

Mean Mesiodistal Width Determination of Canines in Patients Reporting to a Tertiary Care Hospital at Karachi

Muhammad Ashfaq¹, Syed Shah Faisal², Sadia Rizwan³, Syed Sheeraz Hussain⁴

Abstract

Objective: Objective of our study was determination of mean mesiodistal width of maxillary and mandibular canines in males and females in Pakistani population for ideal replacement of these teeth.

Methods: It was a cross sectional study. Data was obtained from patients referring to orthodontic department at a tertiary care hospital. Informed consent was taken verbally from the patients recruited for study. Sample size was 130. Patients with both genders and having age range of 17-21 were included. Patients having unerupted, partially erupted, any prosthetic replacement, any restoration of maxillary or mandibular canines were excluded from the study. Mesiodistal measurement of both the upper and lower canines were obtained on the plaster casts with the help of digital Vernier caliper. All the measurements were noted on a preformed proforma (Annex-1).

Results: They were 130 patients who were recruited for the study. The mean age of the patients in this study was 18.90 ± 1.523 years. Mean maxillary canine width mesiodistally was found to be 8.502 mm with standard deviation of 0.615 mm. Mean width of mandibular canine mesiodistally was found to be 7.44 mm with having standard deviation of 0.764 mm.

Conclusions: This study helped us to conclude that the canines for right and left side were not exactly similar to each other. It was found that sexual dimorphism is present in the widths of maxillary and mandibular canines mesiodistally. It is also concluded from the study that males have greater mesiodistal widths of canines than females.

Keywords: Canine, odontometry, orthodontics, alveolar process.

IRB: Dissertation approved by College of Physicians and Surgeons Pakistan, Ref No: CPSP/REU/DSG-2013-174-1179. Dated: 3rd February 2015.

Citation: Ashfaq M, Shah faisal S, Rizwan S, Hussain SS. Mean Mesiodistal Width Determination of Canines in Patients Reporting to a Tertiary Care Hospital at Karachi [online]. Annals ASH KMDC;2020:25

(ASH & KMDC 25(1):16;2020)

Introduction

Odontometry is type of anthropological study which helps to differentiate between different groups and populations on the basis of their dental measurements. In orthodontics, odontometry is used to compute tooth size disparity to aid in individualized orthodontic management. Crowding and spacing are two major reasons of malalignment. Therefore,

size of teeth and overall arch perimeter should be corresponding in acceptably aligned arch cases. The accurate alignment of teeth and establishment of perfect posterior intercuspation could be challenging in the presence of when tooth size discrepancies¹. Thus, the space required for proper alignment of all teeth within the dental arch is the sum of mesiodistal size of all the teeth to fit in that arch². Tooth size varies among different populations and ethnicities³ and is mainly influenced by heredity, ethnicity, and sex. Tooth sizes were measured and compared in many studies for example Lavelle (1972) in his study concluded that sexual dimorphism was present in tooth dimensions and in the ratio between upper and lower arch tooth size⁴.

^{1,2,4} Department of Orthodontics,
Karachi Medical and Dental College

³ Department of Orthodontics,
Dow University of Health Sciences

Correspondence: Dr. Muhammad Ashfaq
Department of Orthodontics,
Karachi Medical and Dental College
Email: ashfaqyounus231@hotmail.com
Date of Submission: 27th June 2019
Date of Acceptance: 12th March 2020

Estimation of tooth size is also important in a population when artificial teeth are given in place of missing tooth or certain teeth are substituted in place of other missing teeth for example during cuspidation of a premolar in case of impacted or missing canine or lateralization of a canine.

