ORIGINAL ARTICLE

Determinant Factors of Maxillary Arch Dimension of Students Aged 18 - 25 Years at Prosthetic Department Bhittai Dental and Medical College

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ABSTRACT

Objective: To determine the factors of maxillary arch dimension of students aged 18–25 years in the prosthetic department at Bhittai Dental and Medical College

Methods: This cross-sectional study was done at the prosthetic department at Bhittai Dental and Medical College, MirpurKhas. All the students having Class I canine and molar relationships; well-aligned upper and lower dental arches; mixed dentition; good facial symmetry; and no previous orthodontic treatment. Dental arch dimensions of width, length, and depth were taken by one examiner using the Korkhaus' compass and a digital pachymeter. All the data was collected by the study proforma and SPSS version 26 was used for the purpose of analysis.

Results: A total of 50 students were studied. Their mean age was 22.68+3.32 years. According to the arch width, the mean inter canine distance was 35.28+1.98 mm, the mean inter pre molar distance was 42.92+2.36 mm, the mean inter first molar distance was 52.48+4.03 mm, and the mean inter 2nd molar distance was 59.52+3.61mm. According to the maxillary arch length, the anterior arch length was 8.32+1.34mm, molar ventricle distance was 29.72+2.52 mm and the total arch length was 43.2+2.1mm. In the arch width and length, the mean inter 2nd molar distance and anterior arch length were statistically insignificant according to age and gender (p-<0.05).

Conclusion: In conclusion, within the age range that was investigated, slight gender discrepancies were evident using all available approaches in maxillary arch width and length. There was found a slight difference in age groups and gender as the average maxillary arch width and length were observed to be slightly higher than females.

Keywords: Maxillary arch, width, length, age, gender

INTRODUCTION

During the period of rapid development and growth, these dental arch proportions systematically fluctuate, although they become less pronounced as people age.[1] Due to this, numerous studies have examined alterations in arch dimensions, including arch width, during different phases of development and the growth.[1] For a very long time, the shape and dimensions of the dental arch have served as an important source of information not just for dentists but also for many other disciplines, including biology, anthropometric measurements, paintings, and sculpture.[2,3] The dental arches are a curvature that is typically characterized and categorized by qualitatively geometric shapes or quantitative mathematical computations. Its shape and size are determined by the muscles that surround the bone of the jaws, the alveolar bone, and hereditary factors. Other influences include the environment, growth of the bone, rotation, eruption, and incline of the teeth.[2,4] Such as normal tooth growth, proper soft and hard palate development, which aids in proper phonation as well as other physiological functions.[5,6] The palate is thought to be an important anatomical feature that shapes skeletal patterns because of its morphology and location.[5] Due to the fact that the major goal of orthodontic therapy is to rectify underlying malocclusions, changes in arch dimensions may have an impact on the palate.[5] Dimensions of the arch are frequently altered by the various arch wires being used in orthodontic treatment, resulting in an effect on the stability of the outcomes. It is also claimed that the stability of both the mandibular and maxillary arch widths is influenced by a variety of factors both before and after orthodontic treatment.[5,7] As per the gender factor, the previous study found that men had wider maxillary arches than women, which was consistent with several earlier investigations. Clinicians have hypothesized that women's smaller bone ridges and alveolar processes, mean muscular weakness, and later growing period in men compared to women have significant influences on the width and height of the dental arch and face breadth measures. Numerous other environmental and genetic factors, position and size of the tooth, craniofacial pattern of the growth and other variables affect the size and shape of the dental arch in different people.[10] However, clinical orthodontics needs to know the proportions of the palatal and maxillary arches in human populations.[10] However, this study has been done to determine the factors of students aged 18 - 25 years maxillary arch dimension in the prosthetic department Bhittai Dental and Medical College.

