A study on the correlation of lip prints, fingerprints and mandibular intercanine distance for the gender determination

Dr Bela Mahajan
Professor & Head, Department of Oral Pathology, Institute of dental sciences, Sehora, Jammu

Dr Vandana Katoch*
Reader, Department of Oral Pathology, Institute of dental sciences, Sehora, Jammu
*Corresponding author

Dr Premlata
Professor, Department of Oral Surgery, Institute of dental sciences, Sehora, Jammu

Dr Jasjit Kaur Sahota
Professor, Department of Periodontology, Institute of dental sciences, Sehora, Jammu

Dr Harmeet Singh
Reader, Department of Conservative Dentistry And Endodontics, Maharaja Ganga Singh Dental college and research centre, Sriganganagar

Dr Saurav Saini
Reader, department of Oral Medicine and radiology, Institute of dental sciences, Sehora, Jammu

Abstract---Background: Dental, fingerprints and DNA comparisons are most common techniques used in identification of an individual. Establishing the identity of an individual was one of the challenges faced by forensic in earlier days. The concept of "identity" is a set of physical characteristics, functional or psychic, normal or pathological- that define an individual. The present study was conducted to study the correlation of lip prints, fingerprints and mandibular intercanine distance for the gender determination. Material & methods: The study was conducted among 400 participants (200 males and 200 females) aged between 18 and 25 years, in department of Oral Pathology of the Institute of dental sciences, Sehora, Jammu. Cheiloscopy, fingerprint

analysis, and mandibular canine index (MCI) were performed in each participant to investigate the accuracy in gender determination. The results of all the three parameters were collected and a correlation between each pair of the parameters was statistically done using univariate ANOVA test. Results: With regard to lip print pattern, Type II lip print was found to be predominant in males (35.5) and in both(33) whereas Type I was predominant in females (32). In fingerprint pattern, the arch pattern (50%) was predominant in both males and females followed by whorls (34.5%) and loop (15.5%). Mandibular intercanine distance (MICD), mesiodistal width of right mandibular canine, mesiodistal width of left mandibular canine, right MCI, and left MCI gave statistical significance results, and sexual dimorphism of right mandibular canine is proved to be higher than that of left mandibular canine. On correlating all the three parameters, the observations were subjected to statistical analysis and the results were not of statistical significant in gender determination. Conclusion: The present study concluded that all the three parameters, lip prints, fingerprints and mandibular intercanine distance were not of statistical significant in gender determination.

Keywords---lip prints, fingerprints, gender determination, mandibular intercanine distance.

Introduction

Gender determination plays an important role for identifying an individual in forensics. Dental, fingerprints and DNA comparisons are most common techniques used in identification of an individual.[1] Lip prints have a great significance in medico-legal issues. Identification plays a major role in any criminal investigation. The external surface of lips has many elevations and depressions forming a characteristic pattern called lip prints, examination of which is known as cheiloscopy. The lip prints are unique and distinguishable for every individual like fingerprints.[2] The theory of uniqueness is a strong point used in the analysis of fingerprints. Fingerprint evidence is the most reliable and acceptable evidence for the identification of an individual in the court of law.[3] "Dermatoglyphics" refers to epidermal ridges present on the palm, sole, fingers, and toes."[4] Every individual has an unique fingerprint pattern, and based on genetic characters of each individual, it remains unchanged throughout life.[5] Findings in teeth have been extremely useful in this field; since the tooth, the hardest tissue in the human body, is extremely resistant to physical and chemical agents[6] and durable even at high temperature. Since no two teeth have similar morphology and they are readily available they can be produced as a tool for forensic sciences. Research studies have established that the greatest sexual dimorphism is seen in mandibular canine among all teeth.[7] This is because mandibular canines are exposed to less plaque, calculus, abrasion from brushing, or heavy occlusal loading than other teeth, they are also less severely affected by periodontal disease and so, usually are the last teeth to be extracted with respect to age.[8] These findings indicate that mandibular canines can be considered as the 'key teeth' for personal identification.[9] The present study was conducted to

study the correlation of lip prints, fingerprints and mandibular intercanine distance for the gender determination.

