

Original article:

Comparative evaluation of sex with shape of the Dental arch and hard palate: Surgical implications

***Gore Pratibha G¹, Thorat Pravin S², Kulkarni Meena M³**

¹ Sr. Lecturer, ³ HOD & Professor. Department of Oral and Maxillofacial Pathology & Microbiology. Rural Dental College, PIMS, Loni.

² Associate Professor. Department of Anaesthesiology & Critical Care. Rural Medical College, PIMS, Loni.

*Corresponding author: Dr. Pratibha Gore, Sr. Lecturer, Department of Oral and Maxillofacial Pathology & Microbiology, Rural Dental College, PIMS, Loni.

Abstract

Aim: To compare the sex dimorphism with shape of the Dental arch and dimensions of the Hard palate.

Objectives: The present study was conducted to find out the correlation between the sex and shape of the dental arch and dimensions of the hard palate among the rural population of Rahata Taluka in Ahmednagar district (Maharashtra).

Materials and Methods: This prospective cross sectional study was conducted among 200 subjects, in which 100 males and 100 females were selected by simple random sampling method. Subjects selected were with full complement of maxillary teeth in the age range of 15-65 years.

Results: Statistical analysis was done by applying 'Z' test of difference, at 5% (p, 0.05) and 1% (p, 0.01) level of significance. Closed 'U' shaped palate in males and 'U+V' in females was predominant and that was statistically significant. Width of palate was more in males (42.96mm) than in females (36.06mm) and was statistically significant.

Conclusion: There was significant correlation between sex dimorphism, shape of the dental arch and dimensions of the hard palate. These parameters can be used as important parameter for gender identification in forensic science. It is also useful in various surgical impactions.

Key words: Sex dimorphism, Dental arch, Hard palate, Forensic science.

Introduction

The word forensic, states Clark, is derived from the Latin "*forensic*", which means 'before forum'. Forensic dentistry or forensic odontology, therefore, has been defined by the Federation Dentaire Internationale (FDI) as 'that branch of dentistry which, in the interest of justice, deals with the proper handling and examination of dental evidence, and with the proper evaluation and presentation of dental findings' ⁽¹⁾. The identification of an unknown individual has always been of paramount importance in forensic odontology. Human identification is based

on scientific principles mainly involving dental records fingerprints and DNA comparisons. Sex determination from human skeletal remains is a subject of continuous investigation in the field of physical anthropology, as it is particularly critical for the purpose of human identification.

The word dimorphism comes from the etymology 'Dimorphos' (Latin) ⁽²⁾.

By definition dimorphism means occurring in two different forms. "Sexual dimorphism" refers to those, difference in size, structure and appearance between male and female that can be applied to

dental identification⁽³⁾. Sex determination from bones in forensic cases has limited success as the bones are available in fragments. The skull is probably the second best area of the skeleton for determining sex following pelvis. The skull measurements vary significantly in different ethnic groups and the discrimination models for Indian populations are rare. Nature has made each and every individual different in his or her own way and personal identification is the proof. Forensic odontology involves dentist's participation in assisting legal and criminal issues⁽⁴⁾. Establishing a person's identity can be a difficult task in cases of traffic accidents or acts of terrorism or in mass disaster situations.⁽⁵⁾ The skull is a very important source of information regarding an individual's identity. Sex is determined on the basis of 20 craniofacial features. Palate is one of the important structure. The male palate is large and broad. Hard palate is preserved even in severe damages to skull, hence appropriate for studying sexual dimorphism.

With this background, the present study was intended to observe the various shapes and measure the dimensions of the dental arch and hard palate in both genders belonging to rural population of Rahata Taluka, Ahmednagar district (Maharashtra), in order to evaluate sexual dimorphism if any in the selected population. The results of the study can be applied in forensic scenarios in and around Ahmednagar district whenever the need arises.

Materials and methods

The present prospective cross sectional study was conducted in the department of oral pathology & microbiology, Rural Dental College, Loni. The study population was selected from the patients attending the various departments of the Rural Dental College Loni. Total of 200 subjects, 100 males and 100

females (n=100) in the age group of 15 – 65 years were selected randomly. This study was conducted after obtaining institutional ethical committee clearance and informed written consent from the subjects.