MATERIAL AND METHODS

This cross-sectional study was done at the prosthetic department at Bhittai Dental and Medical College, MirpurKhas. The study duration was 6 months from February 2020 to August 2020. All the students having Class I canine and molar connections, properly positioned arches of the upper and lower teeth, having good symmetry of the face, mixed dentition, and those without a history of orthodontic treatment were included. All the students having no healthful or complete pairs of teeth, histories of face or orthodontic surgeries, cases with absence of complete or permanent 2nd molars and those who were not agreeing to participant in the study were excluded. One examiner measured the breadth, depth, and length of the dental arches by using the digital pachymeter and the Korkhaus compass.[1] The lengthening was calculated as the angle between the first molar's line of depths and the line perpendicular to the central incisors' raphe point of the dental arch overall. By measuring the perpendicular distance from the line that joins the central incisors up to the canine's distal line, the length of the anterior part of the arch was calculated. The distance between the arch's total length and its anterior section length allowed researchers to measure the posterior segment's lengthening of the arch.[1] through the measurements of the distance in-between the right and left canines' cups tips, the inter-canine width was determined. The space in-between the left and right premolars' central sulcus, or primary second molars, was used to determine inter-first-premolar breadth. By measuring the distance between the central sulcus of the right and left first molars, inter-first-molar width was calculated.[1] The space between the central sulcus of the right and left second molars, or inter-second-molar width, was measured. All the data was collected by the study proforma and SPSS version 26 was used for the purpose of analysis.

RESULTS

A total of 50 students were subjected to assessing the maxillary arch dimension. The overall average age of the cases was 22.68+3.29 years. Males were 60% and females were 40%. Average of inter canine distance was 35.28 + 1.96 mm, inter premolar distance was 42.92 + 2.33 mm, inter first molar distance was 52.48 + 3.99 mm, and inter 2nd molar distance was 59.52 + 3.58 mm, while the average of Anterior Arch length was 8.32 + 1.33 mm, molar vertical distance was 29.72 + 2.49 mm, total arch length was 43.28 + 2.16 mm, and palatal depth was 20.62 + 1.96 mm. Table.1

Table. 1. Descriptive statistics of age, gender and maxillary arch dimension n= 50

Variables		Statistics	
Age (years)		22.68+3.29	
Gender	Males	30	60.0
	Females	20	40.0
	Total	50	100.0
Maxillary Arch Dimension	Inter canine distance	35.28 + 1.96 mm	
	Inter premolar distance	42.92 + 2.33 mm	
	Inter first molar distance	52.48 + 3.99 mm	
	Inter 2nd molar distance	59.52 + 3.58 mm	
	Anterior Arch length	8.32 + 1.33 mm	
	Molar vertical distance	29.72 + 2.49 mm	
	Total arch length	43.28 + 2.16 mm	
	Palatal depth	20.62 + 1.96 mm	

Table. 2. Maxillary arch dimension according to age n= 50

Maxillary Arch Dimension	Gender	N	Mean	Std. D	p-value
Inter canine distance (mm)	18-21 years	18	34.88	2.19	0.238
	22-25 years	31	35.58	1.80	
Inter premolar distance (mm)	18-21 years	18	42.77	1.51	0.720
	22-25 years	31	43.03	2.75	
Inter first molar distance (mm)	18-21 years	18	53.44	2.61	0.219
	22-25 years	31	51.96	4.60	
Inter 2nd molar distance (mm)	18-21 years	18	58.33	4.02	0.093
	22-25 years	31	60.12	3.21	
Anterior Arch length (mm)	18-21 years	18	8.33	1.371	0.891
	22-25 years	31	8.38	1.28	
Molar vertical distance (mm)	18-21 years	18	30.44	1.94	0.145
	22-25 years	31	29.35	2.73	
Total arch length (mm)	18-21 years	18	43.33	1.45	0.555
	22-25 years	31	43.00	2.09	
Palatal depth (mm)	18-21 years	18	20.77	1.86	0.701
	22-25 years	31	20.54	2.07	

Table. 3. Maxillary arch dimension according to gender n= 50

Maxillary Arch Dimension	Gender	N	Mean	Std. D	p-value
Inter canine distance (mm)	Males	30	35.60	1.69	0.162
	Females	20	34.80	2.28	
Inter premolar distance (mm)	Males	30	43.00	2.43	0.707
	Females	20	42.80	2.23	
Inter first molar distance (mm)	Males	30	53.06	4.63	0.206
	Females	20	51.60	2.64	
Inter 2nd molar distance (mm)	Males	30	61.73	1.76	0.001
	Females	20	56.20	3.00	
Anterior Arch length (mm)	Males	30	7.93	1.50	0.010
	Females	20	8.90	0.71	
Molar vertical distance (mm)	Males	30	29.40	2.37	0.272
	Females	20	30.20	2.66	
Total arch length (mm)	Males	30	43.26	2.42	0.958
	Females	20	43.30	1.78	
Palatal depth (mm)	Males	30	21.20	1.88	0.009
	Females	20	19.75	1.80	

