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Original Research Article | **Orthodontics**

Decoding the link between Dental Arch Dimensions and Vertical Facial Morphology in Class II Div 1 Subjects

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Abstract

Proportional equalance in all dimensions i.e transverse, vertical and sagittal, is the foundation for a well-balanced face. In a broader perspective, the vertical dimension is important in determining the harmony and esthetics of the face. Therefore, this study was conducted to evaluate the relationship between dental arch dimensions and vertical facial morphology in Class II Div 1 subjects as determined by the Jarabak ratio and examine the differences in dental arch dimensions between untreated male and female adults. ***Materials and Methods:*** Lateral cephalograms of 60 Indian patients in the age group 18-26 years were taken, The Jarabak ratio was measured on cephalograms of each patient. Based on the measured values, the subjects were divided into three groups – hypodivergent, normodivergent, hyperdivergent growth pattern. Study models were used for measuring the arch dimension. After using One Way ANOVA test, Student's t-test, Post Hoc Tukey test we obtained the results. All statistical analysis done using the software, Statistical Package for Social Sciences (SPSS for Windows - Version 20.0): ***Results****:* After analysing the observations, the following results were obtained: 1)Arch perimeter is highest in normodivergent groups. 2)Intercanine, first intermolar is highest in normodivergent male groups. 3)First intermolar, arch length is highest in normodivergent female. 4)Overbite is highest in hypodivergent groups. 6)Palatal height and Jarabak's ratio is highest in hypodivergent females. ***Conclusion:*** It was concluded from the study that the vertical face morphology and gender is associated with dental arch dimension. Thus, customization of archwires and using individualized arch wires according to each patient's pre-treatment arch form and arch width is beneficial during orthodontic treatment.

Keywords: Proportional equalance, female adults, hypodivergent females.

INTRODUCTION

The goal of Orthodontic treatment is to obtain the Functional Efficacy, Esthetic harmony and Structural balance as per the Jackson's triad. One of the key determinants in treatment selection is the individual's facial pattern as it influences:

1. Anchorage system
2. Growth prediction of maxillofacial structures
3. Treatment outcome

The arch form of each individual is primarily an important aspect in Orthodontics as it is related to the future growth. However, the change in arch form has been traditionally found in treatment outcomes with respect to the arch width, length and perimeter. Arch form has been equated by Penrose [1] as 'Form=Size+Shape'. Usually, the Dental arches are adapted to varying Jaw relationships to maintain normal interrelationship between arches for the purpose of function and stability.

Schudy [2] described the extremes of vertical facial dysplasia as:

1. Hypodivergent
2. Hyperdivergent

Opdebeeck [3] classified the vertical dysplasia as:

1. Short face Syndrome (SFS)
2. Long face Syndrome (LFS)

Schudy characterized the hypodivergent subjects by a forward rotating mandible due to relatively large vertical condylar growth along with small amount of vertical growth of alveolar process usually associated with the anterior facial sutures. The hyperdivergent subjects are characterized by backward rotating mandible due to opposite differential growth pattern. The facial pattern and dental arch form influences the Diagnosis and treatment plan. According to Rickett's [4] a long face or Leptoprosopic individual usually presents with narrower arch dimensions and a short face or Euryprosopic individual has wider arch dimensions.

MATERIALS AND METHODS

Inclusion criteria

- All permanent teeth should be present in each arch [3rd Molar may or may not]
- Skeletal relation class II and Angles class II div 1 malocclusion.
- No history of previous orthodontic treatment

Exclusion criteria

- Craniofacial anomalies like cleft lip, palate and syndromes.
- Subjects with deleterious oral habits like mouth breathing, tongue thrusting and thumb sucking.
- History of trauma to dentofacial region.
- Marked jaw asymmetries and TMJ abnormality.

ETHICAL CLEARANCE

The study protocol was reviewed, and ethical clearance was provided by the 'Ethical Committee' of A.J Institute of Medical Sciences.

ARMAMENTARIUM

1. Lateral cephalograms (Kodak 8000C digital panoramic cephalometric system)
2. Acetate matt paper
3. Pencil (0.5 mm lead pencil)
4. Cephalometric tracing kit.

According to the inclusion criteria 60 pre-treatment lateral cephalogram were collected which were above the age of 18 yrs.

The pre-treatment lateral cephalogram were taken with a single digital Photostat (KODAK 8000c machine, 69 kvp, 12MA, 2 sec) (Figure 1), with patient positioned in natural head position and soft tissues at rest.