Inclusion criteria:

Subjects with full dentulous arch with good periodontal status and having no systemic disease belonging to Rahata population were included in the study.

Exclusion criteria:

Subjects with any congenital anomalies of the palate, previous orthognathic surgery, allergic to impression materials, bony or soft tissue protuberances on the palate, any active lesion, deformity, scars or trauma to palate and subjects who were wearing partial & fixed dentures and braces were excluded.

For all such selected study subjects, maxillary alginate impression was made and poured with dental stone. A plaster of Paris base was made and casts were preserved for the interpretation. Examination of the dental arch & palate (shape & dimensions) was done taking into considerations following parameters⁽⁶⁾.

1. Shape of the dental arch & palate categorized as U/ U+V/ V.

This was recorded by visualizing the palate. (Figure.1)

2. Dimensions of the dental arch & palate:

A divider with an adjustable screw and measuring scale were used to measure the dimensions of the dental arch and hard palate.

- a) Width: A line joining the tips of mesiopalatal cusp of the first permanent molars(MP6 – MP6);(a-b). Distance from

the point a to b was measured using metallic divider with adjustable screw and metallic scale. (Figure.2)

- b) Depth: Median palatal raphe in relation to maxillary first permanent molar(MP6) and the same intercuspal line for the width is used to project a point below & perpendicular to it on the median palatal raphe(MR6). $MP6-MR6 = a-c$ & $b-c$; Right &

left respectively. (Figure.3)

- c) Center: This is the perpendicular distance between the line MP6 to MP6 (a-b) & the point MR6 (d-c).The scale was kept parallel to the occlusal plane with reference to point a to b. Then mid point of this line a-b(d) and mid point on the palatal raphe (c) was marked.(Figure.4)

Sr. no	Cast no	Shape (U/U+V,V)	Width (mm)	Depth (mm)	Center(mm)

Method of data collection:

The study analysis of the shape and dimensions of the dental arch and hard palate was done by four observers which included one PI [One primary investigator(PI) and three other observers]. These three observers were classified as Co-PI. The analysis of data was done by considering average of these four experimenters. This was done to avoid the errors/difficulties during rugae analysis and to maintain the accuracy in analysis of rugae.

Statistical analysis:

Statistical analysis done by descriptive statistics as means, SD, percentage etc. “Z” test of difference between two sample means was applied at 5% (p,0.05) and 1%(p,0.01) level of significance. Two – way analysis of variance (ANOVA) test and Tukey-Kramer multiple comparison test was applied to compare variables. Statistical software SYSTAT version- 12 was applied.

Results

Total 200 subjects equally distributed sexwise in the age range of 15-65 years were included in this study.The mean age of male subjects was 32.92 years and the mean age of female subjects was 28.73 years. Maximum numbers of subjects were in the age group of 15- 25 years. Out of which 43 were males and 62 were females. Minimum numbers of subjects were in the age group of 46- 55 years. Out of which 8 were males and 6 were females.

In males 66% cases showed closed ‘U’ shaped palate. By applying the Z test of difference between two means the shape of palate was significant for type U (closed shaped) in males (p<0.05).In females 56% cases showed closed ‘U+V’ shaped palate, By applying the “Z” test of difference between two means, the shape of palate was significant for the U+V (parabolic) shaped in females (i.e.p<0.05).

In males mean value of width of palate was found 42.96 mm(SD ±3.23).In females mean value of width of palate was 36.06 mm (SD ±2.99).By

applying the Z test of difference between the mean values of dimensions, there is significant difference in the width of the palate in males and females. ($p < 0.05$)

In males mean value of depth of palate was found 28.44 mm (SD ± 2.54). In females mean value of depth of palate was found 27.66 mm (SD ± 3.01). In males mean value of center of palate was found 21.0 mm (SD ± 2.08). In

females mean value of center of palate was found 20.69 mm (SD ± 2.35).

No significant difference was found for the depth and center of the dental arch and palate when compared in males and females.

