

Original Article

Comparative Assessment of Lip Print and Tongue Print in Gender Determination: A Cross-Sectional Study

M. Sudhaa Mani, Yasmeeen Ahamed, Pavithra Dhandapani, G. Sivaraman, P. Ambiga, N. Balan

Department of Oral Medicine and Radiology, Vivekanandha Dental college for Women, Tiruchengode, Tamil Nadu, India

Received: 19 May, 2021.
Revised: 20 May, 2021.
Accepted: 23 May, 2021.
Published: 30 June, 2021.

INTRODUCTION

The indispensable role of forensic odontologists is to identify the distinctive features of the diverse anatomy prevailing in the head-and-neck region. The maxillofacial region is unique in its presentation of hard- and soft-tissue structures and its characteristics.^[1] By reviewing literature, it can be specified that forensic dentistry works with the two objectives; postmortem identification of an individual and identification of the culprit from evidences that may be left.^[2]

The study of lip prints is known as cheiloscropy and is derived from the Greek word cheilos meaning “lips” and eskopein meaning “to see.”^[3] The wrinkles and grooves present on the lip were designated as “sulci labiorum rubrorum” by Suzuki and Tsuchihashi in 1970.^[4] Lip prints are seen to remain same for an individual throughout his/her life unless scarring occurs due to a pathosis, a trauma, or due to any surgical procedure. By analyzing the imprints of lips left at the crime scene and their comparison with the suspects, investigating personnel can place the culprit at the crime scene and in a mass disaster also can give a positive match.^[5]

ABSTRACT

Introduction: In the recent times, anthropological traits such as lip prints and tongue prints are being acknowledged as a great fortune in gender determination. Not only the traits are unique, but also they can be acquired and secured from person through least invasive and cost-effective techniques.

Aim: The aim of the study is to determine the predominant type of lip print and tongue print and to correlate the lip print with tongue print in identification of gender.

Materials and Methods: This study was carried out with fifty individuals (25 males and 25 females) who were reporting to the Department of Oral Medicine and Radiology. For each individual, lip prints were recorded using a dark-colored lipstick and analyzed according to Suzuki and Tsuchihashi classification, and the tongue impression was recorded by making alginate impression and being preserved using the alginate molding. The Chi-square test was used for statistical analysis.

Results: Type 3 pattern in males and Type 1 pattern in females were the predominant lip patterns. In tongue, the physiological texture, pentagonal shape, scrotal tongue in 8% and blunt apex were the predominant features in males whereas ovoid shape with sharp lingual apex were seen predominantly in females. A statistically significant correlation was found between the lip print and tongue print with $P < 0.05$.

Conclusion: The lingual impression may constitute precise methods for forensic dentistry identification in addition to lip print.

KEY WORDS: Gender determination, lip print, tongue print

Tongue is a musculoskeletal organ which performs sensory and motor functions. The analysis of shape, texture, and color is unique, and it highlights any abnormalities, thereby making it a useful tool in personal identification. It conveys a lot of information regarding the health status of an individual. The dorsal surface of the tongue is unique for each person. The characteristic features of the tongue exhibit remarkable difference even between identical twins.^[6] Lingual impressions (impression of the dorsal surface along with the lateral borders) have been proved to be useful in forensic dentistry identification when used in conjunction with methods such as cheiloscropy and rugoscopy.^[7] Its use in natural and human-made disasters is yet to be documented although the tongue is one of the main components for diagnosis. There are studies, with correlation of lip print with the fingerprint.^[8] The tongue print can be used in case of criminal investigation. There are limited studies done to correlate the lip and the tongue print.^[9] With this background,

Address for correspondence: Dr. M. Sudhaa Mani,
E-mail: drsudhaaanimds@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Mani MS, Ahamed Y, Dhandapani P, Sivaraman G, Ambiga P, Balan N. Comparative assessment of lip print and tongue print in gender determination: A cross-sectional study. *Int J Forensic Odontol* 2021;6:60-4.

Access this article online	
Quick Response Code: 	Website: www.ijfo.org
	DOI: 10.4103/ijfo.ijfo_16_21

the present study was conducted to determine the predominant lip print and tongue print patterns in males and females and also to find out any correlation between the lip print and the tongue print patterns within a gender.