Material & Methods

The study was conducted among 400 participants (200 males and 200 females) aged between 18 and 25 years, in department of Oral Pathology of the Institute of dental sciences, Sehora, Jammu. Before the commencement of the study, informed consent was taken from all the study subjects, along with the institutional ethical committee approval. Cheiloscopy, fingerprint analysis, and mandibular canine index (MCI) were performed in each participant to investigate the accuracy in gender determination.

For cheiloscopy

The lips of each subject were thoroughly examined clinically for any deformity, scars, or abnormality, and the findings were noted. If any abnormality was noticed, then such cases were excluded from the study. Lips of the subjects were cleaned, and they were asked to open the mouth where red or brown-colored lipstick was applied in a single motion. Subjects were asked to gently rub the lips together to spread the lipstick evenly, and then, they made a lip impression in the normal rest position of the lips, by dabbing it in the center first and then pressing it uniformly toward the corners of the lips. Care was taken to avoid sliding of the lips so as to prevent smudging of the print over the entire area of the red part of the lips. After 2 min, a lip impression was made on a strip of cellophane tape. The cellophane strip was then stuck to the white paper for permanent record purpose, and then, the recorded lip prints were visualized utilizing magnifying lens. Because of numerically superiority of properties of the lines in the middle part of the lower lip (10 mm wide) and almost visible in any trace, this fragment was selected for the study area. In this study, the classification of patterns of lines on the lips given by Tsuchihashi[10] was followed:

- Type I: Clear-cut vertical grooves that run across the entire lip
- Type I': Similar to Type I but does not cover the entire lip
- Type II: Branched grooves (Y-shaped pattern)
- Type III: Intersecting
- Type IV: Crisscross patterns, reticular grooves
- Type V: Undetermined

For finger prints

The subjects included were all healthy, and individuals with physical disability, systemic illness, or syndromes were excluded. Subjects were asked to wash and dry their hands to remove dirt and grease. The imprint obtained from the left thumb using blue ink stamp pad was transferred on to white bond paper. These prints were examined, classified, and analyzed using the magnifying glass. Analysis of fingerprint patterns was carried out using the most widely accepted Michael Kucken's classification[11]:

1. Loop pattern,
2. arch pattern,
3. whorl pattern

All the above values of lip print and fingerprints were subjected to Chi-square test.

For mandibular canine index

Besides fulfilling the criteria of having the full complement of teeth, abnormalities such as severe malocclusion, increased overjet and overbite, supernumerary teeth, and transposed canine were excluded. Mandibular impressions of all the samples were made with alginate and study models were prepared in dental stone. Mandibular study models were used for the analysis. On the study model, the following measurements were taken for all the subjects using a digital vernier caliper.

- Mandibular canine width was measured as the greatest mesiodistal dimension of mandibular canine on either side of the jaw using a vernier caliper, and the average of this was taken.
- The intercanine distance was measured as the linear distance between the cusp tips of right and left mandibular canine. The observed mandibular canine width and intercanine width were subjected to statistical analysis to assess gender difference using independent t-test.[12,13]

- Mandibular Canine Index = Mesiodistal crown width of mandibular canine
                                                 Mandibular canine arch width

The results of all the three parameters were collected and a correlation between each pair of the parameters was statistically done using univariate ANOVA test.

Results

With regard to lip print pattern, Type II lip print was found to be predominant in males(35.5) and in both(33) whereas Type I was predominant in females (32). Results were analyzed by Chi-square test and showed very high statistical significance ($P < 0.0001$) for different lip patterns in between males and females.

