ORIGINAL ARTICLE

Sex Determination Using Arch Width in North Indian (Punjab) Population

Ritu Jindal[1], Rohini Dua[2], Eera Bunger[3]

[1] Professor, Department of Pedodontics & Preventive Dentistry, National Dental College & Hospital , Derabassi - INDIA

[2] Professor, Department of Pedodontics & Preventive Dentistry, National Dental College & Hospital , Derabassi - INDIA

[3]Post Graduate Student
Department of Pedodontics & Preventive Dentistry, National Dental College & Hospital , Derabassi – INDIA

Corresponding Author

Dr Eera Bunger
Address: House no- 279 Urban Estate Phase II, Jalandhar, Punjab (India)
Phone numbers: 9316474414
E-mail address: dreerabunger@gmail.com

Access this Article Online

www.idjsr.com

Use the QR Code scanner to access this article online in our database

Article Code: IDJSR 0065

Quick Response Code

Abstract

Teeth exhibit the least turnover of natural structure and are readily accessible for examination. They are the least destructible part of the body and are useful in determination of gender by using different odontometric techniques. The study sample consisted of casts of 300 subjects (150 males; 150 females) with an age range of 12-14 years of Punjab population. Alginate Impressions of both arches were taken and dental casts were made. Inter first molar arch width both in maxillary and mandibular arch was measured with the help of Digital Vernier Caliper. It was found that Inter First Molar arch width was more in males as compared to females and the difference was statistically significant. Also, maxillary arch width was found to be varying significantly as compared to mandibular arch in both sexes.

Key Words: Molar arch width, Punjab population, normal class I occlusion

Introduction

The variety of teeth, number and morphology in each individual, is a fact which increases its importance as an identifying element.[5] The establishment and maintenance of normal occlusion constitute one of the important objectives of orthodontic treatment whether it is preventive, interceptive, or corrective.[14]

Graber stated that a balanced, healthy, and stable occlusion could be considered normal, even if small tooth rotations and small tooth size–arch length discrepancies are present.[16]

The task of an orthodontist is to align the teeth to improve the masticatory efficiency, facial esthetics and alignment of the dental arches, which becomes frustrating in the presence of crown-size discrepancies.[15]

Dental arch dimensions are not static and change systematically during the period of intensive growth and development. Causes of changes in size and form of the dental arch are multifactorial, such as sutural expansion in the maxilla, remodelling of alveolar bone, interarch relationships of the teeth, and contractile properties of supracrestal fibers. Many other factors such as heredity, growth of the bone, eruption and inclination of the teeth, external influences, and ethnic background also affect the size and shape of the dental arches. In the dental arch, relatively rapid changes occur during transitional dentition, and once a functional permanent dentition is established, smaller changes are observed to continue.[8]

Teeth being the central component of the masticatory apparatus of the skull are good sources of material for civil and medico legal identification.[13] Sex determination using dental features is primarily based upon the

comparison of tooth dimensions in males and females. Sexual dimorphism refers to the systemic difference in the form (either in shape or size) between individuals of different sexes in the same species.[7]

Materials and Methods

Eleven hundred children were examined from a contemporary population of Punjab which included children studying in the different schools of Punjab and those seen in the Out Patient block of Department of Pedodontics and Preventive Dentistry, National Dental College & Hospital, Derabassi, Mohali, Punjab. All the subjects were diagnosed as having Class I occlusion, with no history of orthodontic treatment. The sample consisted of good quality study casts of both maxillary and mandibular of 300 subjects (150 males and 150 females) with an age range of 12-14 years of Punjabi ethnic population. Written consents were obtained from the parents of all students who underwent examination and/or impression taking.

Inclusion Criteria:

1) Fully erupted dentition upto first permanent molar with no interproximal caries, restorations, attrition & dental anomaly.
2) No previous or ongoing orthodontic treatment.

Exclusion Criteria:

1) Clinically evident interproximal dental caries.
2) An alteration in the number or shape of the teeth that might affect the diameter of the dental arch.
3) Any oral habit that might influence the dental arch.
4) Experience of orthodontic treatment prior to the start of examination.

Impressions of both maxillary and mandibular arches were made using standard protocols and according to manufacturers recommendations using irreversible hydrocolloid; Alginate (Tropicalgin chromatic alginate material; Zhermack). After the complete setting of the alginate, tray was removed from the mouth and poured immediately in Green Dental Stone (Kalstone Dental Stone Class III; Kalabhai, Mumbai). The green dental stone was allowed to set for at least 60 minutes after which it was gently separated from the impressions. After trimming the models, bases were made with Plaster of Paris (Kaldent Dental plaster class II; Kalabhai, Mumbai) with teeth in occlusion. The study models thus prepared were finished and polished.