Manual tracing of the radiograph was done by a single operator on acetate paper using 0.5mm lead pencil (Figure 2).

Study model measurements were performed using a digital caliper (Figure 3).

Based on inclusion criteria, 60 pre-treatments lateral cephalograms and study models will be taken which will be further divided into three groups, based on facial divergence pattern (according to Jarabak's ratio).

- Hypodivergent (Figure 4)
- Normodivergent (Figure 5)
- Hyperdivergent (Figure 6)
- Anterior facial height = N to Me
- Posterior facial height = S to Go

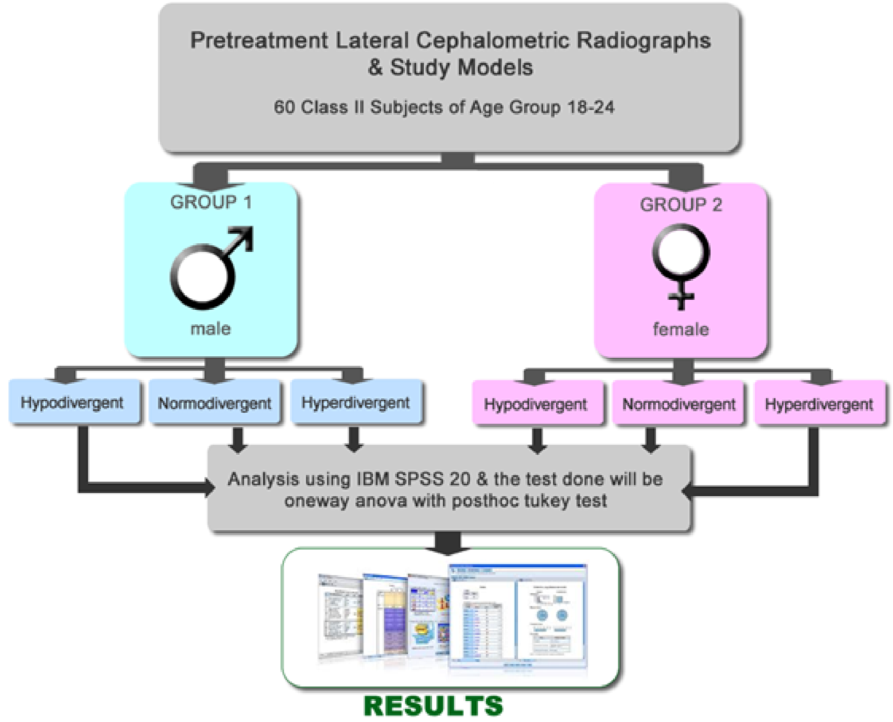
Measurements for Each Subject

1. Intercanine
2. First interpremolar width
3. First intermolar width
4. Arch length
5. Arch perimeter
6. Cumulative mesiodistal crown width
7. Palatal height
8. Overjet and overbite
9. Curve of spee

Data was compiled and statistical analysis was performed to evaluate the correlation of Vertical Facial morphology and dental arch dimension in Class II Div 1 subjects.

STATISTICAL ANALYSIS

- Microsoft Excel was used to compile the data.
- The means and standard deviations of the measured values were obtained using the One-Way ANOVA test.
- Post Hoc Tukey test was done to determine whether there was a significant difference among the three groups.
- All statistical analysis was performed using Statistical Package for Social Sciences software package. (SPSS for Windows - Version 20.0)