Canine is of the most significant tooth in the oral cavity because of its functional and anatomical value due to which an orthodontic treatment is always planned with canines being given the most importance. Both maxillary and mandibular canines closely resemble each other, so as their functions. The four upper and lower canines are placed at the "corners" of the oral cavity; each of which is the third tooth to right and left, from the median line, in the maxilla and mandible. Canines are usually referred to as the cornerstone of the mouth. They are the longest teeth in the mouth; their crowns are usually as lengthy as those of the upper central incisors, and they have single root that is longer than any of the other teeth. Crowns and roots on most surfaces are markedly. The position and shape of the canines plays important part in the teeth guidance into the inter-cuspal position via canine guidance.

Since the labiolingual thickness of crown and root is greater in correspondence to anchorage in the alveolar processes of the jaws, canines are the teeth with maximum stability in the oral cavity. The shape of the crown portion of canines promotes cleanliness. Both upper and lower canines have another quality that the shape and position of these teeth and their anchorage value within the bone, along with the alveolar bone ridge over the labial portions of the roots, which is called the canine eminence, also have aesthetic value. Canines tend make a foundation that assists normal facial expression at the mouth corners. Loss of all canines makes it very difficult, if not impossible to do substitution/replacements that would help restore that natural facial appearance of the face for any length of time.

As it was found that the maxillary canine impaction prevalence is between 1-3%⁵, so in cases

with impacted canines, substitution with premolars is an option. Canines have been shown to exhibit higher dimorphism sexually as crown size in concerned compared to any other tooth in the oral cavity⁶. Sexual dimorphism can be defined as the systemic difference in either in shape or size between individuals of various sexes in the similar species⁷. Having those facts in considerations one must know average dimension of both maxillary and mandibular canines in a particular population.

Among various proportions - width and length, width is assumed to be more important. Various studies on dental morphology have been conducted in the past using either direct intraoral measurements or measurements on plaster casts. Barrett et al. (1963)⁸ have noticed that the intraoral measurements are comparatively less reliable than on plaster casts. But Kaushal et al. (2003)⁹ in his study determined no significant difference comparing the two methods. Keeping in mind Barretts observation, it was decided to do the measurements in this study on casts.

A study was in Lahore by Ahsan Naveed¹⁰ in 2010 in which mesiodistal width of maxillary canine was found along with another tooth. Mean mesiodistal width of maxillary canines in Lahore population was found 7.82 mm with SD + 0.51mm.

This study will help to develop recent local data in Karachiites regarding mesiodistal canine width, which will further help orthodontists in Karachi to treat cases with missing and impacted canines through replacement or substitution of these teeth.

Objective of this study was to determine mean mesiodistal dimension of maxillary and mandibular canines in males and females' subjects in a sample of patients referred to department of orthodontics in a tertiary care hospital.

Material and Methods

It was a cross-sectional study. The duration of study was Six months from 4th February 2015 to 3rd August 2015. The ethical approval was taken from

CPSP for the study. Study was conducted at Dental OPD with non-probability consecutive sampling technique. Sample size was 130 which was calculated by WHO 7.1 calculator by using the stats given by Madhavi Yuwan in which mean left maxillary canine width in males was given 7.88 mm with standard deviation of ± 0.773 mm. Margin of error was kept 1.5.

Patients from both genders were included. Patients with age 17-21 years were included in our study, as wear and attrition are minimal in this age group. Only patient with all permanent canines erupted was included in the study.

Patients excluded from this study were having unerupted, partially erupted, any prosthetic replacement, any restoration of maxillary or mandibular canines. Patients with orofacial syndromes or cleft lip and palate were also excluded.

Data was gathered from patients presenting to department of orthodontics. All the patients were examined by researcher himself. After thorough history and clinical examination patients were recruited for the study. Informed consent was taken from the patients verbally. Alginate impressions were taken with standard sterilization protocol was followed for each patient and plaster casts were formed. The mesiodistal widths of upper and lower canines were measured with the help of digital Vernier caliper. To control bias, measurement was done by co-researcher and identification of gender was not known to him at the time of measurement. The mesial and distal tooth surfaces were marked and the distance between the mesial crest of curvature and distal crest of curvature was measured. All measurements were recorded under ample light and comfortable position. All the values were noted on a preformed proforma. (Annex-1)

Data was analyzed in SPSS version 20.00. Mean and standard deviation was calculated for mesiodistal dimension of upper and lower canines. Frequency was calculated for gender and age groups. Further effect modifiers (gender) were stratified to see the effect of these on the outcome using t- test and $p < 0.05$ will be taken as significant.