Table 1: Comparison between males & females for lip prints

Lip prints	Males N(%)	Females N(%)	Total N(%)	Chi-square	P-value
Type I	52(26)	64(32)	116(29)	24.03	< 0.0001
Type I'	12(6)	29(14.5)	41(10.5)		
Type II	71(35.5)	61(30.5)	132(33)		
Type III	31(15.5)	14(7)	45(11.25)		
Type IV	29(14.5)	24(12)	53(13.25)		
Type V	5(2.5)	8(4)	13(3.25)		

Total N(%)	200(50)	200(50)	400(100)		

The study revealed that in fingerprint pattern, the arch pattern (50%) was predominant in both males and females followed by whorls (34.5%) and loop (15.5%). All the results were subjected to statistical analysis by Chi-square test and the results obtained were not of significance within the gender (P = 0.234).

Table 2: Comparison between males & females for finger prints

Finger prints	Males N(%)	Females N(%)	Total N(%)	Chi-square	P-value
Loop pattern	33(16.5)	29(14.5)	62(15.5)	4.08	0.234
arch pattern	105(52.5)	95(47.5)	200(50)		
whorl pattern	62(31)	76(38)	138(34.5)		
Total N(%)	200(50)	200(50)	400(100)		

Mandibular intercanine distance (MICD), mesiodistal width of right mandibular canine, mesiodistal width of left mandibular canine, right MCI, and left MCI gave statistical significance results, and sexual dimorphism of right mandibular canine is proved to be higher than that of left mandibular canine. All measurements indicate that in the sample investigated, males have larger tooth and arch dimensions and found to be statistically significant.

Table 3: Comparison between males & females for MICD, MWRMC, MWLMC, RMCI and LMCI

Variables	Male Mean±SD	Female Mean±SD	Total Mean±SD	p-value
MICD	26.08±1.87	24.65±1.76	25.87±1.82	< 0.0001
MWRMC	7.23±0.67	6.56±0.55	7.12±0.63	
MWLMC	6.89±0.54	6.21±0.47	6.54±0.51	
RMCI	0.24±0.03	0.23±0.03	0.24±0.03	
LMCI	0.24±0.03	0.23±0.03	0.23±0.03	

Table 4: Correlation between lip prints, fingerprints, and mandibular intercanine distance for males
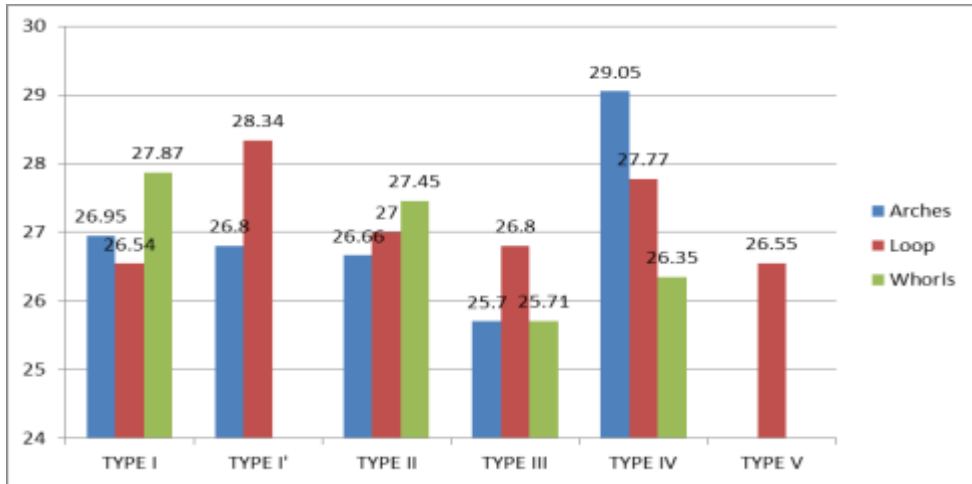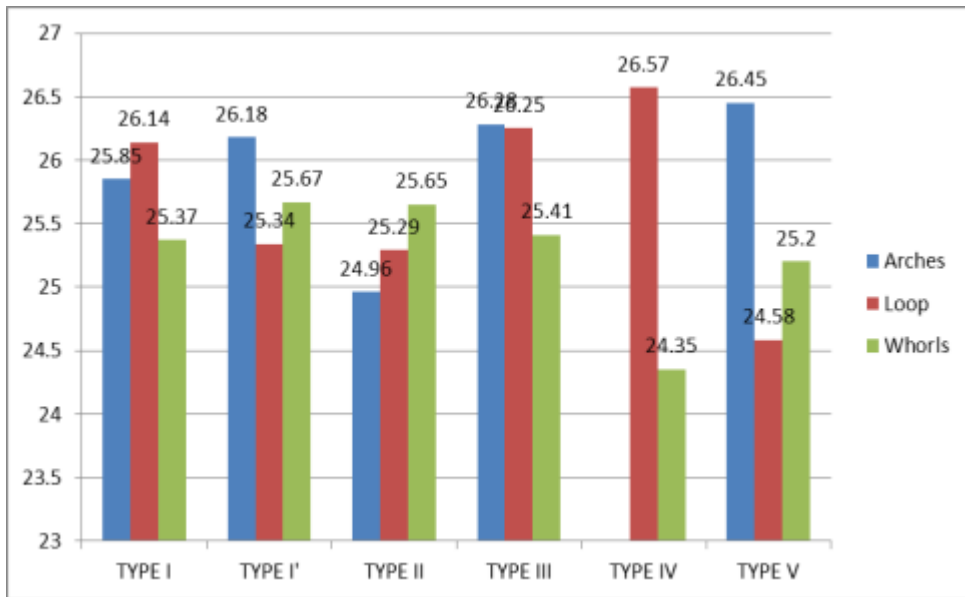