ARMAMENTARIUM

Figure 1: Cephalostat

Figure 2: Pencil and eraser

Figure 3: Vernier callipers

NORMODIVERGENT

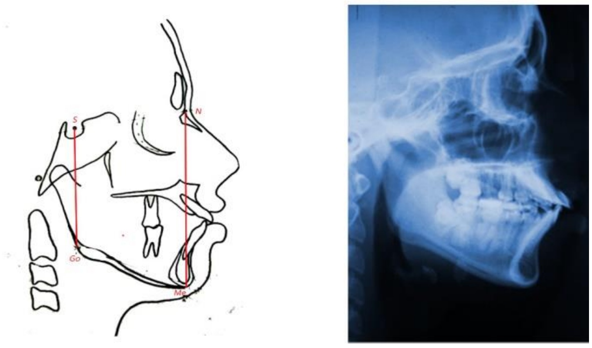


Figure 4

HYPODIVERGENT

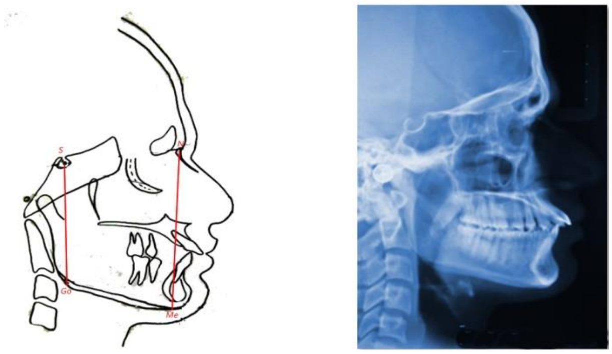


Figure 5

HYPERDIVERGENT

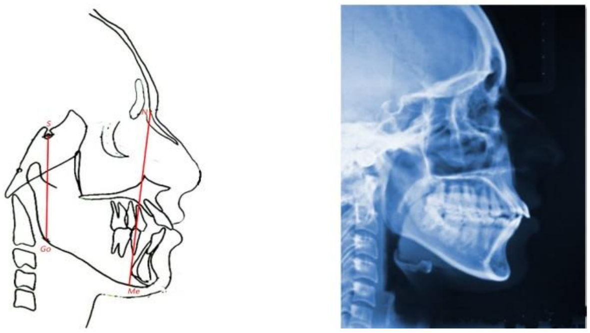


Figure 6

RESULTS

The arch dimension measurements of hypodivergent, normodivergent and hyperdivergent subgroups of males and females are shown in Table 1 (Graph 1, 2 & 3) and Table 2 (Graph 4, 5 & 6).

The arch perimeter measurements in various Subgroups of Males are shown in Table 3 (Graph 7) and subgroups of Females are shown in Table 4 (Graph 8).

The Normodivergent group had much larger arch dimensions than the other two groups except for the maxillary and mandibular arch length which was found to be higher in hyperdivergent female group.

The palatal height and curve of Spee was also higher in hyperdivergent groups especially female groups when the palatal heights were compared.

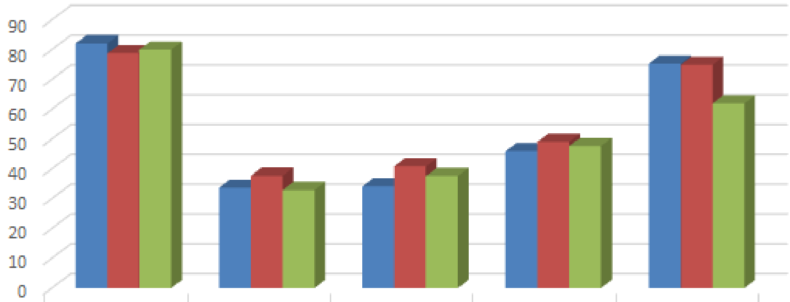
The maxillary and mandibular intercanine, first molar and first premolar is highest in normodivergent groups in both male and female groups.

The maxillary and mandibular arch perimeter measurements among males and female groups are depicted in Table 5 (Graph 9).

It was clearly demonstrated that males had larger maxillary arch dimensions than females.

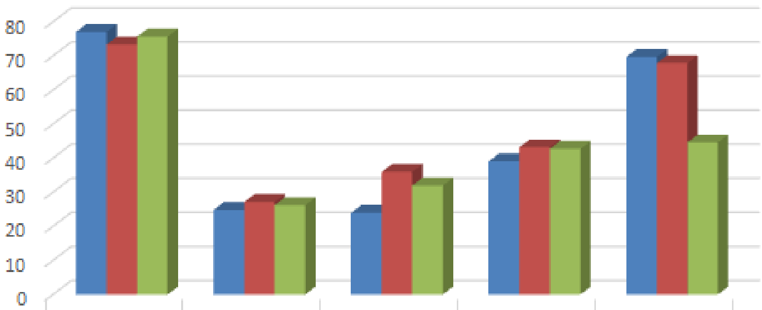
Table 1: Comparison in Females One Way Anova Test with Posthoc Tukey Test