MATERIALS AND METHODS

The study duration was 3 months, and it was a cross-sectional study. The sample size was chosen based on the convenience sampling, and it was calculated using the formula:

$$n = 2 P (1-P) [Z_{1-\alpha/2} + Z_{\beta}]^2 / [p_1 - p_2]^2$$

The study sample was comprised fifty participants, all reported to the Department of Oral Medicine and Radiology (25 males and 25 females) from Namakkal, Tamil Nadu. Following approval of the ethical committee, each participant was examined for any pathology of the lips and tongue that could affect the lip print and the tongue print. The methods of recording lip and tongue prints were explained to the participants, and the consent of all the individuals was obtained.

Healthy individuals and participants who were willing to participate in the study without any systemic disease that alter the tongue and lip anatomy were included in the study. Patients with malformations, deformity, inflammation, trauma, surgical scars, gross deformity of lips such as cleft lip, ulcers, traumatic injuries on lips, angular cheilitis, lip pits, cheilitis glandularis, cheilitis granulomatosa, participants allergic to lipstick, alginate, HIV, and contagious diseases, gag reflex, gigantism, and dwarfism were excluded from the study.



Figure 1: Armamentarium used for taking lip prints

Each individual was asked to gently clean his/her own lips by rinsing with water and the lips were allowed to dry. The armamentarium for recording lip print [Figure 1]. A dark-colored lipstick was applied evenly in one stroke and spread it uniformly by the cotton tips. The sticky side of the cellophane tape was placed over the lips in resting position and then pressed uniformly. Tape was gently removed from the lips without distorting the lip print. Cellophane tape was then stuck to the bond sheet [Figure 2].

Although many classifications have been proposed for lip prints, it is the classification by Suzuki and Tsuchihashi^[4] [Figure 3] that is most widely used, and it is as follows:

- Type I: Clear-cut vertical grooves that run across the entire lips
- Type I': Similar to Type I, but the grooves do not cover the entire lip
- Type II: Branched grooves
- Type III: Intersected grooves
- Type IV: Reticular grooves
- Type V: Grooves do not fall into any of the Types I-IV and cannot be differentiated morphologically (undetermined).

The examination of the tongue was carried out after its prior cleaning with sterile compresses, together with abundant rinsing of the oral cavity.

In addition, the participants were asked not to suddenly protract their tongue up to maximum protraction, but in a relaxed position which would prevent a marked contraction of the striated lingual muscles, which would alter the characteristic aspects, as well as the shape of the tongue. The purpose of the direct examination of the tongue was to emphasize morphological features such as shape, type, and characteristics of the longitudinal medial septum and the related grooves, as well as the lingual apex type. The classification was put forth by Stefanescu *et al.* in 2014 [Table 1].^[10]

The alginate-molded impression is the most diagnostic, which has the advantages of duplicating the most minute details and coming off the model easily; we thus performed the detailed analysis for identification purposes [Figure 4], by taking the impression of the dorsal surface and the lingual lateral edges, with the help of the alginate which was directly applied from

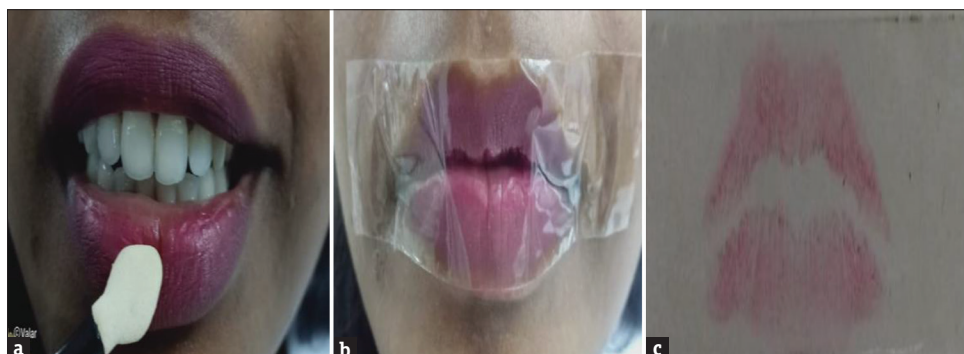


Figure 2: (a) Lipstick applied as a thin layer uniformly over the lower lip. (b) Placement of cellophane tape on the lip for recording of the lip print. (c) Cellophane tape strip stuck onto the bond paper

the level of the oral commissures up to the lingual tip in order to avoid the regurgitation reflex. The molds resulted as such were filled, in the dental technology laboratory, with Class IV dental stone [Figure 5], so as to have a relevant positive image for identification.

