Original Research Paper

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RELATIONSHIP BETWEEN DENTAL ARCH WIDTH AND VERTICAL FACIAL MORPHOLOGY IN UNTREATED ADULTS- A RETROSPECTIVE STUDY

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ABSTRACT Arch dimensions can change during orthodontic treatment. So Orthodontist should require adequate knowledge about changes in arch dimensions prior to orthodontic treatment. The aim of the study was to determine whether there is a correlation between dental arch widths & Growth pattern.The comparison of the dental arch width between the groups and the gender prediction is evaluated.The study population included 61 patients, reporting to Department of Orthodontics and Dentofacial Orthopaedics in Best Dental Science College, Madurai. Based on Jarabak's ratio the study subjects were divided into horizontal and vertical growers. The parameters such as Inter cuspal & Most buccal widths of canine, I & II premolars & I molar were measured in both the arches. Arch widths of the study subjects were measured from the study models. All the data were tabulated & subjected to statistical analysis (Students t test). Based on the findings, Vertical growers have narrow arch width in both maxilla & mandible compared to the horizontal growers with p value of 0.002. Among the gender difference, Female arch widths were constricted than male arch widths in both maxilla & mandible with p value of 0.002.To conclude Vertical growers have narrow arch width in both maxilla & mandible.

- Using arch wires based on each patient's pre-treatment shape of arch and widths is recommended during orthodontic treatment, since dental arch width is correlated with growth pattern.

KEYWORDS : Dental arch width, Growth pattern, Untreated adults.

INTRODUCTION

According to Penrose, the phrase "form = size + shape" applies to the arch [1].

In order to determine the optimal arch widths, Hawley used an equilateral triangle with the base equal to the breadth of the intercondylar joints. The breadth of the lower canines and incisors taken together determines the width and length of the lower premolars and molar teeth, which are aligned in an arc[2]

The shape of dental arches is determined by a complicated characteristic. The genetic component may include vertical growth patterns and environmental influences linked to functional, muscular, and local aspects.[3].

Arch forms indicate the status of orthodontic therapy; if we attempt an overcorrection, it may result in temporary or permanent harm. Orthodontic archwires come in a variety of shapes and sizes. A number of authors studied different arch shapes to determine the ideal one[4-6]. As a result, archwires are available in a wide range of sizes and shapes, making it challenging to choose the optimal one for our patients.

Arch forms play a significant part in determining a person's facial form are both genes and phenotypes. Many individuals think that a person's face shape and body size can affect how well their teeth-clenching muscles work.[7]

F.F. Schudy et al (1964) studied the growth changes in the vertical and the anteroposterior direction. He found that the growth changes influences the function of the mandible[8]. Opdebeeck (1978) studied the short face syndrome. The findings reveal reduced lower facial height, decreased ramus height, reduced SN MP angle[9].

According to research by Rickets and colleagues, those with long faces (leptoprosopic) have narrower arch dimens ions, whereas those with short faces (europrosopic) had broader arch dimensions [10]. Preformed arch wires are frequently used by orthodontists in their practices. Therefore, it is necessary to establish a link between arch width and vertical face morphology. For both male and female participants, vertical face morphology and the width of the dental arches can be used to predict the most effective treatment strategies[11].

AIM:

The aim of the study was to determine correlation between dental arch widths and vertical facial pattern.

OBJECTIVES:

1. To compare the maxillary and mandibular arch widths in horizontal growers and vertical growers.
2. To compare the maxillary and mandibular arch widths in males and females.
3. To correlate the dental arch widths and vertical facial pattern in males and females.

Study Population:

The study population includes patients reporting to Department of Orthodontics and Dentofacial Orthopaedics, Best Dental Science College. The study subjects were divided into horizontal and vertical growers based on Jarabak's ratio The parameters included in the study are Inter cuspal & Widest labial widths of canine, I & II premolars & I molar. Arch widths of the study subjects were measured from the study models. All the data were tabulated & subjected to statistical analysis (Student t test).

Inclusion Criteria :

1. The study population included patients with Class-I, Class-II, Class-III categorized based on the growth pattern from Jarabak's ratio from the cephalometric findings.
2. The age range of 15 to 34 years.
3. Full dentition except for the third molars, lateral cephalogram, maxillary and mandibular dental casts were required to be included in the study.
4. Subjects with no previous Orthodontics treatment.

Exclusion Criteria :

1. Missing or grossly decayed teeth.
2. Periodontally compromised grade – II and grade – III mobile teeth.
3. Crowding more than 9 mm.
4. Diagnosed systemic illness
5. Craniofacial dysmorphology.
6. Subjects not willing to participate.

Sampling Procedure :

- Stratified random sampling

Sample Size

Total sample size: 61

61 subjects will be categorized into two groups based on the Jarabak's ratio from the cephalometric findings.