Results

Overall 130 patients were recruited for the study. The mean patient age was 18.88 ± 1.518 years. There were (34/130) 26.2% male and (96/130) 73.8% female as shown in Fig 1.

Mean width of maxillary canine mesiodistally was found to be 8.509 mm with standard deviation of 0.613 mm. Mean width of lower canine mesiodistally was found to be 7.455 mm with standard deviation of 0.756 mm. The confidence interval was kept 95%. Table 1.

While comparing the mesiodistal width of maxillary canines in males and females it was found that in males it was 8.851 mm and in females it was 8.388. P-value was found to be less than .001 which shows that it was significant. In mandible males and females have widths of 7.814 and 7.328 respectively. Table 2.

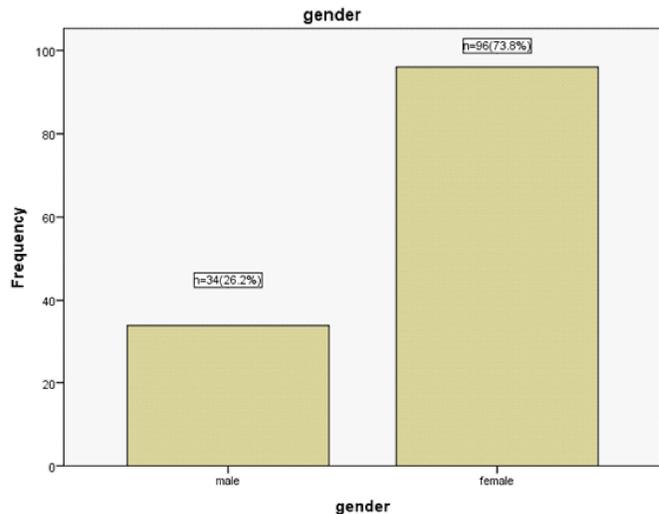


Fig 1. Frequency of gender

Table 1. Mean mesiodistal widths in maxilla and mandible (n=130)

| Arch | Mean | SD | Right side | Left side |
|----------|----------|----------|-----------------|----------------|
| Maxilla | 8.509 mm | 0.613 mm | 8.525 mm+ 0.623 | 8.493 mm+0.617 |
| Mandible | 7.455 mm | 0.756 mm | 7.469 mm+ 0.819 | 7.442 mm+0.829 |

Table 2. Mesiodistal width comparison in males and females (n=130)

| Arch | Male | Female | P value |
|----------|-----------------|-----------------|---------|
| Maxilla | 8.851 mm+ 0.533 | 8.388 mm+ 0.595 | < 0.001 |
| Mandible | 7.814 mm+ 0.493 | 7.328 mm+ 0.794 | 0.001 |

Discussion

The dentist is the person responsible to gather, correspond, measure the biomechanical information and evaluate the selection of anterior artificial teeth so that it can fulfill individual's cosmetic and functional needs. To evaluate the amount of crowding, the interdental relationships between the maxillary and mandibular teeth, and the skeletal and dental relationships, precision is required. Therefore, it is important to evaluate the dimensions of each tooth pretreatment in order to localize and quantify dental disharmony¹¹.

The age group in the current study was selected to be relatively young to reduce the influence of tooth wear and attrition on tooth width measurements. The average age of the patients were 18.88 years with range from 17 to 21 years. In a study by Khan SH¹² mean age was found to be 18.3 years. Moreover, tooth measurement was conducted on study models which offers a significant improvement on direct intra-oral tooth measurement and allow remeasurement when required¹³.