STATISTICAL ANALYSIS

All data collected were maintained confidentially. Data obtained were entered into Microsoft Excel and analyzed using SPSS. Level of statistical significance was to be kept at ≤ 0.05 . To determine the correlation between lip print and

tongue print, Chi-square test was done.

RESULTS

The predominant lip pattern in males was found to be Type III pattern followed by Type II pattern where it was Type I, followed by Type III and Type IV in females. Out of 25 males, Type III, i.e. intersecting pattern was found to be present predominantly followed by Type II branching pattern. Of 25 females, Type I – complete vertical pattern was found to be present predominantly, followed by Type III – intersecting pattern, then Type IV pattern [Graph 1].

The distribution of shape of the tongue is predominantly pentagonal followed by rectangular and ovoid in males, whereas it was mostly ovoid, followed by pentagonal and rectangular in females. Graph 2 represents pentagonal-shaped tongue of about 60% in males and ovoid of about 68% in females.

Graph 3 represents the tongue texture for both males and females. Physiological texture of tongue was more in common in males where 8% of males shows the presence of scrotal tongue, whereas in females, there were the presence of physiological tongue texture in all the participants.

Graph 4 represents the distribution of lingual apex in males and females. The lingual apex was blunt in most of the male participants, and it was sharp in most of the female participants. Hence, from this study, the lingual apex for males is predominantly blunt and it is sharp for females.

There was a statistically significant correlation found between the lip print and tongue shape and apex in both males and females with $P < 0.05$ [Tables 2 and 3].

The Type III lip print with the pentagonal shape tongue of $P = 0.009$ and the blunt apex with the $P = 0.003$ was found to be statistically significant in males.

The Type I lip print with the ovoid shape tongue of $P = 0.001$ and the sharp apex with the $P = 0.001$ was found to be statistically significant in females.

DISCUSSION

From time immemorial, human anatomy has undergone several phenomenal structural alterations, for example, the involution of the rudimentary organs such as the appendix, as well as evolution in the size, shape, and phenotype of the tooth. Therefore, every individual differs genetically by 0.001% that infuses the characteristic trait in him/her,