According to the arch width average of inter canine distance, inter premolar distance and inter 2nd molar distance were lower in the age group of 18–21 years, and mean inter first molar distance was lower in the age group of 22–25 years. These findings were statistically insignificant (p = >0.05). According to the arch length, the mean anterior arch length and total arch length were lower in the age group of 18–21 years, and the mean molar vertical distance and palatal depth were slightly lower in the age group of 22–25 years, while the results were statistically insignificant (p = >0.05). Table.2

Mean inter canine distance, inter premolar distance, inter first molar distance, inter 2nd molar distance, total arch length, and palatal depth were lower in females compared to males, while the findings were statistically insignificant (p = >0.05). Table.3

DISCUSSION

For the prosthetic restoration, the mean levels of the arch's size and the shape anatomically are essential, so it is important to understand the natural dental arch form.[11] Due to this, the size and shape of the dental arch have been the subject of numerous research.[11] In this study, the overall average age of the cases was 22.68+3.29 years. Males were 60% and females were 40%. Average of inter canine distance was 35.28 + 1.96 mm, inter premolar distance was 42.92 + 2.33 mm, inter first molar distance was 52.48 + 3.99 mm, and inter 2nd molar distance was 59.52 + 3.58 mm, while the average anterior arch length was 8.32 + 1.33 mm, molar vertical distance was 29.72 + 2.49 mm, total arch length was 43.28 + 2.16 mm, and palatal depth was 20.62 + 1.96 mm. These findings were almost similar to other studies as the average of the palatal depth in the area of the molars was 22.53 ± 2.10 mm. According to other studies, that was 20.76 ± 3.1 mm and the 14.90 ± 2.05 mm.[12] In a 2018 study of Saudi individuals, Alkadhi et al. found that the average palatal height was 20.90 ± 2.08 mm in men and 20.54 ± 2.09 mm in women.[13] In 2012, Nahidh et al. assessed the average palatal height in dental models of type-I malocclusion in such an Iraqi population and discovered that it was 14.9 ± 1.78 mm.[14]

In this study, average arch width like inter canine distance, inter premolar distance, and inter 2nd molar distance were slightly lower in the age group of 18–21 years, and the mean inter first molar distance was slightly lower in the age group of 22–25 years. These findings were statistically insignificant (p = >0.05). In this study, according to the arch length, the mean anterior arch length and total arch length were lower in the age group of 18–21 years, and the mean molar vertical distance and palatal depth were slightly lower in the age group of 22–25 years, while the results were statistically insignificant (p = >0.05).

In this study, the mean inters canine distance, inter premolar distance, inter first molar distance, inter 2nd molar distance, total arch length, and palatal depth were lower in females compared to males, while the findings were statistically insignificant (p = >0.05). Consistently, Al-Zubair NM et al[10] reported that the maxillary arch widths were higher in men than in women, which was supported by numerous other investigations. Further, they reported that the practitioners have assumed that females' alveolar processes and bony ridges are smaller than men's, and the average male musculature is weaker, which has significant implications for measurements of facial breadth and the height and width of the dental arch, as well as men's later growth period than women.[10] There were also no gender differences in the length of the anterior or total maxillary arches in their study, and their findings are closed to this study. Dental arches' dimensions, including their width, length, and form, are significant factors in the diagnosis, planning, and outcomes of orthodontic treatment for patients of all ages. Dental arch dimensions and characteristics vary amongst ethnic groups and populations. Consequently, it is recognized that throughout development and growth, the dimensions are changed of the dental arch; moreover, the change lessens towards adulthood. This is why a lot of experts are curious to find out how the proportions of the tooth arch alter as an individual grows and develops.[15,16]

CONCLUSION

As per study conclusion, slight gender discrepancies were evident using all available approaches in maxillary arch width and length. There was found a slight difference in age groups and gender as

the average maxillary arch width and length were observed to be slightly higher than females. Due to the limited sample size of the study and several other limitations, further large-scale studies are recommended.

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