Overall, mean value for size of the palate in males was 30.8mm (SD ± 2.61) and for females 28.01mm (SD ± 2.78)

Table No.1: Age and sex wise distribution:

Sr no.	Age groups(years)	Male	Female
1	15-25	43	62
2	26-35	28	13
3	36-45	09	11
4	46-55	09	06
5	56-65	12	08
6	Total	100	100
		32.92 \pm 14.84 (Mean \pm SD)	28.73 \pm 12.78 (Mean \pm SD)

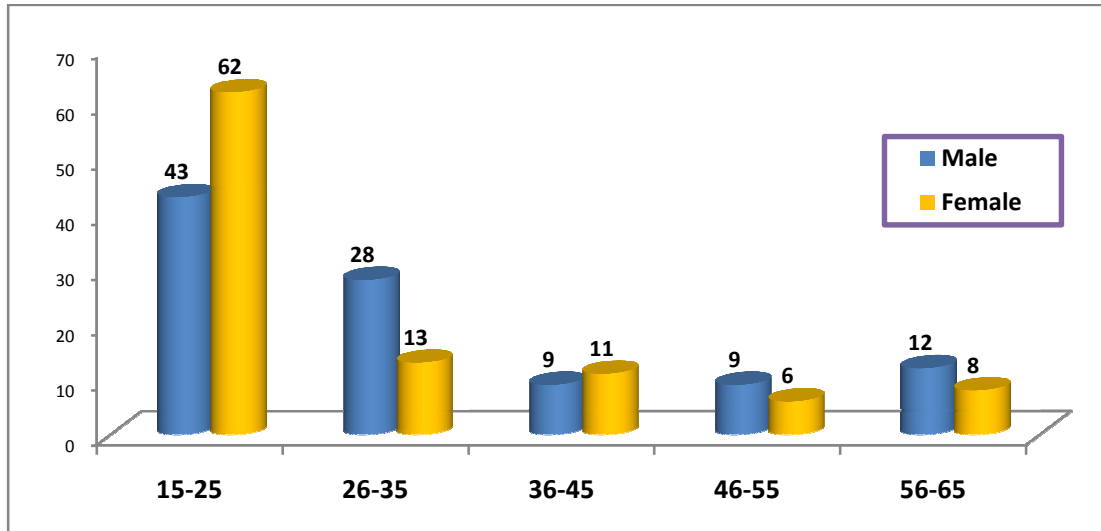
Table No.2 :Distribution of cases depending on shape of dental arch and palate.

Shape of palate	Male (n=100)	Female (n=100)	'p' value and Result
U(closed)	66	28	0.0017, significant
V	14	16	
U+V(parabolic)	20	56	0.0025, significant

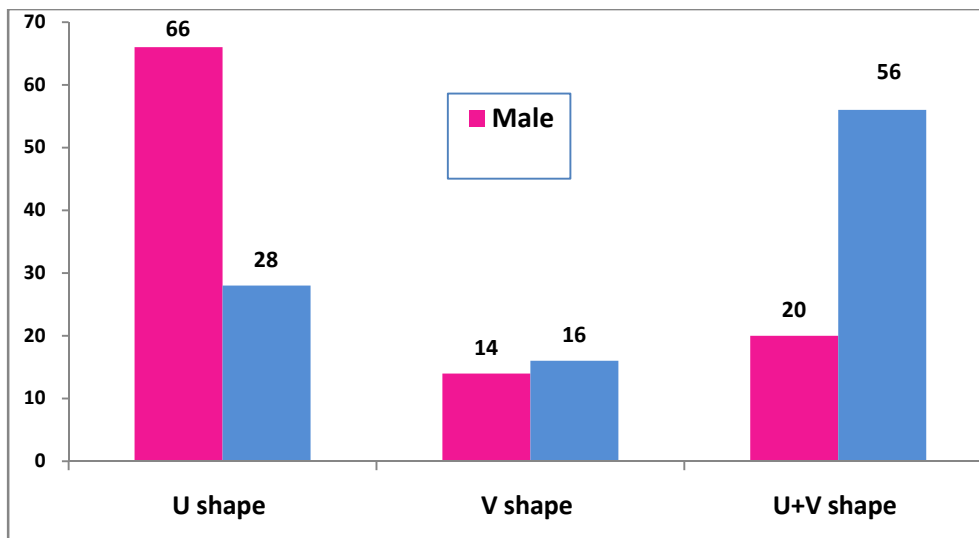
Table No.3: Dimensions of the dental arch & palate (mm):

Dimensions of the dental arch & palate (mm)	Male (n=100)	Female (n=100)	'p' value and Result
Width	42.96±3.23	36.06±2.99	0.0023, significant
Depth	28.44±2.54	27.66±3.01	0.124, not significant
Center	21.0±2.08	20.69±2.35	0.221, not significant

