



OCCLUSAL RADIOGRAPH IN GENDER DETERMINATION- A HIDDEN TOOL

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ABSTRACT **Aim:** To evaluate the reliability of dental arch linear and angular measurements on occlusal radiographs and to assess the usefulness of occlusal radiographs in sex determination. **Materials and Methods:** A prospective study was conducted on 50 patients (25 males and 25 females) using occlusal radiographs with age ranging from 20 to 25 years. Standard occlusal radiographs were taken without any errors by intraoral dental X-ray machine with required ideal exposure parameters after taking due radiation protection and safety measures. The radiographs were carefully processed and the images obtained were traced for angular and linear measurements, attributing capital letters to the maxillary arch and small letters to the mandibular arch. The obtained data were analysed by ANOVA using SPSS Software Version 22.0 for statistical analysis using discriminate methods. **Results:** All the linear variables analysed by t test showed higher values in males than in females that were found statistically highly significant ($P < 0.001$) for gender differentiation. Angular measurement values have shown highly significant differences ($P < 0.004$) between males and females only in "CIX" L, "MIZ" L, "CIX" R, and "MIZ" R. **Conclusion:** The present study building upon previous studies conducted, provides evidence regarding the significance of occlusal radiograph in gender determination. It is an economical, quick and a reliable method.

KEYWORDS :

INTRODUCTION:

Forensic odontology is a branch of forensic medicine that in the interest of justice deals with dental evidence presented in the courts of law. Human identification is the foundation of civilization, and the unique features of teeth and jaws has been used since Roman times for identification of unknown individuals.^[1] Gender dimorphism represents a group of morphologic characteristics that discriminate gender of an individual. Gender assessment is given first priority in the process of identification of bodies mutilated beyond recognition.^[2] Skeletal remains have been used for determining gender and has proven to give accurate results when skeletal bones are complete. The incomplete or fractured skeletal remains renders the forensic expert confused, hence in such case teeth being the most enduring structure is an excellent piece of evidence for gender determination.^[3] The radiographic examination has long been used for routine examination, as well as in forensic science for identification. Various radiographic imaging modalities such as orthopantomography, skull views, and hand wrist, and occlusal are powerful tools in forensic science.^[4] The present study was conducted to evaluate the reliability of dental arch linear and angular measurements on occlusal radiograph in gender determination.

Materials and Methods

A prospective study was conducted using occlusal radiographs of 50 subjects (25 male and 25 female) with an age ranging from 20 to 25 years in the post graduate department of Oral Medicine and Radiology, Govt Dental College, Srinagar. Patients having complete dentition without any abnormality and "U" shaped palate were included and patients with attrited teeth, carious teeth, history of tooth extractions/missing tooth, and anatomical abnormalities in maxillary and mandibular dental arches were excluded from the study. Standard occlusal radiographs (50 maxillary and 50 mandibular) were taken on intraoral dental X-ray machine with required ideal exposure parameters after taking due radiation protection and safety measures. After following standard processing techniques, the images obtained were traced for angular and linear measurements, attributing capital letters to the maxillary arch and small letters to the mandibular arch. In maxilla, letter "L" indicates the left side and "R" indicates the right side and in mandible "r" and "l" for right and left respectively of the patient on occlusal radiograph. [FIGURE 1]

Angular measurements

The median line is drawn touching the vestibular area of the occlusal radiographic projections of the maxillary central incisors. The intersection of these points denoted as "I" point. From this point, another line was drawn toward the most vestibular portion of the canine tooth denoted as "C" point, and this line named as angular measure "IC". The angle formed by these two points and "X" point,

locating in the line that coincides with the union of the palatal processes of maxillary bone, i.e. medial line, named as "CIX". Following the same methodology, a line from "I" point to the most vestibular portion of the second pre-molar denoted as "P" point and second molar as "M" point were drawn and named as angular measure "IP" and "IM," respectively. The angle obtained by these two points ("IP" and "IM") and "Y" and "Z" points located in the line that coincides with the medial line of palate, called as "PIY" and "MIZ" respectively. Similarly, in mandibular arch, the angular measures abbreviated as "ic", "ip", and "im" and the angles formed by these two points, and "x" point, "y" point, and "z" point were abbreviated as "cix", "piy", and "miz". [FIGURE 2]

Linear Measurements

Measures related to the maxillary and mandibular dental arches width were made in three portions corresponding to the line drawn from the most vestibular portions of the left and right canines, second premolars and second molars named as IC, IP, and IM for maxillary arch and ic, ip, and im for mandibular arch with "I" and "i" indicating "inter" in maxilla and mandible respectively. [FIGURE 3] The obtained data were analysed by ANOVA using SPSS Software Version 22.0.

