Medical and Research Publications
International Open Access

Research Article **Journal of Case Reports (Volume 7 Issue 3)**

Best of Three Techniques in Determining Gender

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Received Date: April 15, 2023

Published Date: May 01, 2023

Abstract

Aim:

To assess the reliability of odontometrics, Barr bodies identification from cytology smear and Rugoscopy in determining Gender of an individual and to find out the best of three techniques in determining Gender.

Materials and methods:

The study group includes 15 subjects of three age groups- less than 15 years (n=5), 18 to 25 years (n=5) and 50 to 65 years (n=5) from a Dental Hospital. Maxillary and mandibular impressions were taken and study casts were obtained. They were analysed for palatal rugae pattern, mandibular and maxillary canine index, and maxillary incisor index for gender determination. Saliva smears were taken, they were stained with Papanicolaou stain, to identify the Barr bodies. All the three methods were compared with each other to assess the reliability in gender determination.

Results:

Study findings reveal that odontometrics and rugoscopy were reliable methods for gender determination in young adults (18-25 years) but are not reliable in children (<15 years) and the elderly (>50 years). Hence, modification of existing odontometrics is needed for children and adults and further studies are needed for modifications and validation of existing techniques.

Introduction

The British Association for Forensic Odontology defined Forensic Odontology as Branch of forensic medicine and, in the interests of justice, deals with the proper examination, handling and presentation of dental evidence in a court of law. Forensic odontology is an investigative aspect of dentistry that analyses dental evidence for human identification. Apart from assisting in the identification of an individual, it reveals the age and gender of the same.**[**1**]**

Gender determination is a subdivision of forensic odontology and it is very important especially when information relating to the deceased is unavailable. Sex determination becomes the first priority in the process of identification of a person by a forensic investigator in the case of mishaps, chemical and nuclear bomb explosions, natural disasters crime investigations, and ethnic studies.**[**2**]** When bones are fragmented or burned, a proper choice is usually the teeth. Teeth are known as the most durable body components and can stand at high temperatures, air disasters, hurricanes, and decay for a duration much longer than other organs **[**3,4**]**

Classification of Methods used for gender Determination

- Visual method or clinical method
- Microscopic methods
- Advanced methods.

1. Visual method or clinical methods:

Differences between the sexes with respect to

a. Tooth size
b. Root length and crown diameter
c. Using canine dimorphism
d. Tooth morphology
e. Dental index
f. Odontometric differences.
g. Rugoscopy

2. Microscopic methods

   a. Sex determination using Barr bodies

3. Advanced methods

   a. Sex determination using Polymerase Chain Reaction (PCR)
   b. Sex determination using enamel protein1.

The Current study was conducted to assess the reliability of mandibular and maxillary canine index, maxillary incisor index, Rugoscopy and identification of Barr bodies in cytology smear in determining gender.

Materials and Method

The study includes sample size of 15 patients of three age groups from Dental Hospital

- Group 1 - Less than 15 years
- Group 2 - 25 to 50 years and
- Group 3 - 50 to 65 years.

Each group comprises of 5 patients.

The inclusion criteria include presence of all the anterior teeth and exclusion criteria include caries, filling, attrition, abrasion, erosion, abfraction, bruxism, crowding, dental/occlusal abnormalities, dental diseases, proximal stripping and history of orthodontic treatment.

Cytology smear:

Gender can be determined by the study of X and Y chromosomes in the cells which are not undergoing active division. Presence or absence of X chromosome can be studied from buccal smears, skin biopsy, blood, cartilage, hair root sheath, and tooth pulp. Deeply stained X chromatin and intra-nuclear structure in females is also known as Barr body as it was first discovered by Barr and Bertam.**[**5**]**

The buccal smears were taken from all the groups and was stained with Papanicolaou stain and visualised in microscope (100x) as basophilic structures in periphery of nuclei of the cell

Rugoscopy:

Trobo Hermosa, a Spanish investigator in 1932 first proposed on palatal rugoscopy. Palatal rugoscopy or rugoscopy is the study of the pattern on the palatal rugae to identify a person. It is stable and persists throughout life and used in forensic science for human identification.**[**6**]**