	GROUPS	**N**	**Mean**	**Std. Deviation**	**Statistics/ mean squares**	**df2(welch) / F(Anova)**	**P VALUE**
Cumulative mesiodistal Crown width [TTM]	Hyperdivergent	7	82.14286	3.532165	22.527	0.392	0.68
	Normodivergent	9	78.77778	8.584547			
	Hypodivergent	14	80	8.264847			
	Total	30	80.13333	7.421931			
Intercanine width	Hyperdivergent	7	33.61429	2.468082	2.37	13.401	0.131
	Normodivergent	9	37.67778	6.173082			
	Hypodivergent	14	32.88571	2.476616			
	Total	30	34.49333	4.370744			
First interpremolar width	Hyperdivergent	7	34.1	5.021952	90.806	1.879	0.172
	Normodivergent	9	40.87778	8.397883			
	Hypodivergent	14	37.6	6.732242			
	Total	30	37.76667	7.159095			
First intermolar width	Hyperdivergent	7	45.94286	2.665744	18.806	0.688	0.511
	Normodivergent	9	49.03333	5.867921			
	Hypodivergent	14	47.65714	5.684218			
	Total	30	47.67	5.172017			
Arch Length	Hyperdivergent	7	75.31429	17.39611	1.926	15.265	0.15
	Normodivergent	9	74.94444	12.67982			
	Hypodivergent	14	61.94286	20.53843			
	Total	30	68.96333	18.45783			
Cumulative mesiodistal Crown width [TTM]	Hyperdivergent	7	77.02857	4.740504	0.854	17.084	0.579
	Normodivergent	9	73.31333	6.424453			
	Hypodivergent	14	75.67429	8.550212			
	Total	30	75.282	7.128843			
Intercanine width	Hyperdivergent	7	24.77143	2.106905	0.911	15.59	0.422
	Normodivergent	9	27.1	6.492111			
	Hypodivergent	14	26.18857	3.579288			
	Total	30	26.13133	4.362052			
First interpremolar width	Hyperdivergent	7	23.93429	2.699425	289.161	7.347	**0.003**
	Normodivergent	9	35.93333	6.568485			
	Hypodivergent	14	31.92	7.199538			
	Total	30	31.26067	7.522464			
First intermolar width	Hyperdivergent	7	39.05714	3.79511	39.606	1.508	0.239
	Normodivergent	9	43.15556	5.756325			
	Hypodivergent	14	42.68571	5.24373			
	Total	30	41.98	5.213272			
Arch Length	Hyperdivergent	7	69.64286	18.92686	2163.414	6.547	**0.005**
	Normodivergent	9	67.85556	15.20815			
	Hypodivergent	14	44.6	19.4578			
	Total	30	57.42	21.37382			
Overjet	Hyperdivergent	7	6.42857	1.812654	1.698	0.196	0.823
	Normodivergent	9	7.33333	3.464102			
	Hypodivergent	14	6.78571	3.017349			
	Total	30	6.86667	2.861557			
Overbite	Hyperdivergent	7	3.85714	1.214986	7.564	3.29	0.053
	Normodivergent	9	4	1.322876			
	Hypodivergent	14	5.35714	1.736803			
	Total	30	4.6	1.631585			
Palatal height	Hyperdivergent	7	16.14286	1.345185	0.17	16.924	0.873
	Normodivergent	9	16.77778	2.905933			
	Hypodivergent	14	16.14286	3.655494			
	Total	30	16.33333	2.963378			
Curve of spee	Hyperdivergent	7	3.42857	0.9759	0.37	0.545	0.586
	Normodivergent	9	3.11111	0.927961			
	Hypodivergent	14	3.03571	0.664029			
	Total	30	3.15	0.811023			
JARABAK'S RATIO	Hyperdivergent	7	56.06%	1.60%	72.109	16.476	**<0.001**
	Normodivergent	9	62.06%	1.41%			
	Hypodivergent	14	67.71%	2.82%			
	Total	30	63.30%	5.21%			



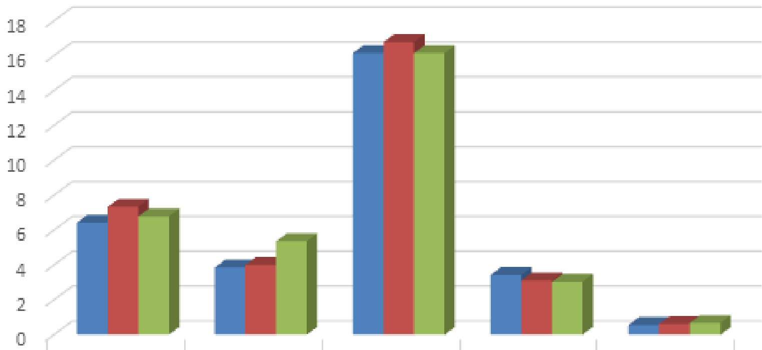
	Cumulative mesiodistal Crown width [TTM]	Intercanine width	First interpremolar width	First intermural width	Arch Length
Hyperdivergent	82.14286	33.61429	34.1	45.94286	75.31429
Normodivergent	78.77778	37.67778	40.87778	49.03333	74.94444
Hypodivergent	80	32.88571	37.6	47.65714	61.94286