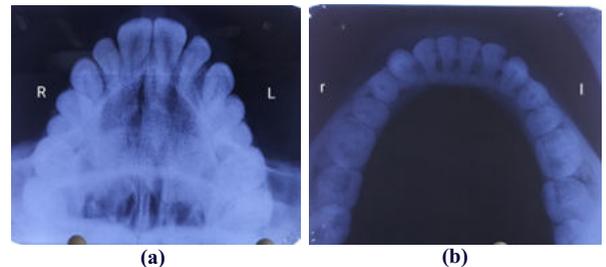


FIG 1: (a) Maxillary occlusal radiograph (b) Mandibular occlusal radiograph

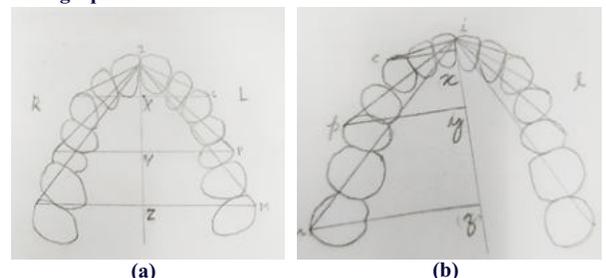


FIG 2: Diagrammatic representation of angular measurements (a) Maxillary (b) Mandibular

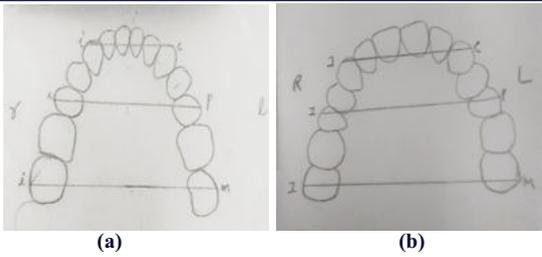


FIG 3: Diagrammatic presentation of linear measurements (a) Mandibular (b) Maxillary

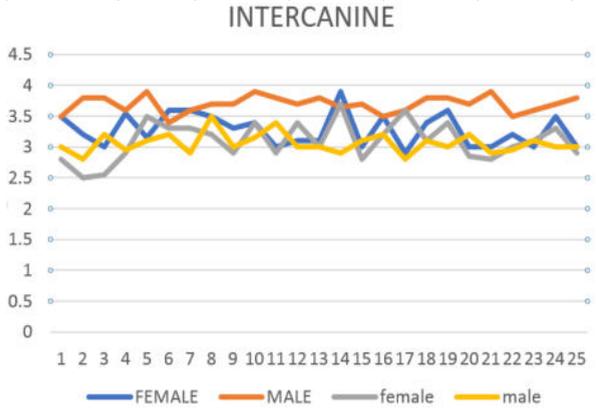
Mean obtained from linear measurements and angular measurements for males and females are exhibited in Tables 1 and 2, respectively. All the linear variables analysed by t test showed higher values in males than in females that were found statistically highly significant ($P < 0.001$) for gender differentiation [Table 1]. Angular measurement values have shown highly significant differences ($P < 0.004$) between males and females only in "CIX" L, "MIZ" L, "CIX" R, and "MIZ" R [Table 2].

Table 1: LINEAR MEASUREMENTS (cm)

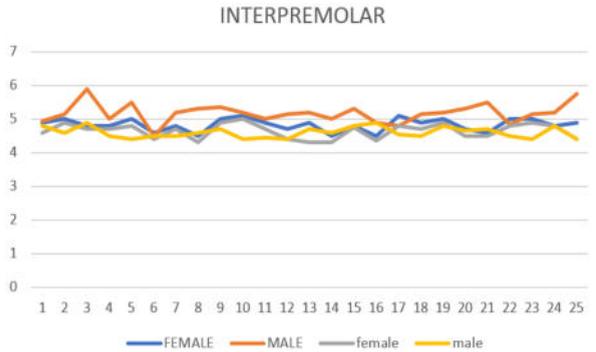
		IC	IP	IM	ic	ip	im
Male	Mean	3.698	5.18	6.414	3.058	4.602	6.122
Female	Mean	3.28	3.48	5.904	3.096	4.644	5.714
Results	p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 2: Presentation Of Angular Measurements