Hashim and Murshid (1993)¹⁴, managed a study with Saudi males and females having age range of 13-20 years to numerate the teeth in oral cavity with the highest probability of dimorphism and established that only the canines in both upper and lower jaws possesses a significant sexual dissimilarity while the other teeth do not exhibit the same. Keeping in mind the facts of this and many other similar studies mesiodistal dimension of upper and lower canines was selected to be measured in this study.

Various studies were notifiable in literature investigating mandibular canine width and mandibular canine index. However, our study was confined to

measurement of canine widths of upper and lower arch.

The mean width of maxillary canines mesiodistally was found to be 8.509 mm with a standard deviation of 0.613 mm. On right hand it was 8.520 while on the left-hand side it was 8.493 mm. The average difference between the right- and left-hand side was 0.037 mm. Those values showed that right or left side measurements, could be taken to represent mesiodistal crown dimensions in our population. These results are similar to that given by Khan SH and other population groups. However, these results were different to those given by Lundstoum¹⁵.

Mean mesiodistal width for mandibular canines was found to 7.455 mm with a standard deviation of 0.756 mm. On right side it was 7.469 while on the left-hand side it was found to be 7.442 mm.

It was also found in this study that mean mesiodistal for maxillary canines in males was 8.851 mm while in females it was 8.388 mm. $p < 0.001$ which is significant and shows that maxillary canine shows dimorphism in our population. When compared to a previous study in Bangladesh¹⁶ the results were different as that study quoted no significant difference between males and female tooth dimensions. Mean mesiodistal width was found also different in our sample when compared to a study by Pamecha S¹⁷ where the mean width for maxillary canine in males and females was found 8.01 and 7.84 mm respectively.

For mandibular canines the width in our study was found 7.814 mm for males and it was found 7.328 mm for females. $p = 0.001$ which is significant and according to our values there was dimorphism in the mandibular canines as well. The values for mandibular canines in males were similar to that given in study by Madhavi Yuwan. However, our results for mandibular canines were different from stats given by Eera bungger¹⁸ in his study in Indian population.

Acharya and Mainalli¹⁹ established reverse dimorphism in the mesiodistal width of lower second

premolars in Nepalese population. The finding could be projected to a development resulting in a decrease in sexual dimorphism, inducing an overlap of tooth dimension in modern-day males and females. Analogous results were determined by Karen Boaz and Chaavi Gupta²⁰ in a dimorphic survey of upper and lower canines in 100 patients in South Indian population and showed the absence of note worthy dimorphism in canines. He also disclosed the observations of reverse dimorphism where the females possessed larger canines than males.

In present study dimensions of crown for males were found wider than females in both upper and lower arches which is consistent with the results shown by Garn et al²¹ and Singh & Goyal 2006²². According to Moss and de Vito²³ reason behind this difference in tooth dimensions in males and females is because of thick enamel in males due to longer period of amelogenesis when compared to females. And calcification of crown in females is also completed earlier as compared to males.

Kalia. S²⁴ stated that according to Townsends, the difference in tooth dimensions between sexes have been due to difference in balanced hormonal production which results from the contradistinction of either male or female gonads during the sixth or seventh week of embryo genesis rather than because of any direct effect of sex chromosome themselves.

Reason behind dimorphism can also be due to a biologic alteration, which is a characteristic of life and is extremely credited to genetics, family and environmental parameters.

Conclusion

This survey was done in a sample consisting of Pakistani population in order to enumerate the mean mesiodistal width of maxillary and mandibular canines. It was determined that there is variation in mesiodistal width in maxillary right and left canines with right side slightly greater in maxillary arch. This signifies that the canines are not reflections of

each other. Sexual dimorphism was also evident in the widths of upper and lower canines mesiodistally. It can also be concluded from this study that males are found to have greater widths of canines mesiodistally than females.