Graph 1



	Cumulative mesiodistal Crown width [TTM]	Intercanine width	First interpremolar width	First Intermolar width	Arch Length
Hyperdivergent	77.02857	24.77143	23.93429	39.05714	69.64286
Normodivergent	73.31333	27.1	35.93333	43.15556	67.85556
Hypodivergent	75.67429	26.18857	31.92	42.68571	44.6

Graph 2

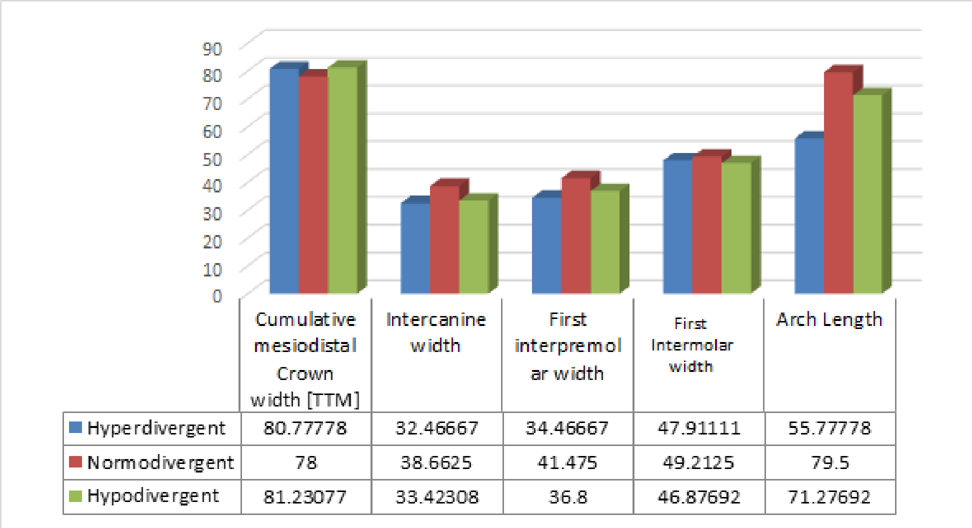


	Overjet	Overbite	Palatal height	Curve of spee	JARABAK'S RATIO
Hyperdivergent	6.42857	3.85714	16.14286	3.42857	56.06%
Normodivergent	7.33333	4	16.77778	3.11111	62.06%
Hypodivergent	6.78571	5.35714	16.14286	3.03571	67.71%