Group-I : Horizontal grower -31
Males -16, Females- 15

Group-II : Vertical grower -30
Males – 17, Females- 13

Sample Size Calculation :

- The sample size is calculated using G- power software and found to be 61.
- Total sample size = 61
- Number of groups = 2
- Sampling units per group = 30
- Alpha error at 5% significance level (95% confidence) = 0.005
- Beta error at 95% (power of the study) = 0.95
- Effect size : f = 0.4288

MATERIALS AND METHODS:

The study samples were collected from the patients reporting to the Department of Orthodontics and Dentofacial Orthopedics, Best Dental Science College & Hospital, Madurai. Study models and pretreatment lateral cephalograms were collected and measurements were made.

Figure 1: Represents measurements of inter canine width on mandibular model.

Figure 2: Represents the measurements of inter premolar width in labial aspect

Statistical Methods :

Student t -test was used to find statistical significance in maxillary and mandibular arch width differences in males and females.

RESULTS:

Table-1 Mean Values And Standard Deviation Of The Arch Width In The Maxillary Arch For Males And Females

PARAMETRS	MALE		FEMALE		P value
	MEAN	S.D	MEAN	S.D	
ICW(CT)	33.89	2.56	32.12	2.53	0.002
ICW(MB)	36.56	2.33	34.75	2.28	0.003
FPW(BCT)	42.25	2.65	38.56	2.56	0.002
FPW(MB)	38.80	3.45	41.20	3.22	0.002
SPW(BCT)	45.56	3.39	43.56	2.20	0.010
SPW(MB)	46.89	3.43	45.06	2.33	0.012
IMW(MBCT)	50.23	3.65	49.06	3.03	0.008
IMW(CF)	43.34	3.09	42.67	2.86	0.005
IMW(MB)	56.09	4.18	52.35	2.87	0.009
IMW(ML)	45.80	4.76	37.42	2.45	0.009

Table -2 Mean And Standard Deviation Of Arch Width In The Mandibular Arch For Males And Females

PARAMETRS	MALE		FEMALE		P value
	MEAN	S.D	MEAN	S.D	
ICW(CT)	25.45	2.03	25.45	2.23	0.003
ICW(MB)	28.35	2.45	28.27	2.43	0.002
FPW(BCT)	32.15	2.28	30.56	2.77	0.002
FPW(MB)	34.80	2.78	32.45	3.22	0.002
SPW(BCT)	34.78	3.13	35.27	3.33	0.034
SPW(MB)	41.20	3.01	40.05	3.89	0.009
IMW(MBCT)	41.30	3.46	39.16	2.88	0.011
IMW(CF)	39.56	3.29	35.78	1.54	0.020
IMW(MB)	48.19	3.89	45.19	3.44	0.032
IMW(ML)	31.67	2.47	30.29	1.78	0.027

Table -3 Maxillary Arch Width Measurements In Millimeters For Low And High Mp –sn Angle In Males

PARAMETRS	Horizontal Growers		Vertical Growers		P value
	MEAN	S.D	MEAN	S.D	
ICW(CT)	35.45	1.39	33.45	1.18	0.002
ICW(MB)	39.12	2.18	34.50	1.37	0.005
FPW(BCT)	39.34	2.30	36.9	2.95	0.003
FPW(MB)	43.20	2.45	40.12	2.90	0.002
SPW(BCT)	44.18	2.67	44.32	3.12	0.025
SPW(MB)	49.34	2.33	46.13	3.33	0.035
IMW(MBCT)	51.37	2.22	49.22	3.52	0.035
IMW(CF)	46.19	2.19	44.35	3.30	0.011
IMW(MB)	56.35	3.48	50.12	2.27	0.013
IMW(ML)	39.37	3.02	36.34	4.28	0.009

Table -4 Mandibular Arch Width Measurements In Millimeters For Low And High Mp –sn Angle In Males

PARAMETRS	Horizontal Growers		Vertical Growers		P value
	MEAN	S.D	MEAN	S.D	
ICW(CT)	27.45	2.14	26.32	2.13	0.007
ICW(MB)	29.12	2.32	27.25	3.22	0.009
FPW(BCT)	33.37	3.17	33.01	3.85	0.002
FPW(MB)	35.12	3.33	36.15	2.82	0.005
SPW(BCT)	38.45	4.17	35.48	3.17	0.010
SPW(MB)	39.15	2.17	40.34	4.27	0.029
IMW(MBCT)	45.25	2.38	43.12	3.98	0.012
IMW(CF)	40.32	2.37	36.19	3.26	0.009
IMW(MB)	49.15	2.12	47.82	3.13	0.008
IMW(ML)	31.27	2.32	30.19	2.17	0.005

Table- 5 Maxillary Arch Width Measurements In Millimeters For Low And High Mp –sn Angle In Females.