Graph No.1: Age and sex wise distribution



Graph No.2: Distribution of cases depending on shape of dental arch and palate



Graph No.3: Dimensions of the dental arch & palate (mm)

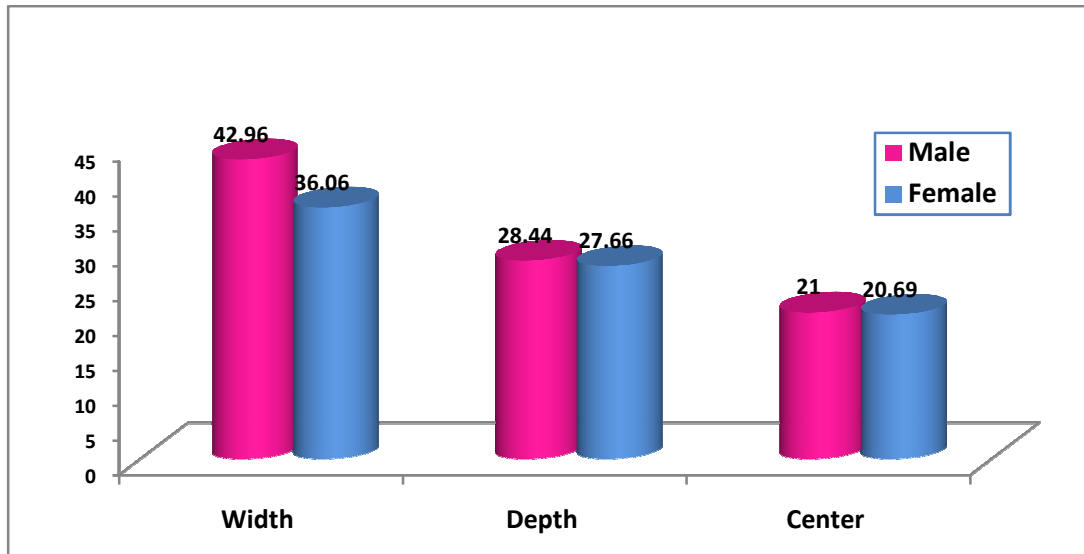
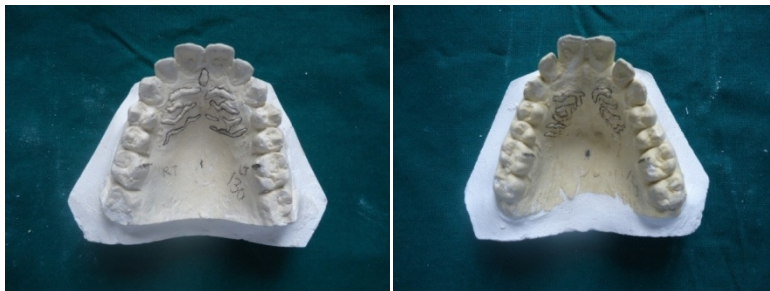


Figure. 1 Various shapes of hard palate



U Shaped



U+V Shaped

V Shape



Figure.2 Measurement of the Width of dental arch and hard palate



Figure.3 Measurement of the depth of dental arch and ha



Figure.4 Measurement of the center of dental arch and hard palate.

Discussion

Establishing a person's identity can be a difficult task in cases of traffic accidents or acts of terrorism or in mass disaster situations. As Morlang has stated, fingerprints have long been the standard for identification, but this form of identification is not possible if there are no ante mortem records. Also, postmortem fingerprints are often unavailable, especially in cases involving fire, decomposition, and massive trauma. Nature has made each and every individual different in his or her own way and personal identification is the proof.⁽⁵⁾

The present study was an attempt to evaluate the shape of dental arch and dimensions of the hard palate in the rural population of Rahata Taluka in Ahmednagar district (Maharashtra). Study was carried out to find out the variations in the shape of the dental arch, and dimensions of the hard palate and also to evaluate the sex dimorphism in the males and females of the selected rural population.