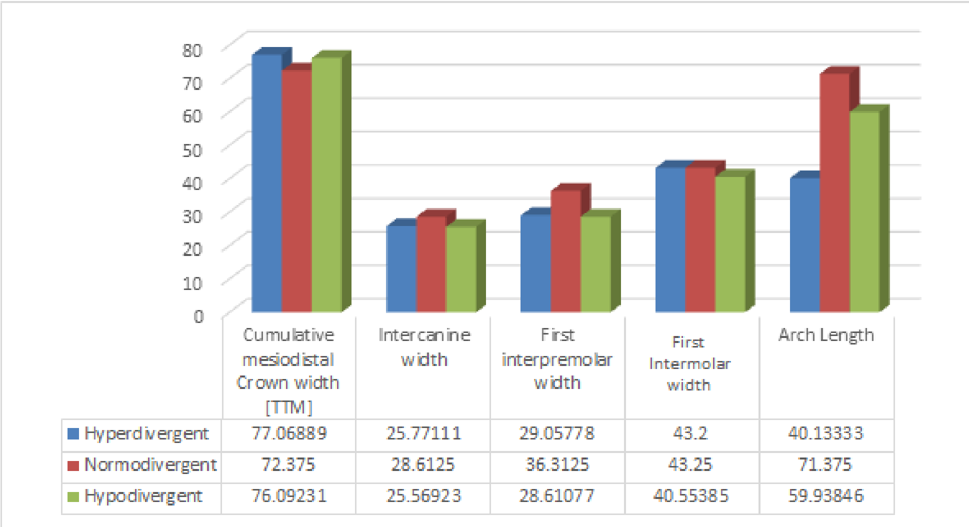
Graph 3

Table 2: Comparison in Males One Way Anova with Posthoc Tukey Test

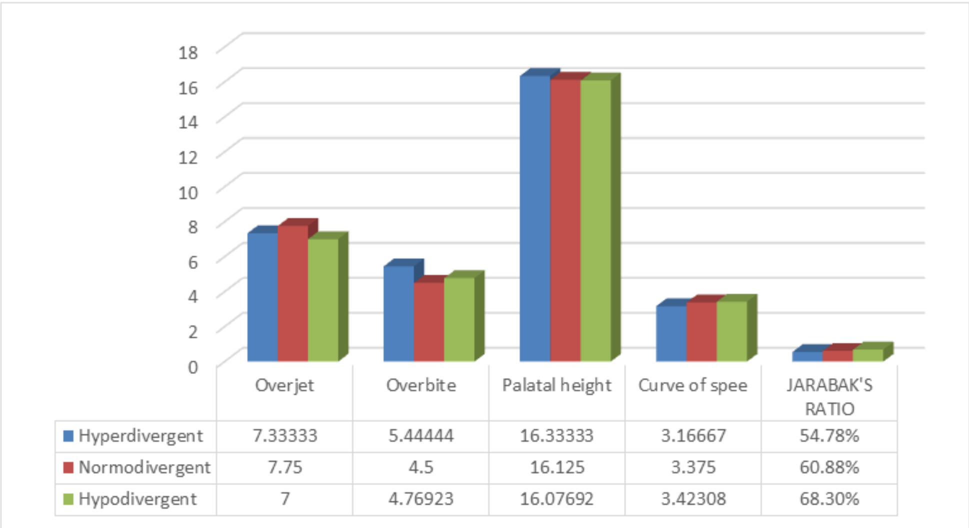
	GROUPS	N	Mean	Std. Deviation	Statistics/ mean squares	df2(welch) / F(Anova)	P VALUE
Cumulative mesiodistal Crown width [TTM]	Hyperdivergent	9	80.77778	8.120618	27.752	0.618	0.546
	Normodivergent	8	78	4.105745			
	Hypodivergent	13	81.23077	6.869666			
	Total	30	80.23333	6.610771			
Intercanine width	Hyperdivergent	9	32.46667	2.382226	3.807	14.12	**0.048**
	Normodivergent	8	38.6625	5.794563			
	Hypodivergent	13	33.42308	2.463451			
	Total	30	34.53333	4.331627			
First interpremolar width	Hyperdivergent	9	34.46667	8.688067	1.363	13.442	0.158
	Normodivergent	8	41.475	8.771016			
	Hypodivergent	13	36.8	5.200481			
	Total	30	37.34667	7.615308			
First intermolar width	Hyperdivergent	9	47.91111	5.244627	13.573	0.502	0.611
	Normodivergent	8	49.2125	6.246699			
	Hypodivergent	13	46.87692	4.442813			
	Total	30	47.81	5.109852			
Arch Length	Hyperdivergent	9	55.77778	21.22715	6.025	14.074	**0.013**
	Normodivergent	8	79.5	4.105745			
	Hypodivergent	13	71.27692	18.64158			
	Total	30	68.82	18.95067			
Cumulative mesiodistal Crown width [TTM]	Hyperdivergent	9	77.06889	9.01131	1.531	16.484	0.246
	Normodivergent	8	72.375	4.501984			
	Hypodivergent	13	76.09231	6.910193			
	Total	30	75.394	7.117282			
Intercanine width	Hyperdivergent	9	25.77111	3.330978	0.403	13.633	0.676
	Normodivergent	8	28.6125	9.043299			
	Hypodivergent	13	25.56923	3.102253			
	Total	30	26.44133	5.344548			
First interpremolar width	Hyperdivergent	9	29.05778	8.623911	166.362	3.101	0.061
	Normodivergent	8	36.3125	6.915911			
	Hypodivergent	13	28.61077	6.575092			
	Total	30	30.79867	7.837334			
First intermolar width	Hyperdivergent	9	43.2	4.835545	26.257	0.952	0.398
	Normodivergent	8	43.25	6.146311			
	Hypodivergent	13	40.55385	4.940246			
	Total	30	42.06667	5.242027			
Arch Length	Hyperdivergent	9	40.13333	18.01874	12.495	14.933	**0.001**
	Normodivergent	8	71.375	5.527529			
	Hypodivergent	13	59.93846	22.81084			
	Total	30	57.04667	21.48051			
Overjet	Hyperdivergent	9	7.33333	2.44949	1.4	0.215	0.808
	Normodivergent	8	7.75	2.915476			
	Hypodivergent	13	7	2.380476			
	Total	30	7.3	2.479572			
Overbite	Hyperdivergent	9	5.44444	1.333333	2.085	0.846	0.44
	Normodivergent	8	4.5	1.690309			
	Hypodivergent	13	4.76923	1.640825			
	Total	30	4.9	1.561388			
Palatal height	Hyperdivergent	9	16.33333	3.316625	0.184	0.022	0.978
	Normodivergent	8	16.125	2.295181			
	Hypodivergent	13	16.07692	2.841993			
	Total	30	16.16667	2.767837			
Curve of spee	Hyperdivergent	9	3.16667	0.5	0.184	0.315	0.732
	Normodivergent	8	3.375	1.06066			
	Hypodivergent	13	3.42308	0.702559			
	Total	30	3.33333	0.74664			
JARABAK'S RATIO	Hyperdivergent	9	54.78%	2.05%	0.05	83.06	**<0.001**
	Normodivergent	8	60.88%	1.64%			
	Hypodivergent	13	68.30%	3.01%			
	Total	30	62.26%	6.31%			



