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Sex determination using palatal arch width in Chhattisgarh population

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Abstract

Aim: To determine the palatal arch width across premolar and molar region and compare the obtained values between male and female.

Materials and Method: Arch width of 100 maxillary casts (50 male & 50 female) were measured at the premolar and molar region with the help of digital verniar caliper and were compared.

Results: Arch width at premolar and molar region were significantly more in males as compared to females.

Conclusion: Palatal arch width measurement can be used as a valuable tool in sex determination in forensic investigations.

Keywords: Forensic, Palatal Arch Width, Sex Determination.

Introduction

Forensic odontology is an investigative aspect of dentistry that analyzes dental evidence for human identification. Forensic odontology plays an important role in establishing sex, age, and race of victims. Many times, determination of sex / gender using skeletal remains presents a great problem to forensic experts, especially when only fragments of body are recovered. Forensic odontologist can assist other experts to determine sex of the remains by using teeth and skull traits. Various features of teeth, like morphology, crown size, root length etc. are, characteristics differentiating male and female sexes. There are also differences in skull pattern and skull traits of two sexes.[1]

The use of morphological features of the skull and mandible is a common approach used by the anthropologists in sexing. A number of features are known to show variation between the sexes. Williams and Rogers found that sex could be predicted correctly in 96% of cases using different features of skull and mandible.[2]

In the clinical dental field, arch size and shape are of particular interest to orthodontists and prosthodontists. In the anthropologic field, studies on dental arches have been conducted directly or indirectly. Direct methods involved measurements. Various landmarks have been described and discussed by different investigators, but universal agreement on how dental arch width should be determined has not been reached.[3]

Materials and method:

For this study 100 (50 male and 50 female) maxillary casts were obtained.

Inclusion criteria: age group from 17-25 years with well aligned arch or mild spacing

Exclusion criteria: crowding or narrow arch

Method: Arch width was measured at premolar and molar region. A digital verniar caliper, accurate to with in ±0.02mm were used to carry all manual measurements. Width at the premolar region was measured from the distal pit of one upper first premolar to the distal pit of the opposite first premolar with the pointed ends of the vernier caliper. Width at the molar region was measured from the mesial pit of one upper first molar to the mesial pit of the opposite first molar (figure 1 and 2).

Results

Data obtained was analysed and following results were obtained

Arch width at premolar and molar region were significantly more in males as compared to females.

Graph 1 shows the difference in the value between male and female in the premolar region. Mean premolar width for males was 40.14 ±2.75 and for female it was 36.39±2.51. Using Z-test for difference between two means, statistically significant difference was found in mean premolar width of male and female(z=7.11,p-value=0.000) (table 1). Percentage of sexual dimorphism was higher 10.32.

Graph 2 shows the difference in the value in the molar region. Mean molar width for males was 49.26 ±3.13 and for female it was 44.49±2.92. Using Z-test for difference between two means statistically significant difference was found in mean molar width of male and female(z=7.86,p-value=0.000)(table 2). Percentage of sexual dimorphism was higher 10.72. Standard value was calculated for both premolar and molar arch width. Any value above was considered as male and any value below was considered as female. The standard value for premolar arch width was 38.14 and accuracy of sex determination for male was 76% and for female was 72%. The standard value for molar arch width was 46.77 and accuracy of sex determination for male was 70% and for female was 68%.

Discussion

Forensic odontology is an investigative aspect of dentistry that analyzes dental evidence for human identification. Forensic odontology plays an important role in establishing sex, age, and race of victims. Many times, determination of sex / gender using skeletal remains presents a great problem to forensic experts, especially when only fragments of body are recovered. Forensic odontologist can assist other experts to determine sex of the remains by using teeth and skull traits. Various features of teeth, like morphology, crown size, root length etc are, characteristics differentiating male and female sexes. There are also differences in skull pattern and skull traits of two sexes.[1]