PARAMETRS	Horizontal Growers		Vertical Growers		P value
	MEAN	S.D	MEAN	S.D	
ICW(CT)	32.18	1.37	30.64	1.26	0.002
ICW(MB)	35.25	1.28	38.27	2.05	0.006
FPW(BCT)	39.17	2.98	35.28	1.35	0.003
FPW(MB)	43.28	2.32	36.9	1.28	0.003
SPW(BCT)	44.26	2.45	40.26	2.36	0.002
SPW(MB)	49.18	3.67	43.91	2.86	0.009
IMW(MBCT)	44.38	2.30	46.50	1.82	0.008
IMW(CF)	49.32	4.35	40.12	2.82	0.013
IMW(MB)	35.36	2.08	50.37	1.34	0.007
IMW(ML)	41.17	4.33	36.21	2.32	0.012

Table -6 Mandibular Arch Width Measurements In Millimeters For Low And High Mp –sn Angle In Females

PARAMETRS	Horizontal Growers		Vertical Growers		P value
	MEAN	S.D	MEAN	S.D	
ICW(CT)	24.34	2.08	24.32	1.36	0.002
ICW(MB)	25.35	2.19	25.26	1.27	0.003
FPW(BCT)	31.82	2.56	27.30	1.18	0.012
FPW(MB)	34.36	2.17	32.82	1.98	0.011
SPW(BCT)	35.92	3.46	33.12	2.82	0.012
SPW(MB)	38.17	2.07	40.22	3.17	0.013
IMW(MBCT)	43.32	2.76	41.46	1.87	0.009
IMW(CF)	35.16	3.08	33.32	2.03	0.010
IMW(MB)	44.32	1.19	46.17	2.36	0.011
IMW(ML)	30.16	1.28	33.46	2.01	0.009

RESULTS:

A Student's t-test was used to determine whether the differences between male and female mandibular arch measurements were statistically significant. It was demonstrated that a p value of less than 0.05 is statistically significant. In both the maxilla and the mandible, the tests revealed that male arch widths were larger in dimensions than female arch widths for all parameters and this difference was statistically significant. A total of 61 samples were included in the study. The mandibular plane angles were used to further differentiate these samples. For the study 16 males and 15 females were included in horizontal growing individuals, 17 males and 13 females were included in vertical growing individuals.

The mean maxillary and mandibular arch width measurements for men with low and high mandibular plane angles are displayed in Tables 3 and 4. Low angle cases had the widest maxillary and mandibular arch measurements followed by high angle cases. The table above shows that measures of arch width decrease with increasing mandibular plane angle for both the maxilla and the mandible.

The average measures of the maxillary and mandibular arches for girls with low and high mandibular plane angles are shown in Tables 5 and 6. Low angle cases had the widest measures of the maxillary arch followed by high angle cases. When it comes to the mandibular arch, cases with high angles follow low angle cases in terms of width measurements. According to the average of all the findings, the arches were broader in low angle scenarios than in high angle ones. As the mandibular plane angle increases in females, the maxilla and mandible's arch width measurements decrease.

DISCUSSION:

The study was conducted to find whether there is a relationship between arch width and vertical facial morphology as well as whether there is a variation in arch width between men and women. The students t-test was performed to determine the differences in arch width between men and women, the results were statistically significant (p value less than 0.05) in both the mandibular and maxillary arches. Participants with low mandibular plane angles had the greatest arch width, followed by those with high mandibular plane angles.

Virligo (1994) studied the shape of the dental arches in healthy permanent human dentition. Gender differences were particularly noted in maxillary arch, Male mean curves were larger than the females particularly in the maxillary arch. Mandibular mean curves showed less gender differences.The study results were in par with this study[6].

Mandava Prasad (2013) examined the differences in dental arch width between different skeletal models in the South Indian population and concluded that dental arch width was related to sex, race, and vertical facial morphology. The results showed that female arch widths were significantly smaller than those of males with the P value of < 0.05 and there was a significant decrease in inter arch width as the vertical facial morphology increases in untreated adult in South Indian population The present study too proves the same result[7]

According to Wei SH significant difference between the inter canine widths in males and females were found. The results states that the male arch widths were larger in size than those of females with the P value of $P < 0.05$. In both males and females, arch width increases by increasing the vertical height. Thus the correlation was found between arch width & vertical facial morphology. Thus the results of the study justifies this study result[11].

Thus the array of literature reveals that there was correlation between the dental arch width and facial pattern.

CONCLUSIONS:

The study results reveal that

Males dental arch widths were larger than the females. When the mandibular plane angle increases in men and females, the arch width tends to decrease. Thus there is a correlation between the dental arch and vertical morphology in males and females.

Thus to maintain the inter canine width & to reduce the relapse tendency which aids in maintaining a stable occlusion, the customized arch forms were indicated based on the pretreatment arch widths.

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