Table 5: Correlation between lip prints, fingerprints, and mandibular intercanine distance for females

On correlating all the three parameters, the observations were subjected to statistical analysis and the results were not of statistical significant in gender determination.

Discussion

Different techniques of identification can be of significant benefit in establishing the correct identity of a person. The use of lip prints were first recommended as

early as in 1932 by Edmond Locard, one of France's greatest criminologists.The distinctive pattern of grooves and wrinkles in lips has made cheiloscopy a reliable technique for personal identification.[14] The lip print pattern is identifiable as early as the sixth week of intrauterine life. Lip pattern is unique for each of the examined individuals, even in twins and family relatives. This finding is hoped to be useful in the identification process, both in civil and criminal issues.In fact, the lip prints have played important role in convicting criminals in important cases.[15]

With regard to lip print pattern, Type II lip print was found to be predominant in males (35.5) and in both (33) whereas Type I was predominant in females (32). In fingerprint pattern, the arch pattern (50%) was predominant in both males and females followed by whorls (34.5%) and loop (15.5%). Mandibular intercanine distance (MICD), mesiodistal width of right mandibular canine, mesiodistal width of left mandibular canine, right MCI, and left MCI gave statistical significance results, and sexual dimorphism of right mandibular canine is proved to be higher than that of left mandibular canine. On correlating all the three parameters, the observations were subjected to statistical analysis and the results were not of statistical significant in gender determination.

Some of the studies conducted in Rajasthan[16], Gujarat[17] revealed Branched pattern is the predominant lip pattern. In another study conducted by Devaraj et al at Karnataka[18] showed Reticular Pattern is the common type. The analysis of fingerprints as a form of identification has been used since 1891. No two fingerprints even in a given individual have the same ridge pattern and this remains unchanged throughout life from birth till death. This uniqueness in its presentation of the fingerprint analysis offers an excellent means of forensic investigations.[16] Hashim and Murshid who conducted a study on Saudi males and females and found that only the canines in both jaws exhibited a significant sexual difference.[20,22,23]

Bai JS et al found that Type II lip print pattern and loop pattern of fingerprints were the predominant patterns in both males and females, and mesiodistal width of right MCI has greater sexual dimorphism than left MCI. Although lip prints, fingerprints, and MCI had their own specifications, correlation of the three parameters did not show any significance.[21]

Conclusion

The present study concluded that all the three parameters, lip prints, fingerprints and mandibular intercanine distance were not of statistical significant in gender determination.