The values for mesiodistal widths for sampling population could be used for treatment planning for space management missing canine or lateral incisors where canine has to be substituted or prosthetically replaced.

Conflict of Interests

Authors have no conflict of interests and received no grant/funding from any organization.

References

1. Malcok S, Basciftci FA, Nur M, Catalbas B, Maxillary and mandibular mesiodistal tooth sizes among different malocclusions in a sample of the Turkish population, *Eur J Orthod* 2011;33: 592-6. [doi: 10.1093/ejo/cjq111]
2. Koora K, Sriram CH, Muthu MS, Rao RC, Sivakumar N. Morphological characteristics of primary dentition in children of Chennai and Hyderabad [online] *J Indian Soc Pedod Prev Dent* 2010;28:60-7. Available from: <http://www.jisppd.com/article.aspx?sn=0970-4388;year=2010;volume=28;issue=2;epage=60;epage=67;aulast=koora> Accessed on: 10th February 2020.
3. Proffit WR, Fields HW, Sarver DM [online]. *Contemporary Orthodontics*. 5th ed. St. Louis: Elsevier; 2012 Available from: https://scholar.google.com.pk/scholar?q=3.+Proffit+WR,+Fields+HW,+Sarver+DM.+Contemporary+Orthodontics+.5th+ed.+St.+Louis:+Elsevier%3B+2012.&hl=en&as_sdt=0&as_vis=1&oi=scholart. Accessed on: 10th February 2020.
4. Lavelle CLB. Maxillary and mandibular tooth size in different racial groups and in different occlusion categories. *Am J Orthod* 1972 61: 29-37. [doi:10.1016/0002-9416(72)90173-x]
5. Dachi SF, Howell FV. A survey of 3,874 routine full mouth radiographs, II. a study of impacted teeth. *Oral Surg Oral Med Oral Pathol* 1961;14:1165-9. [doi:10.1016/0030-4220(61)90204-3]
6. Hattab FN, al-Khateeb S, Sultan I. Mesiodistal crown diameters of permanent teeth in Jordanians. *Arch Oral Bioi* 1996;41:641-5. [doi:10.1043/0003-3219(2006)076[0459:TSDAAP]2.0.CO;2]