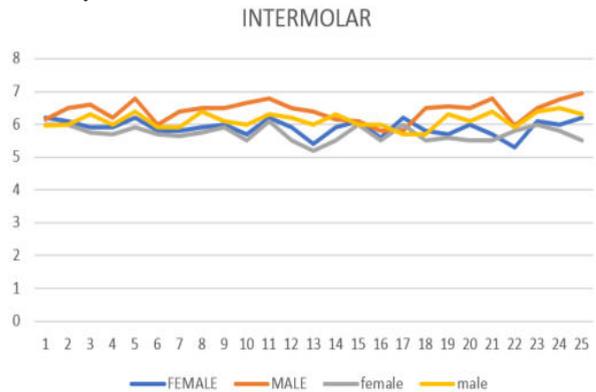
	CIX"R"	PIY"R"	MIZ"R"	CIX"L"	PIY"L"	MIZ"L"	cix"r"	piy"r"	Miz"r"	Cix"l"	Piy"l"	Miz"l"
MALE Mean	68.7	50.4	39.41	67.8	50.8	38.12	74.9	55.18	41.2	74.38	46.48	43.7
FEMALE mean	67.8	49.9	39.34	66.5	48.9	37.04	74.5	54.8	40.8	74.3	45.7	43.5
P value	<0.004	>0.004	<0.004	<0.004	>0.004	<0.004	>0.004	>0.004	>0.004	>0.004	>0.004	>0.004



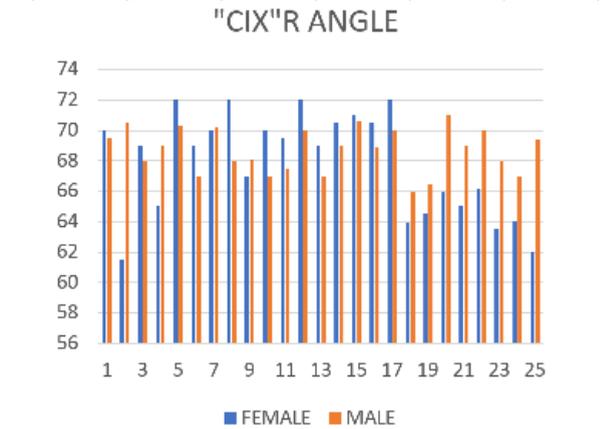
Graph 1: Depicting comparison of inter canine width in maxillary and mandibular arch in male and females



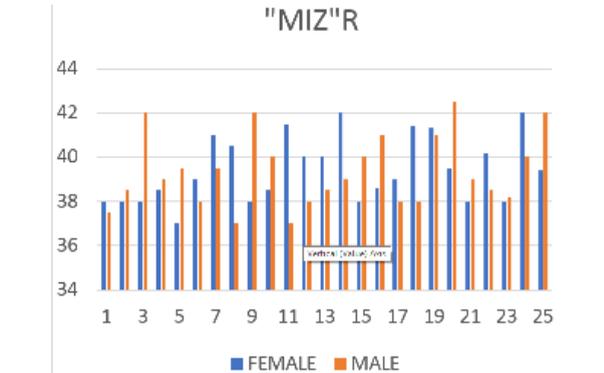
Graph 2: Depicting comparison of inter premolar width in maxillary and mandibular arch in male and females



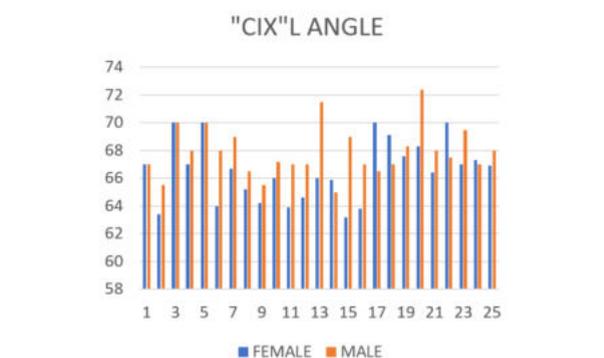
Graph 3: Depicting comparison of inter molar width in maxillary and mandibular arch in male and females



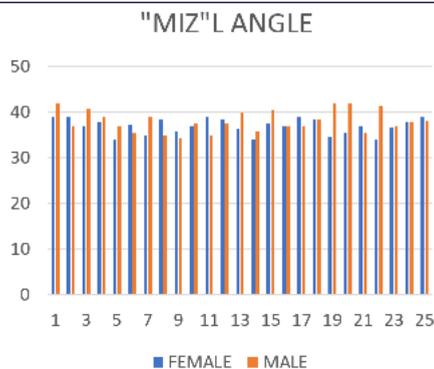
Graph 4: comparison of the "CIX" angle on the right side for male and female