Comparisons of data on dental arch dimensions from different studies are hampered by the fact that it is not easy to tabulate all data on different landmarks. Moreover, different authors chose different sample groups for measurement. It has also been shown that individual dental arch dimensions change with age.[4] Various landmarks have been described and discussed by different investigators, but universal agreement on how dental arch width should be determined has not been reached. Most studies used the dimension of the arch across the permanent canines, premolars, and first molars, at the cusp tips, central fossae, or contact points, or the greatest distance between buccal surfaces.[3] In this study we used two

landmarks that is the distal pit of the first upper premolar and the mesial pit of the first upper molar as we use in the Pont's analysis.[5]

Ling et al in 2009 investigated the dental arch width of the Southern Chinese across buccal cusps, central fossae, or lingual cusps and found that all maxillary and mandibular male arch widths were significantly larger than female arch widths, except at the incisor regions.[3] In 1970 Riquelme and Green used the measurement between molars at cervical aspect of mesiolingual cusps at the junction if tooth and gingival margins to differentiate between the monozygotic and dizygotic twins.[6] In 1985 Laine conducted study to investigate correlations among different dimensions of the alveolar arch in maxilla and mandible and to determine the relationship between alveolar arch dimensions and occlusal traits in males and females, but no statistical difference was found.[7]In 2008 Petrecevic et al found that the distal maxillary arch width was significantly larger in men than females.[8]

Conclusion

Forensic odontologist assists in determination of gender where skeletal remains present a great problem to forensic experts, especially when only fragments of body are recovered. Thus, forensic odontologist plays a key role in identifying the gender. Palatal arch width measurement can be used as a valuable tool in sex determination in forensic investigations.