Graph 4



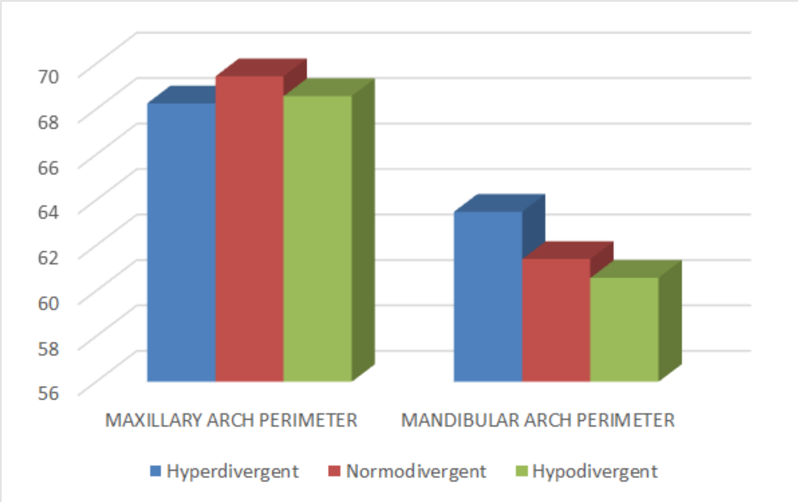
Graph 5



Graph 6

Table 3: Arch Perimeter Comparison - Females

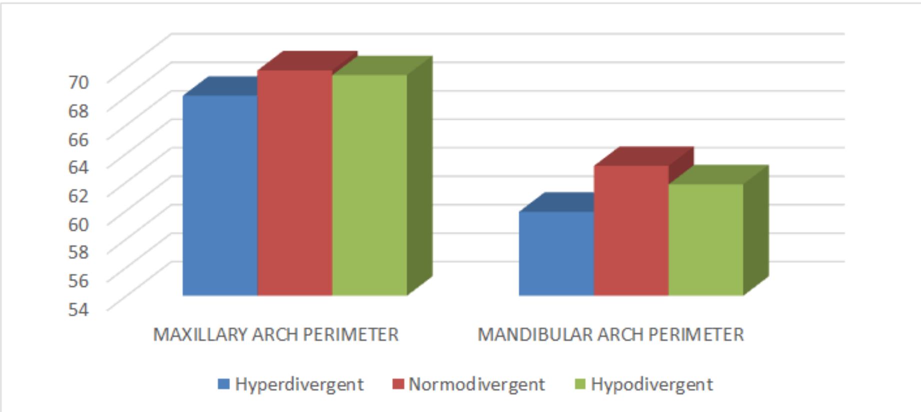
	GROUPS	N	Mean	Std. Deviation	Statistics/ mean squares	df2(welch) / F(Anova)	P VALUE
MAXILLARY ARCH PERIMETER	Hyperdivergent	7	68.2571	2.05982	3.242	0.271	0.765
	Normodivergent	9	69.4444	3.5788			
	Hypodivergent	14	68.5714	3.87565			
	Total	30	68.76	3.37165			
MANDIBULAR ARCH PERIMETER	Hyperdivergent	7	63.4857	3.23853	19.881	1.493	0.243
	Normodivergent	9	61.4	2.68654			
	Hypodivergent	14	60.5714	4.28727			
	Total	30	61.5	3.71103			