Measurements

The maximum mesiodistal dimension of each tooth on the study models between the mesial and distal contact points on its approximal surfaces was measured with the help of a Digital Vernier Caliper with an accuracy of 0.01 mm (Precise, Germany) which was held parallel to the occlusal plane perpendicular to the tooth's long axis.

Transverse Measurement: Maxillary & Mandibular Inter First Molar Arch Width

The arch width of maxillary and mandibular first permanent molar and its analog on the contra lateral side was measured keeping central fossae as reference points.[10]

All measurements were done by a single examiner to eliminate intraobserver error. For assessment of intraexaminer error; the data collection procedure was repeated by randomly selecting the study models of 40 subjects. The measurements were made by the same examiner at an interval of 1 week. Dahlberg's method[1] for calculation of error was applied and a range of 0.051 to 0.183mm was obtained and considered clinically acceptable.

Statistical analysis

The data were subsequently processed and analyzed using SPSS statistical software programme. Independent t-test was employed to evaluate the results. All tests had 0.05 level of statistical significance. This study was approved by institutional review board.

Results

Data was collected from 300 study casts of children ages from 12 to 14 years. One hundred and fifty subjects were males (50%) and one hundred and fifty were females (150%). Males were found to have larger Inter First Molar arch width as compared to females. Statistical analysis of these results was found to be varying significantly. Table 1 and 2 shows the Mean, S.D of Maxillary Inter First Molar Arch Width and Mandibular Inter First Molar Arch Width in males and Females group of Punjab population. Statistical comparison of Inter First Molar arch width of maxillary and

mandibular arches between both sexes is shown in table 3 and 4.

Table 1: Mean, S.D of Maxillary Inter First Molar Arch Width and Mandibular Inter First Molar Arch Width in Male group of Punjab population (12-14years)

Gender		Mean†	S.D	Maximum	Minimum
Males	Maxillary	50.35	1.51	54.10	49.60
	Mandibular	44.75	1.76	49.70	41.50

†Mean Arch Width of each arch is represented in millimetres (mm)
S.D – Standard Deviation

Table 2: Mean, S.D of Maxillary Inter First Molar Arch Width and Mandibular Inter First Molar Arch Width in Female group of Punjab population (12-14years)

Gender		Mean†	S.D	Maximum	Minimum
Females	Maxillary	48.99	1.62	52.60	44.90
	Mandibular	41.90	1.74	45.70	37.30

†Mean Arch width of each arch is represented in millimetres (mm)
S.D – Standard Deviation

Table 3: p value Maxillary Arch (Males versus Females)

Arch	Mean Inter Molar Arch Width†		p value
	Males	Females	
Maxillary	50.35	48.99	<.001***

*p≤0.05Significant, **p≤0.01, ***p≤0.001 Highly Significant, p>0.05 Non Significant
†Mean Arch width of upper arch is represented in millimetres (mm)

Table 4: p value Mandibular Arch (Males versus Females)

Arch	Mean Inter Molar Arch Width†		p value
	Males	Females	
Mandibular	44.75	41.90	<.001***

*p≤0.05Significant, **p≤0.01, ***p≤0.001 Highly Significant, p>0.05 Non Significant

†Mean Arch width of mandibular arch is represented in millimetres (mm)

Discussion

Knowledge of dental arch width in a population plays a key role in orthodontics. The size and form of the dental arches can have considerable implications in orthodontic diagnosis and treatment planning. It affects the space available, dental esthetics and stability of the dentition.[4]

This study was carried out to determine the sexual dimorphism using Inter First Molar arch width of the permanent dentition of school going children in Punjab. This young group of Punjab (North India) was chosen for measurement to minimize the alteration of dental arch dimensions because of attrition, restoration, or caries.

Longitudinal studies in arch growth have shown an increase in arch width up to the age of 13 years, with very little significant growth after this period.[4] Regarding the distance between molars, Sillman did not observe any changes in male individuals 14 years and older.[16] Investigators who have studied transverse arch changes in subjects have reported that molar arch width did not change after 13 years of age in females.[8,17] The minimum ages of the subjects measured in this study were chosen on the basis of these previous studies.

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. In our study, Inter First Molar arch width was measured using central fossae as reference points on both right and left sides.[10]

The maxillary Inter First molar arch width of 50.35mm in males and 48.99mm in females in this study (Table 22, 23) were lower as compared to the earlier study done on Punjab population by Munjal S et al[12] as 51.57mm in males and 49.94mm in females. In the present study, mean value of mandibular Inter First molar arch width in males was 44.75mm and mean value of lower inter molar width in females was 41.90mm (Table 22, 23)which were comparable to the results reported by Munjal S et al[12] as 45.32mm in males and 42.54mm in females.

This difference in the measurements could be attributed to the variability of the

reference points of the measurements for arch dimensions. However, in the present study the central fossae were used as reference points, whereas the mesio buccal cusp tips were used in Munjal et al's[12] study. Hence, meaningful comparisons are not always possible and firm conclusions are difficult to draw.