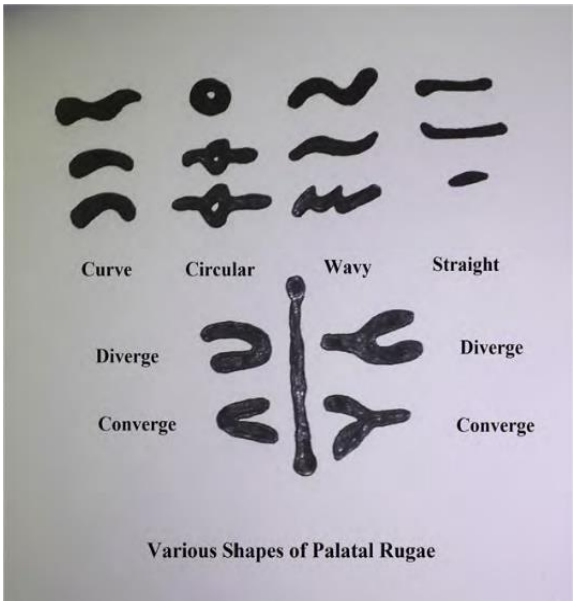
Dental impressions from all the three groups were made using irreversible hydrocolloid (alginate) impression material. Impressions were poured immediately with dental stone

Rugoscopy was done based on Thomas et al classification (1983) **[**6**]**

i) Based on length:

1. Primary - 5 to 10mm
2. Secondary - 3 to 5mm

ii)Based on shape:



1. Curved
2. Wavy
3. Stright
4. Circular
5. Divergent
6. Convergent

Odontometrics:

The mesiodistal (MD) and buccolingual(BL) diameters of all four canines and maxillary central incisors were measured by a Vernier calliper in the dental cast obtained from all the three groups.

1. Mandibular canine index (MCI): Rao et al 1986 **[**7**]**

$$\frac{\textbf{MD of mandibular canine}}{\textbf{Intercanine distance}}$$

The cut-off point, or standard mandibular canine index (MCI) value, obtained by Rao et al.**[**7**]** was 0.274. If the MCI value of a skull specimen is less than or equal to the standard MCI, the individual is categorized as female; a value more than the standard MCI would group the person as male.

2. Maxillary canine index (MACI): Zeinab Davoudmanesh et al 2017 **[**8**]**

12.67+ 2.08(MD of maxillary right canine)- 1.30(BL of maxillary right canine) + 0.9(BL of maxillary left canine)

If the MACI value is more than zero, the individual will be classified as male otherwise as female.

3. Maxillary Central Incisor Index (MCII) (Mohammed Nahidh 2014)

21.53 + 1.033(MD of maxillary right central incisor) +1.609(MD of maxillary right canine)

If the MCII value is more than zero, the individual will be classified as male otherwise as female

Result

- Cytology smear: out of 15 patients in all the three groups there were 9 male patients and 6 female patients. All the female patient's buccal smear showed Barr bodies and male patient's buccal smear showed no Barr bodies.
- Mandibular canine index, Maxillary canine index and maxillary central incisor index: In group I patients, out of 5, only for 3, the indices were correct, for the two female patients the indices result showed incorrect values (table1). In group II patients all the patient's indices showed correct values. In group III patients only 3 got correct values in all three indices. The reliability of all three indices in group I and III were 66.6% and in group II it was 100% reliable (table1, 2 and 3)

- Rugoscopy: Curved rugae pattern was predominant in both genders in all three groups. Convergence pattern was predominant in females and divergent in males in all the groups (table 4)

TABLE 1					
S. no	Age	Gender	MCI	MaxCI	MII
1	12	female	0.3214/male	1.19/male	0.06/male
2	13	male	0.30/male	1.17/male	2.76/male
3	14	female	0.28/male	-0.91/female	- 1.4/female
4	11	male	0.27/male	2.23/male	1.44/male
5	9	male	0.27/male	1.19/male	1.67/male

TABLE 2					
S. no	Age	Gender	MCI	MaxCI	MII
1	26	male	0.30/male	0.57/male	1.67/male
2	24	female	0.22/female	-7.92/female	-0.97/female
3	19	male	0.29/male	2.51/male	2.47/male
4	25	male	0.28/male	0.57/male	1.672/male
5	25	male	0.3092/male	1.83/male	1.443/male

TABLE 3					
S. no	Age	Gender	MCI	MaxCI	MII
1	50	female	0.3043/male	0.27/male	1.215/male
2	55	male	0.32/male	-1.05/female	-0.233/female
3	50	male	0.3076/male	0.77/male	0.394/male
4	55	female	0.25/female	3.77/male	2.24/male
5	56	female	0.26/female	-12.87/female	-0.394/female

RUGAE	MALE	FEMALE
PREDOMINANT PATTERN	CURVED	CURVED
TOTAL NUMBER	↑	↓
PRIMARY	↑	↓
SECONDARY	↓	↑
CONVERGENT	↓	↑
DIVERGENT	↑	↓

Table 4

Discussion

Sex determination using teeth is an inexpensive and easy method of gender identification from fragmented jaws and dental remains. In the present study PAP stain smears were analysed to view all the slides. Similar study was conducted by et al, who collected buccal smear for identification of Barr bodies **[**9**]**. Tibin Kaithappillil Baby, Priya Thomas,in their study used PAP stain to view Barr bodies10. Victor J Ekanem, Lilian E Chris-Ozoko, Peace O Abade used haematoxylin eosin stain and PAP stain and they analysed Barr bodies using Micrometrics SE Premium software**[**11**]**. In the present study the Barr bodies were seen only in female patients in all three age groups and were not seen in male patients.