Graph 5: comparison of the "MIZ" angle on the right side for male and female



Graph 6: comparison of the "CIX" angle on the left side for male and female



Graph 7: comparison of the "MIZ" angle on the left side for male and female

DISCUSSION

The main attributes of biological identity are age, sex, stature and ethnicity- the "Big Fours" in forensic context.^[5] Determination of sex using skeletal remains presents a great problem to forensic experts, especially when only fragments of the body are recovered. Forensic dentists can assist other experts to determine sex of the remains using teeth and skull. Various features of teeth, such as morphology, crown size, and root lengths, are characteristic for male and female sexes. There are also differences in the skull patterns. These will help a forensic odontologist to identify the sex.^[2] It has been reported that 100% accuracy can be achieved in gender determination from skeleton, 98.0% from both pelvis and skull, 95.0% from pelvis only or the pelvis and long bones, 90.0–95.0% from both the skull and the long bones, and 80.0–90.0% from the long bones only.^{[6][7]} A study by Anderson and Thompson in 1973^[8] showed that mandibular canine width and inter-canine distance was greater in males than in females and permitted accurate differentiation between the sexes in 74% of cases.

In recent times, gender dimorphism have been studied with various metric parameters and are found advantageous and reliable in distinguishing gender dimorphism among different populations.^[9] According to Merz, there was no significant differences between genders and concluded that synergic study of tooth size and arch shape might contribute to gender dimorphism.^[10] In the present study the metric parameters have shown a great significance in determining gender; all linear parameters are found highly significant and angular parameters "CIX"R, "MIZ"R, "CIX"L and "MIZ"L are found highly significant as well. This is in accordance with results of study conducted by Maloth et al^[4], Santos LF et al^[11], Leticia et al^[12], Sathawane RS et al^[13].

Santos LF et al.^[11] conducted a study on 50 Brazilian population and concluded that odontology can be used in gender determination. It is a simple, quick and accurate technique for gender determination, which is always population-specific, allowing gender determination through occlusal radiographs, highlighting the obtained linear values.

Maloth et al.^[4] conducted a study on 50 Indian population (25 male and 25 female), analysing dental arch using linear and angular metrics to determine gender and concluded that it is a simple, quick, economical, and valid technique for gender determination.

Leticia et al.^[12], Sathawane RS et al^[13] conducted studies on Brazilian population and Indian population and found highly significant linear measurements and only two angular measurements "CIX"L and "MIZ"L as significant. In the present study, however additionally "CIX"R and "MIZ"R have been found significant.

Dental arch linear and angular parameters can be used in determining gender of individual. It is an economical, quick and a reliable method. Limited sample size and the lack of means to measure the morphologically altered teeth structure, developmentally altered, missing/ extracted tooth are the limitations of present study.

CONCLUSION

The present study building upon previous studies conducted, provides evidence regarding the significance of occlusal radiograph in gender determination. It can be concluded that occlusal radiograph is indeed an economical, quick and a reliable method for gender determination.

REFERENCES

1. Study of odontometric parameters in gender identification Pagare N, Chourasiya S, Dedhia HAustin journal of forensic science and criminology.
2. Gupta B, Gupta M. Sex identification in forensic odontology- a review of various methodology. Int J Forensic Odontology 2016;1:9-13.
3. Gender Determination by Forensic Odontologist: A Review of various methods Siritra Ndapandula Kalistu, Dr. Nagabhashana Doggalli IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861
4. Maloth KN, Reddy KV, Anusha NV, Sumitha K, Saraswathi C, Iraganaboina RC. Occlusal radiograph a hidden tool for sex determination: A radiographic study. J Indian Acad Oral Med Radiol 2019;31:155-8.
5. Rogers TL. Determination of sex of human remains through cranial morphology. J Forensic Sci. 2005;50(3):493-500.
6. Günay Y, Altinkök M, Çağdır S, Sari H. Is foremen magnum size useful for gender determination (in Turkish) Bull Legal Med. 1998;3:41–5
7. Krogman WM, Iscan MY. 2nd ed. Springfield, IL: Charles Thomas Publisher; 1986. The Human Skeleton in Forensic Medicine; pp. 189–243.
8. Anderson DL, Thompson GW. Inter relationships and sex differences of dental and skeletal measurements. J. Dent. Res. 1973;52: 431–438.
9. Camps FE. Gradwohl's legal medicine. 3rd ed. Wright and Son: Bristol John; 1976.
10. Merz ML. Tooth diameters and arch perimeters in a black and white population. Am J OrthodDentofacOrthop 1991;100:53-8
11. Santos LF, Galo R, Alves da Silva RH. Gender evaluation in human beings by occlusal radiographs. Braz J OralSci 2015;14:23-6
12. Leticia Ferreira dos Santos, Rodrigo Galo, Ricardo Henrique Alves da Silva. Gender evaluation in human beings by occlusal radiographs. Braz. J. Oral. Sci. 2015;14(1):23-26.
13. Sathawane RS, Tripathi K. Determination of gender from occlusal radiographic measurements. IP Int J MaxillofacImag 2017;3:92-4.