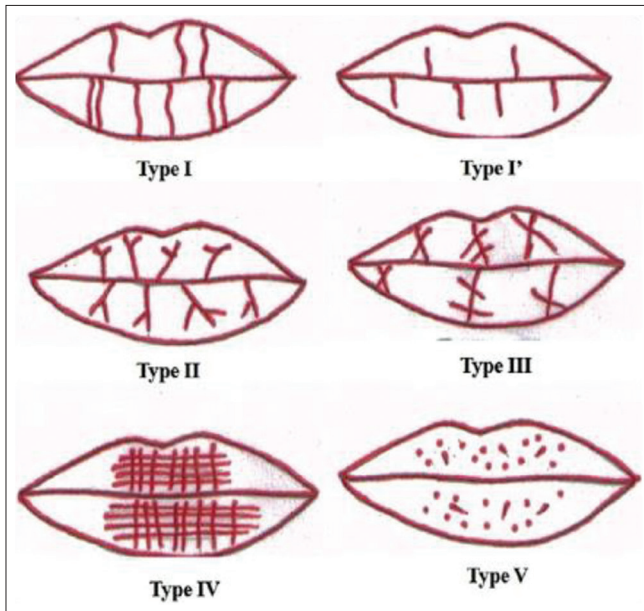


Figure 3: Classification of lip prints based on Suzuki and Tsuchihashi



Figure 4: Armamentarium used for taking tongue prints

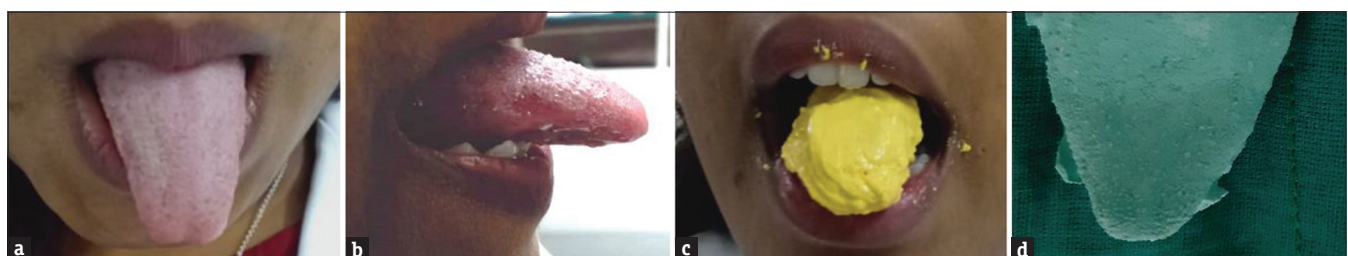
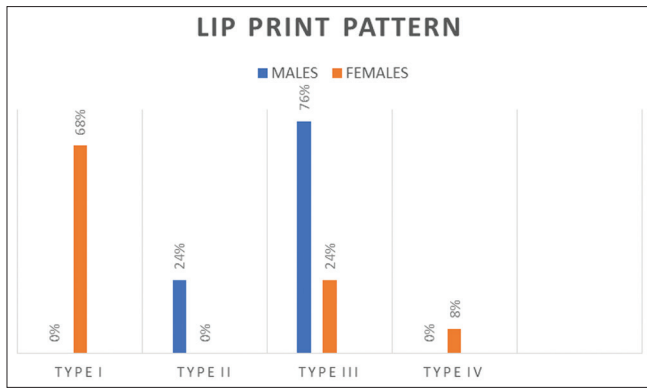
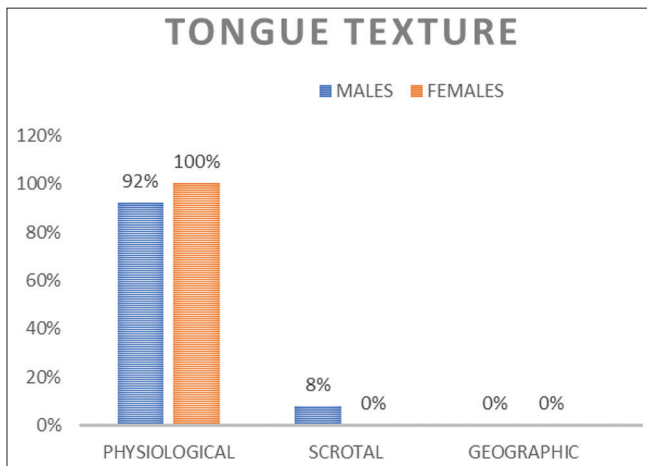


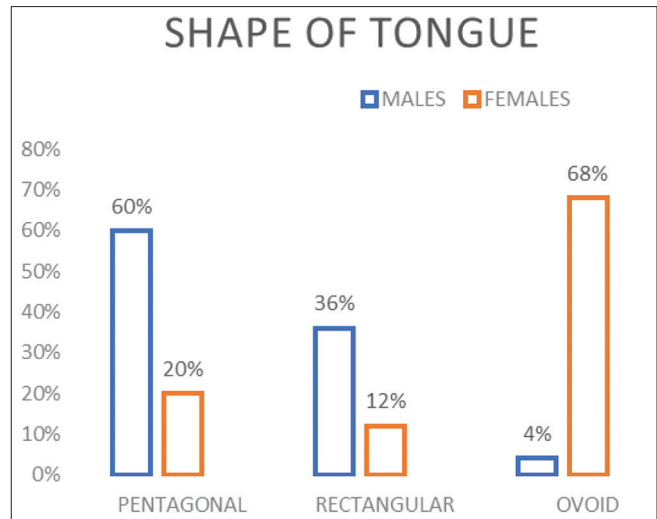
Figure 5: (a) Female subject, 23 years, examination of dorsum tongue; (b) Female participant, 22 years, examination of tongue edges; tongue aspects in physiological protraction; (c) applying alginate on the surface of the dorsum tongue from the level of the oral commissures up to the lingual tip including edges; (d) Class IV dental stone casting