In the present study, maxillary and mandibular Inter First Molar arch width was greater in males than in females. This was in agreement with the results obtained for another North Indian population by Agnihotri G & Gulati MS[3] and for Saudi population[6], but in disagreement with the findings for Egyptian population.[2]

This sexual dimorphism can be of immense medico-legal significance as it can be used for gender determination. It may be related to the longer period of growth in males and also to their tendency to produce greater masticatory forces. However, in contrast, Aluko et al quoted that according to Ross-Powell and Harris in their study of Black American children, there was no significant sexual dimorphism.[4]

In corroboration with study by Moyers[11], it was also observed that sexual dimorphism for Inter First Molar arch width was greater in maxilla than mandible. Differences in arch width have also been reported to exist between the races. Blacks have been shown to have larger arch widths than Whites.[9]

Information regarding maxillary and mandibular arch dimensions in human populations is important to clinicians in orthodontics, prosthodontics, and oral surgery.[17] For the orthodontist; this can also assist with orthodontic wire selection. A survey of arch size could help the clinician in choosing correctly shaped stock impression trays for prosthodontics treatment.[6] In addition to the selection of stock trays; the sizes of artificial teeth and the overall form of the artificial dental arch at the wax trial stage are amenable to modification by the dental surgeon in orthodontic treatment.[17]

Conclusion

The following conclusions were drawn from the present study:

1) Males were found to have larger Inter First Molar arch width than females in Punjab population for both maxillary and mandibular arches.
2) Sexual dimorphism for Inter First Molar arch width was greater in maxilla than mandible.

References

1. Abu Alhaija ES, Qudeimat MA. Mixed dentition space analysis in a Jordanian population: comparison of two methods. Int J Paediatr Dent 2006;16(2):104–10.
2. Aggarwal B, Gorea R, Gupta M. Determination of Gender using Mandibular Teeth in North Indians. J Indo Pacific Acad Forensic Odontol. 2010;1(2):38-40.
3. Agnihotri G, Gulati MS. Maxillary molar and premolar indices in North Indians: A Dimorphic Study. The Internet Journal of Biological Anthropology. 2008;2(1).
4. Aluko IA, daCosta OO, Isiekwe MC. Dental arch widths in the early and late permanent dentitions of a Nigerian population. Nig Dent J 2009;17(1):7-11.
5. Astete JC, San Pedro VJ, Suazo GI. Sexual Dimorphism in the Tooth Dimensions of Spanish and Chilean peoples. Int. J. Odontostomat.2009;3(1):47-50.
6. Hashim HA, Al-Ghamdi S. Tooth width and arch dimensions in normal and malocclusion samples: an odontometric study. J Contemp Dent Pract 2005;6(2):36-51.
7. Khangura RK, Sircar K, Singh S, Rastogi V. Sex determination using mesiodistal dimension of permanent maxillary incisors and canines. J Forensic Dent Sci. 2011;3(2):81-5.
8. Knott VB. Longitudinal study of dental arch width at four stages of dentition. Angle Orthod. 1972; 42(4):387-94.
9. Lavelle CL, Foster TD, Flinn RM. Dental arches in various ethnic groups. Angle Orthod. 1971;41(4):293-9.
10. Ling JY, Wong RW. Dental arch widths of Southern Chinese. Angle Orthod. 2009;79(1):54-63.
11. Moyers RE. Standards of Human Occlusal development Monograph 5, Craniofacial Growth Series. Ann Abor, Michigan Centre for Human growth and development, University of Michigan 1976.
12. Munjal S, Duggal R, Kahlon SS, Bansal S. Comparison of Dental and

Alveolar Arch Width in Patients with Normal Occlusion, Class II Division 1 and Class II Division 2 Malocclusion. J Ind Orthod Soc 2010;44(2):42-7.
13. Rani RMP, Mahima VG, Patil KJ. Bucco-lingual dimension of teeth - An aid in sex determination. Forensic Dent Sci 2009;1:88-92.
14. Santoro M, Ayoub ME, Pardi VA, Cangialosi TJ. Mesiodistal crown dimensions and tooth size discrepancy of the permanent dentition of Dominican Americans. Angle Orthod 2000;70(4):303-7.
15. Singh SP, Goyal A. Mesiodistal crown dimensions of the permanent dentition in North Indian children. J Indian Soc Pedod Prev Dent 2006;24(4):192-6.
16. Tibana RH, Meira Palagi L, Miguel JAM. Changes in dental arch measurements of young adults with normal occlusion--a longitudinal study. Angle Orthod. 2004;74(5):618-23.
17. Uysal T, Usumez S, Memili B, Sari Z. Dental and alveolar arch widths in normal occlusion and Class III malocclusion. Angle Orthod 2005;75(5):809-13.