The reliability of mandibular canine index, the maxillary canine index and maxillary central incisor index in group I and II was 66.6 % and in group II it was 100 % reliable. The overall percentage of reliability in all three indices in the present study is 73.3%. In a study conducted by Nair et al**[**12**]** in south Indian population the accuracy of mandibular canine index was 87% and a similar study conducted by S K Singh et al**[**13**]** using study cast in Indian population also got an accuracy of 85% which was close to Nair et al study.

Thomas and Kotze (1983) studied the rugae patterns of 6 South African populations to analyse the interracial difference. They found that rugae were unique to each ethnic group and that it can be used successfully as a medium for genetic research **[**15**]**. In this study the most common pattern in Rugoscopy in both male and female patient was curved pattern. The convergent pattern was more predominant in male than in female and the divergent pattern was more predominant in male than in female. This finding goes in accordance with Prahalad Gadicherla et al (2017) who in their study of palatal rugae found it valuable for sex identification in a Bengaluru population.**[**14**]**

Conclusion

Sex determination using teeth is an inexpensive and easy method of gender identification from fragmented jaws and dental remains. Study findings reveal that odontometrics and rugoscopy are reliable methods for gender determination in young adults (18-25 years) but are not reliable in children (<15 years) and elderly (>50 years). Hence, modification of existing odontometrics is needed for children and elderly and further studies are needed for modifications and validation of existing techniques. Barr body is reliable in all three groups. Rugoscopy can be used as an adjunct to the above two methods for gender determination.

References

1. Monali C, Pritam P, Tapan M, Kajal D. Gender determination: A view of forensic odontologist. Indian Journal of Forensic Medicine and Pathology. 2011 Oct;4(4):147-51.

2. Gupta B, Gupta M. Sex identification in forensic odontology-a review of various methodology. International Journal of Forensic Odontology. 2016 Jan 1;1(1):9.

3. Rastogi P, Jain A, Kotian S, Rastogi S. Sexual diamorphism-An odontometric approach. Anthropol 2013; 1: 2332-0915.

4. Al-Rifaiy MQ, Abdullah MA. Dimorphism of mandibular and maxillary canine teeth in establishing sex identity. Saudi Dent J 1997; 9: 17-20.

5. Barr ML, Bertram LF, Lindsay HA. The morphology of the nerve cell nucleus, according to sex. Anat Rec 1950; 107:283-97

6. Thomas CJ, van Wyk CW. The palatial rugae identification. J Forensic Odontostomatol 1988; 6:21-5

7. Rao NG, Rao NN, Pai ML, Kotian MS. Mandibular canine index - A clue for establishing sex identity. Forensic Sci Int 1989; 42:249-54.

8. Davoudmanesh Z, Shariati M, Azizi N, Yekaninejad S, Hozhabr H, Kadkhodaei-Oliadarani F. Sexual dimorphism in permanent canine teeth and formulas for sex determination. Biomedical Research. 2017 Mar 31;28(6):2773-7.

9. Dixon AD, Torr JB. Sex chromatin in oral smears. British Medical Journal. 1956 Oct 6;2(4996):799.

10. Baby TK, Thomas P, Palani J, Pillai RK, Ramakrishnan BP. Sex determination efficacy of Papanicolaou and acriflavine Schiff stains in buccal smears. Journal of forensic dental sciences. 2017 Jan;9(1):46.

11. Ekanem VJ, Chris-Ozoko LE, Abade PO. Cytological determination of condensed sex chromatin body in buccal smear and peripheral blood film using various nuclear staining techniques. Annals of Tropical Pathology. 2012 Dec 1;3(2):133.

12. Nair P, Rao BB, Annigeri RG. A study of tooth size, symmetry and sexual dimorphism. J Forensic Med Toxicol 1999; 16:10-3.

13. Singh SK, Gupta A, Padmavathi B, Kumar S, Roy S, Kumar A. Mandibular canine index: A reliable predictor for gender identification using study cast in Indian population. Indian Journal of Dental Research. 2015 Jul 1;26(4):396.

14. Gadicherla P, Saini D, Bhaskar M. Palatal rugae pattern: An aid for sex identification. Journal of forensic dental sciences. 2017 Jan;9(1):48

15. Thomas CJ, Kotze TJ. The palatal rugae pattern: A new classification. J Dent Assoc S Afr. 1983; 38:153