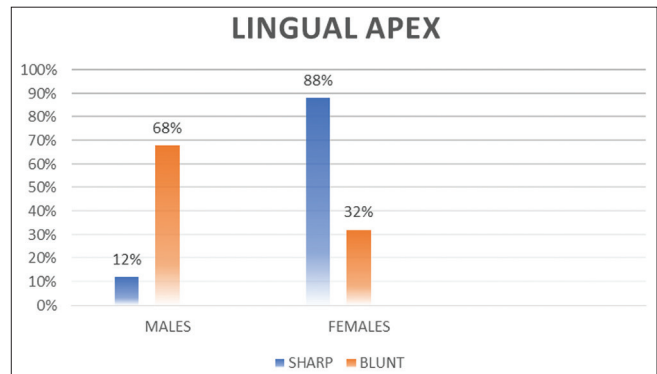
Graph 1: Distribution of lip print patterns among males and females



Graph 3: Distribution of tongue texture in males and females



Graph 2: Distribution of shape of tongue in males and females



Graph 4: Distribution of lingual apex in males and females

Table 1: Characteristics features of the tongue by Stefanescu et al.

Tongue texture	Shapes of tongue	Longitudinal grooves	Lingual apex
Physiological	Ovoid	Perceptible/impewrceptible	Sharp
Scrotal	Ellipsoid	Rectilinear/twisty	Blunt
Geographic	Rectangular Pentagonal Trapezoid to asymmetrical	Superficial/deep	

Table 2: Correlation of lip print and tongue apex in males

Correlation	P	χ^2
Lip print and tongue shape	0.009*	10.5
Lip print and tongue apex	0.003*	9.7

*Statistically significant

Table 3: Correlation of lip print and tongue print in females

Correlation	P	χ^2
Lip print and tongue shape	0.001*	14.4
Lip print and tongue apex	0.001*	13.7

*Statistically significant

this variation serves as a tool in human identification based on morphological traits.^[11] Various methodologies such as fingerprints, DNA analysis, dental profiling, and rugoscopy are

being employed currently.^[12] The quest for reliable, consistent, and specific technologies in the field of forensics is still in progress.^[13] The distinctive pattern of grooves and wrinkles in lips has made cheiloscopy a reliable procedure for antemortem personal identification.^[14] Lip prints can be recognized as early as the 6th week of the fetal stage and remain permanent, resisting environment changes, pathologies, minor traumas, and inflammation.^[15] The moisture from the oral cavity and the secretion of sebum from the sebaceous glands leads to latent lip print formation.^[16] These can be perceived as well discernible patterns on photographs, glass, papers, window, cutlery, cigarette, skin, etc.^[17] A number of chemicals and dyes, for example, Sudan black, lysochrome, carbonate powder, and Nile red are used to highlight these imprints so that they can be easily visualized and identified.^[18]

The study by Amita Negi in 2016 was to find the predominant lip and fingerprint patterns in males and females. The branched pattern in males and the vertical pattern in females were the predominant lip print patterns observed. No statistically significant correlation was found between lip prints and fingerprints. However, the arch type of fingerprint was found to be associated with different lip print patterns in males and females, whereas the lip print of intertwining pattern is more predominant in males and vertical pattern in females in our study.^[8]

The study by Shailesh Govindkar *et al.* in 2009 found that 67 of the actual 70 lip prints of females were correctly identified and 65 of the 70 males were correctly diagnosed as males. Type C (47.14%) was the most commonly occurring trend in females, whereas Type B (70%) was the most commonly occurring trend in males.^[19] Whereas in our study, Type 3 pattern in males and Type 1 pattern in females were the predominant lip patterns.

The study by Stefanescu intends to analyze lingual morphological aspects and demonstrates their importance and reliability as main criteria with force of evidence in using forensic dentistry to identify a person. They found that tip of the tongue in males is blunt, whereas sharp in females, geographic tongue was characteristic feature that was found to be predominant in females.^[7] In this study, the predominant type of tongue tip in male population was blunt, shape was pentagonal, and among the females, tongue tip was found to be sharp and the shape was ovoid. The presence of scrotal tongue is evident in males of about 8%.

