612.
28-Vikash R, Mysore K Sunil, Raghav K. Study of lip prints: A forensic study، Journal of Indian Academy of Oral Medicine & Radiology .2014; 26(1):50-54.
29-Peeran SW, Kumar PN, Abdalla KA, Azaruk FAA, Manipady S, Alsaid FM. A study of lip print patterns among adults of Sebha city, Libya. Journal of Forensic Dental Sciences. 2015;7(1):67-70.
30- Moshfegh M. Morphological patterns of lip prints in an Iranian population. Oral Medicine and Pathology. 2016;8(5):550-555.
31-Ganapathy N, Maheshwari U, Yamunadevi A, Maheswaran T, Ilayaraja V, Tamil Thangam P.Cheiloscopy: An Evolving Tool in Forensic Identification", Journal of Indian Academy of Dental Specialist Researchers. 2018; 5(2):37-41.
32-Karamustafić V, Zukić S, Bajsman A, Vuković A. Forensic Cheiloscopy in the Process of Individual Identification, Acta Scientific Dental Sciences. 2020; 4(3):81-84.
33-Tamara A., Adnan A., Yasir N. A Review of Lip Print as A Tool in Forensic Dentistry. Tikrit Journal for Dental Sciences .2021; 9(2): 80-87.