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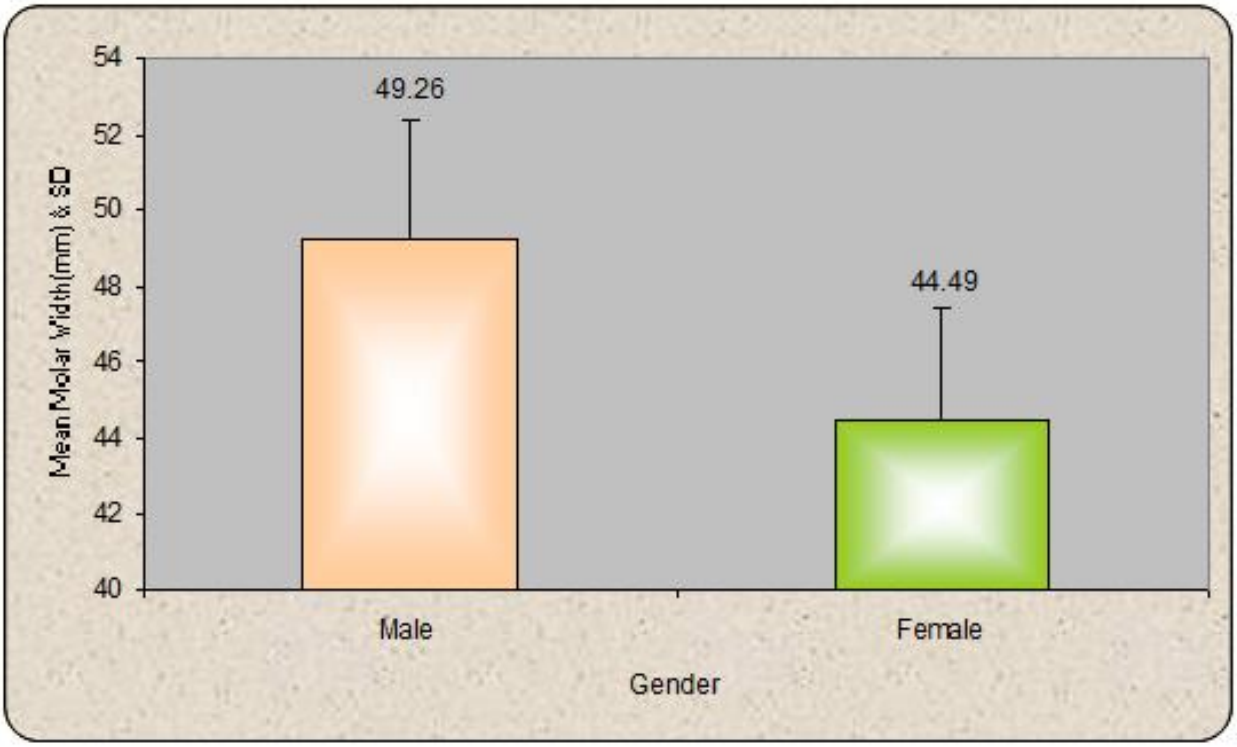
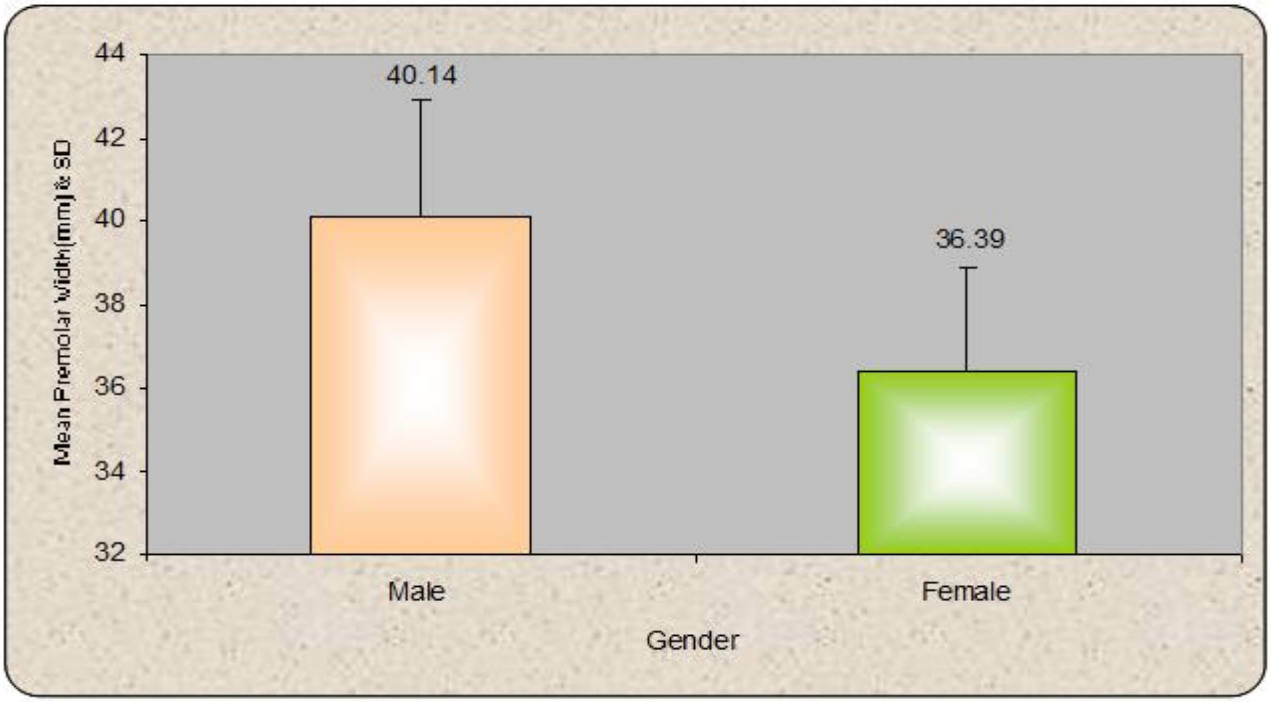
Legend Figures and Tables

Figure 1. Reference point for premolar and molar width

Figure 2. Digital Vernier caliper for measurements



Graph 1. Comparison of premolar width(mm) in males and females



Graph 2. Comparison of molar width(mm) in males and females

Gender	N	Mean	Std. Deviation	Std. Error Mean	Z-Value	P-Value	Sexual dimorphism
Male	50	40.14	2.75	0.38	7.11	0.001* s, p<0.05	10.30
Female	50	36.39	2.51	0.35			

Table 1: Comparison of premolar width(mm) in males and females

Gender	N	Mean	Std. Deviation	Std. Error Mean	Z-value	P-value	Sexual dimorphism
Male	50	49.26	3.13	0.44	7.86	0.001* s, p<0.05	10.72
Female	50	44.49	2.92	0.41			

Table 2: Comparison of molar width(mm) in males and females