As it is a single observer study, the intraobserver validation of recorded lip print and the tongue print patterns were done three times with the time interval of 7 days to avoid observer bias.

The tongue impression technique is little challenging procedure as the tongue is a muscular organ and it is difficult to protrude it in the same position for longer duration is difficult. Hence, further studies with photographic method in the evaluation of tongue morphology and larger sample sizes may lead us in a positive direction.

CONCLUSION

We can suggest that scrutinizing lip prints can serve as a prime tool in sex determination and criminal identification. The dorsal surface of the tongue provides significant details from a morphological and structural point of view and in differentiating peculiarities. The intersecting type of lip print pattern was found to be significantly associated with male participants, whereas females had the vertical lip print pattern predominantly. In case of tongue prints, the blunt lingual apex was predominant in males and sharp apex in females.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Acharya AB, Sivapathasundharam B. Forensic odontology.

In: Shafer's Textbook of Oral Pathology. 5th ed. India private limited, Elsevier: Reed Elsevier India Private Limited, Elsevier; 2006. p. 1199-27.

2. Whittaker DK. An introduction to forensic dentistry. Quintessence Int 1994;25:723-30.
3. Caldas IM, Magalhães T, Afonso A. Establishing identity using cheiloscopy and palatoscopy. Forensic Sci Int 2007;165:1-9.
4. Suzuki K, Tsuchihashi Y. New attempt of personal identification by means of lip print. J Indian Dent Assoc 1970;42:8-9.
5. Amith HV, Ankola AV, Nagesh L. Lip printscan it aid in individual identification. J Oral Health Community Dent 2011;5:113-8.
6. Musa OA, Elsheikh TE, Hassona ME. Tongues: Could they also be another fingerprint? Indian J Forensic Med Toxicol 2014;8:171-5.
7. Nagalaxmi V, Ugrappa S, Naga Jyothi M, Ch L, Maloth KN, Kodangal S. Cheiloscopy, palatoscopy and odontometrics in sex prediction and discrimination – A comparative study. Open Dent J 2015;8:269-79.
8. Negi A, Negi A. The connecting link! Lip prints and fingerprints. J Forensic Dent Sci 2016;8:177.
9. Gondivkar SM, Indurkar A, Degwekar S. Cheiloscopy for sex determination. J Forensic Dent Sci 2009;1:56-60.
10. Stefanescu CL, Popa MF, Candea LS. Preliminary study on the tonguebased forensic identification. Rom J Legal Med 2014;22:263-6.
11. Gopichand PV, Kaushal S, Kaur G. Personal identification using lip prints (cheiloscopy) – A study in 500 Punjabi females. J Indo Pac Acad Forensic Odontol 2010;1:20-2.
12. Abarnalingam D, Dinkar D, Shubhalakshmi D, Gem S. comparison of lip prints, rugae pattern and tongue print among Karnataka, Kerala and Tamil Nadu population - A short study. Int J Innov Sci Res Technol 2019;4:1182-7.
13. Zakirulla M, Meer A. Modern tools in forensic dentistry. Int J Cont Dent 2011;2:28-32.
14. Augustine J, Barpande SR, Tupkari JV. Cheiloscopy as an adjunct to forensic identification: A study of 600 individuals. J Forensic Odontostomatol 2008;26:44-52.
15. El Domiaty MA, Al-gaidi SA, Elayat AA, Safwat MD, Galal SA. Morphological patterns of lip prints in Saudi Arabia at Almadinah Almonawarah province. Forensic Sci Int 2010;200:9.e1-9.
16. Vats Y, Dhall JK, Kapoor A. Gender variation in morphological patterns of lip prints among some north Indian populations. J Forensic Dent Sci 2012;4:19-23.
17. Rastogi K, Parida A. Lip prints – An aid in identification. Aust J Forensic Sci 2011;1:1-8.
18. Castello A, Verdu F. Development on multicoloured surfaces, a problem resolved using fluorescent dyes. Indian J Forensic Med Toxicol 2006;4:1-5.
19. Ashok A, Thomas N. Comparative reliability of cheiloscopy and palatoscopy in human identification and sex determination: Among Kerala population. Int J Forensic Odontol 2020;5:11-8.