In this study mean age of male subjects was 32.92 years and the mean age of female subjects was 28.73 years. Maximum number of subjects were in the age group of 15- 25 years (Table 1). Selected population in the study showed predominantly closed 'U' shaped palate in 66% male subjects and it was statistically significant. 20% males had 'U+V' shape of palate while only 14 % males had 'V' shaped palate. In females, 56% cases showed closed 'U+V' shaped palate, that was statistically significant. In the present study 28% females showed 'U' shape of palate while only 16 % females showed 'V' shaped palate (Table 2). Suazo et al (2008)⁽⁷⁾ in his study concluded the accuracy of diagnosis of sex using the shape of hard palate. The findings of our study was in accordance with the study conducted by Suazo et al, where males had predominantly closed U -

shaped with more length and breadth of palate than females. Females showed parabolic shape which is narrow and shorter palate than the male skull.

The present study showed mean value for width of palate, 42.96 mm (SD ± 3.23) in males and 36.06 mm (SD ± 2.99) in females. There was statistically significant difference in mean values of width of palate when compared in between males and females. (Table 3). Manmohan Patel (2012)⁽⁸⁾ in his study found the average value of maximum palatal width for male cases and female cases 37.17 (± 2.88) mm and 35.50 (± 3.07) mm respectively. Findings of our study were close to their study. Values of the width of the palate was statistically significant when compared between males and females.

In our study, the mean value of depth of palate was found 28.44 mm (SD ± 2.54) in males and 27.66 mm (SD ± 3.01) in females. The mean value of center of palate was found 21.0 mm (SD ± 2.08) and in females 20.69 mm. (SD ± 2.35). No significant difference was found for the depth and center of the dental arch and palate when compared between males and females. (Table 3). Overall mean value of size of palate was more in males (30.8) as compared to females (28.03). The difference between the mean values was statistically significant. (Table 3). This was in accordance with the study conducted by Sumati, Patnaik V. V. G. and Ajay Phatak (2012)⁽⁹⁾. They showed the mean value of size of palate was more in males (31.15) as compared to females (27.86). The difference between the mean values was statistically significant. This was also in consonance with the results of Woo (1949) and Larnach and Freedman (1964) and Larnach and Macintosh (1966 and 1970) who concluded that the size of palate is important variable for sex determination from skulls⁽⁹⁾.

Forensic science has achieved giant strides in recent times and the use of dimensions of the dental arch and hard palate has gained prominence over several decades. From this study conducted in the rural population of Maharashtra it was analysed that the

shape and dimensions of the Dental arch and Hard palate can be used as important parameter for gender identification in forensic science. It is also useful in various surgical impactions.

References

- 1) Acharya AB, Sivapathasundharam B. Forensic Odontology. In Rajendran R, Shivpathisundaram B. Editors. Shafer's Text book of oral pathology. 5th edition. Elsevier: New Delhi; 2006. P.1199-1227.
- 2) Tabers Cyclopedic Medical Dictionary. 16th edition, Jaypee Pub, New Delhi, India 1990.
- 3) Hemani S, Balachander N, Kumar AR, K Ranjan. Dental dimorphism in ethnics of Tamil Nadu: Aid in Forensic identification. J Forensic Odontology 2008; 1:37- 45.
- 4) Indira A P, Manish G, Maria P D Rugoscopy for establishing individuality. Ind JDA, 2011;3(1):427-432.
- 5) Kamala R, Neha Gupta, Amol Bansal, Abhishek Sinha. Palatal Rugae Pattern For Aid In Personal Identification: A Forensic Study Journal of Indian Academy of Oral Medicine and Radiology .2011;23(3):173-178.
- 6) Patil MS, Patil SB, Acharya AB. Palatine rugae and their significance in clinical dentistry: A review of the literature. J Am Dent Assoc 2008; 139:1471-1478.
- 7) Suazo, G. I. C.; Zavando, M. D. A. & Smith, R. L. Accuracy of palate shape as sex indicator in human skull with maxillary teeth loss. Int. J. Morphol., 26(4):989-993, 2008.
- 8) Manmohan patel. A study of the hard palate in the skulls of central indian population. International Journal Of Pharma And Bio-Sciences. June 2012;3(2) :B-727-533.
- 9) Sumati I, Patnaik V. V. G. And Ajay Phatak . Determination of sex from hard palate by discriminant function analysis. International Journal of Basic And Applied. Medical Sciences 2012; 2 (3):243-251.