7. Khangura RK, Sircar K, Singh S, Rastogi V. Sex determination using mesiodistal dimension of permanent maxillary incisors and canines [online]. *J Forensic Dent Sci*. 2011;3:81-5. Available from: <http://www.jfds.org/article.asp?issn=0974-2948;year=2011;volume=3;issue=2;spage=81;epage=85;aulast=Khangura> Accessed on:10th February 2020.
8. Barrett MJ, Brown T, Macdonald MR. Tooth size in Australian aborigines [online]. *Aust Dent J*. 1963;8:150-5. Available from: <https://journals.sagepub.com/doi/10.1177/00220345650440052701> Accessed on:10th February 2020.
9. Kaushal S, Patnaik VV, Agnihotri G. Mandibular canine in sex determination [online]. *J Anat Soc India*. 2003;52:119-24. Available from: <http://medind.nic.in/jae/t03/i2/jaet03i2p119.pdf> Accessed on: 10th February 2020.
10. Naveed A, Asad S, Naeem S, mesiodistal dimension of maxillary anterior teeth: their 4clinical implications [online]. *podj*, 2010 :30 :394-97. Available from: http://podj.com.pk/archive/March_2017/PODJ-41.pdf Accessed on:10th February 2020.
11. Yuwanti M, Karia A, Yuwanati M, Canine tooth dimorphism: An adjunct for establishing sex identity *J Forensic Dent Sci*. 2012 ; 4(2): 80-83 [doi: 10.4103/0975-1475.109892]
12. Lee SJ, Ahn SJ, Lim WH, Lee S, Lim J, Park HJ. Variation of the intermaxillary tooth-size relationship in normal occlusion[online]. *Eur J Orthod*2011;33:9-14. Available from: <https://www.ajodo.org/article/S0889-5406%2813%2900468-X/fulltext> Accessed on:10th February 2020.
13. Khan SH, Hassan GS, Rafique T, Hasan MN, Russell MSH Mesiodistal Crown Dimensions of Permanent Teeth in Bangladeshi Population [online]. *BSMMU J* 2011; 4(2): 81-87 Available from: <https://www.banglajol.info/index.php/BSMMUJ/article/view/8635> Accessed on:10th February 2020.
14. Coleman RM, Hembree JH, Weber FN. Dimensional stability of irreversible hydrocolloid impression material. *Am J Orthod*1979;75:438-46 [doi: 10.4103/ccd.ccd_676_17]
15. Hashim HA, Murshid ZA. Mesiodistal tooth width- a comparison between Saudi males and females. *Egypt Dent J* 1993; 39:343-6
16. Lundstrom A. Tooth Size and Occlusion in Twins. S.Karger, [online]. New York. Martin 1948. Available from: <https://jmg.bmj.com/content/jmedgenet/6/1/55.full.pdf> Accessed on:10th February 2020.
17. Jahan H, Hossain MZ. Tooth size and arch dimension in uncrowded versus crowded class- I malocclusion [online]. *BJOrtho&DentofacOrthoped*, 2011; 2:37-38 Available from: http://podj.com.pk/archive/Dec_2014/PODJ-18.pdf Accessed on:10th February 2020.
18. Pamecha S, Dayakara HR Comparative measurement of mesiodistal width of six anterior maxillary and mandibular teeth in rajasthan population. *J Indian Prosthodont Soc*. 2012 Jun; 12(2): 81-86 [doi: 10.1007/s13191-012-0117-x]
19. Bunger E, Jindai R, Pathana D, Bunger R. Mesiodistal crown dimensions of the permanent dentition among school going children in punjab population: an aid in sex determination. *Int J Dent Health Sci*. 2014; 1(1): 13-23
20. Acharya A, Mainali S. Univariate sex dimorphism in the Nepalese dentition and the use of discriminant functions in gender assessment. *Forensic Sci Int*. 2007;173:47-56. [doi: 10.1016/j.forsciint.2007.01.024]
21. Boaz K, Gupta C. Dimorphism in maxillary and mandibular canines in establishment of gender [online]. *J Forensic Dent Sci* 2009;1:42-4 Available from: <http://www.jfds.org/article.asp?issn=0975-1475;year=2009;volume=1;issue=1;spage=42;epage=44;aulast=Boaz> Accessed on:10th February 2020.
22. Garn SM, Lewis AB, Swindler DR, Kerewsky RS. Genetic control of sexual dimorphism in tooth size. *J Dent Res*. 1967; 46(5):963-72. [doi: 10.1177/00220345670460055801]
23. Singh SP, Goyal A. Mesiodistal crown dimensions of the permanent dentition in North Indian children [online]. *J Indian Soc Pedod Prev Dent* 2006;24(4):192-6. Available from: <http://www.jisppd.com/article.asp?issn=0970-4388;year=2006;volume=24;issue=4;spage=192;epage=196;aulast=Singh> Accessed on:10th February 2020.
24. Rani RMP, Mahima VG, Patil KJ. Bucco-lingual dimension of teeth - An aid in sex determination [online]. *Forensic Dent Sci* 2009;1:88-92. Available from: <http://www.jfds.org/article.asp?issn=0975-1475;year=2009;volume=1;issue=2;spage=88;epage=92;aulast=Prathibha>. Accessed on:10th February 2020.
25. Kalia S. Study of permanent maxillary and mandibular canines and inter-canine arch widths among males and females [online]. [dissertation]. Bangalore: Rajiv Gandhi University of Health Sciences, Karnataka; 2006. Available from: <http://52.172.27.147:8080/jspui/bitstream/123456789/263/1/CDDODIA00028.pdf> Accessed on:10th February 2020.