References

1. Divyadharsini V1, Jayanth Kumar V. Analysing Cheiloscopic Pattern and Mandibular Canine Index for Gender Determination. Research J. Pharm. and Tech 2019; 12(1): 254-258. doi: 10.5958/0974-360X.2019.00048.9
2. Saraswathi T R. Study of Lip prints. Journal of Forensic Dental Sciences 2009; 1(10.4103/0974- 2948.50885)

3. TandonA, Sircar K, ChowdhryA, Babiani D. Comparative analysis of lip and finger print patterns for sex determination. J Forensic Odontostomatol 2013;31:120.
4. Nagasupriya A, Dhanapal R, Reena K, Saraswathi T, Ramachandran C. Patterns – "A crime solver". J Forensic Dent Sci 2011;3:3-7.
5. Sangam MR, Babu AR, Krupadanam K, Anasuya K. Finger print pattern in different blood groups. J Indian Acad Forensic Med 2011; 33
6. Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci.1974;3:233-48.
7. Mughal IA, Saqib AS, Manzur F. Mandibular canine index (mci); its role in determining gender. Professional Med J. 2010;17:459-63.
8. Anderson DL, Thompson GW. Interrelationships and sex differences of dental and skeletal measurements. J Dent Res. 1973;52:431-8.
9. Dahlberg AA. Dental traits as identification tools. Dent Prog.1963;3:155-60.
10. Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci 1974;3:233-48.
11. Kücken M, Newell AC. Fingerprint formation. J Theor Biol 2005;235:71-83.
12. Muller M, Lupi-Pegurier L, Quatrehomme G, Bolla M. Odontometrical method useful in determining gender and dental alignment. Forensic Sci Int 2001;121:194-7.
13. Kaushal S, Patnaik VV, Sood V, Agnihotri G. Sex determination in North Indians using mandibular canine index. JIAFM 2004;26. ISSN 0971-0973.
14. Augustine J, Barpande SR, Tupkari JV. Cheiloscopy as an adjunct to forensic identification: A study of 600 individuals. J Forensic Odontostomatol2008;26:44-52.
15. William TR. Lip prints: Another means of identification. J Forensic Dent 1991;41(3):190-4.
16. Mutalik VS, Menon A, Jayalakshmi N, Kamath A, Raghu AR. Utility of cheiloscopy, rugoscopy, and dactyloscopy for human identification in a defined cohort. J Forensic Dent Sci 2013;5:2-6.
17. Pradhuman Verma. Correlation of Lip prints with Gender, ABO Blood Groups and Intercommissural Distance. North American Journal of Medical Sciences 2013; (10.4103/1947-2714.115777)
18. Rahul Patel. Assessment of correlation of lip print with gender and blood group among dental students of Visnagar, Gujarat, India. International Journal of Preventive and Public Health Sciences 2015; (10.17354/ijpphs/2015/05)
19. Devaraj Patil. A study on Lip Print Types among North Karnataka people. International Journal of Biomedical and Advanced Research 2013; (10.7439/ijbar)
20. Hashim HA, Murshid ZA. Mesiodistal tooth width. Acomparison between Saudi males and females. Part 1. Egypt Dent J 1993;39:343-6.
21. Bai JS, Prakash AR, Reddy AV, Rajinikanth M, Sreenath S, Reddy KV. Correlative study on lip prints, fingerprints, and mandibular intercanine distance for gender determination. Journal of forensic dental sciences. 2018 Sep;10(3):143.
22. Widana, I.K., Dewi, G.A.O.C., Suryasa, W. (2020). Ergonomics approach to improve student concentration on learning process of professional ethics. *Journal of Advanced Research in Dynamical and Control Systems*, *12*(7), 429-445.

23. Widana, I.K., Sumetri, N.W., Sutapa, I.K., Suryasa, W. (2021). Anthropometric measures for better cardiovascular and musculoskeletal health. *Computer Applications in Engineering Education, 29*(3), 550–561. https://doi.org/10.1002/cae.22202