Graph 7

Table 4: Arch Perimeter Comparison - Males

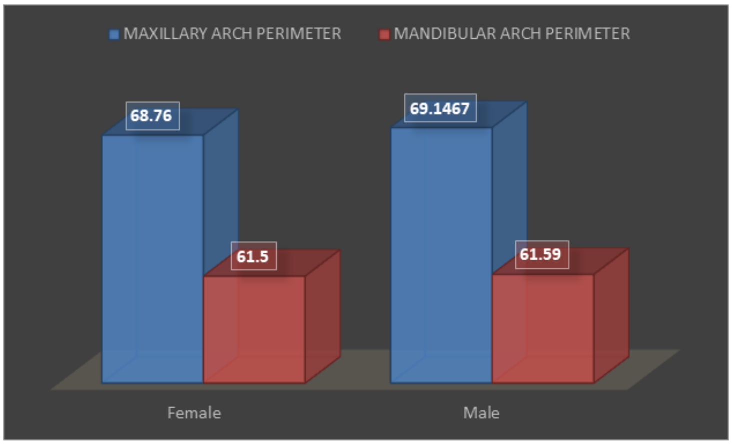
	GROUPS	N	Mean	Std. Deviation	Statistics/ mean squares	df2(welch) / F(Anova)	P VALUE
MAXILLARY ARCH PERIMETER	Hyperdivergent	9	68.0444	3.62702	8.084	0.574	0.57
	Normodivergent	8	69.825	2.32855			
	Hypodivergent	13	69.4923	4.44475			
	Total	30	69.1467	3.69732			
MANDIBULAR ARCH PERIMETER	Hyperdivergent	9	59.9	4.04413	22.478	1.47	0.248
	Normodivergent	8	63.1125	3.74182			
	Hypodivergent	13	61.8231	3.9156			
	Total	30	61.59	3.97313			



Graph 8

Table 5: Independent T Test for Male Female Comaprison

	gender	N	Mean	Std. Deviation	T	df	P VALUE
MAXILLARY ARCH PERIMETER	Female	30	68.76	3.37165	-0.423	58	0.674
	Male	30	69.1467	3.69732			
MANDIBULAR ARCH PERIMETER	Female	30	61.5	3.71103	-0.091	58	0.928
	Male	30	61.59	3.97313			



Graph 9

DISCUSSION

Facial morphology is unique to every individual in the world. The proportional relationship between facial height and width is the first step in facial evaluation during orthodontic diagnosis [5].

The facial growth patterns differs from individual to individual and the variations in the dentofacial patterns are quite high. The assessment of relationship of dental arch dimensions with vertical dentofacial pattern is essential to understand the variation in size and shape of dental arches. Research has established the importance of vertical dimension [6].

It has been suggested that subject with a high MP-SN angle tends to have a longer face and a narrower arch dimension and one with a low MP-SN angle tends to have a shorter face and wider arch dimensions [6]. A well-established sexual dimorphism in the arch dimensions has been found to exist in the vertical plane [7].

Traditionally change in the arch form has been analysed in terms of the behaviour of various linear dimensions such as arch width, arch length. The two extremes of the vertical facial dysplasia have been described as hypodivergent, hyperdivergent by Schudy or Opeedbeeck [8].

Understanding the facial proportion can be the key to both diagnosis and treatment of an orthodontic patient. Renowned artists and architects have used the "golden ratio" to map out their master pieces. With the increased use of arch wires to correct transverse dimensions of the dental arches the increased knowledge of a link between facial proportion and dental arch width can be of immense help to orthodontists [9].

It is generally expected that a relationship exist between dental arch dimension and vertical facial morphology, also the subjects were segregated according to sex to maintain the homogeneity of the sample [10].

In the present study the male and female groups were further subdivided into 3 subgroups: Hypodivergent, Normodivergent, and Hyperdivergent on the basis of Jarabak ratio because it is a reliable measurement, constructed from anatomic landmarks (Bishara and Jacobsen 1985) and the chance of the human error is also minimized by using a ratio instead of linear parameter [11].

When inter group comparison were done between subgroups hypodivergent, normodivergent and hyperdivergent of both male and female groups, it showed maxillary arch perimeter is highest in normodivergent, while mandibular arch perimeter is highest in hyperdivergent groups, while comparing between male and female groups arch perimeter is highest in male groups. But they are statistically insignificant.

Cumulative mesiodistal width is highest in maxillary arch of both male and female hyperdivergent groups while in male mandibular arch hypodivergent group shows highest value but is not statistically significant also cumulative mesiodistal width is higher in male group but is statistically insignificant.

Comparison of intercanine width is highest in maxillary arch of normodivergent female group and is statistically significant with p value of 0.022 also normodivergent male group shows statistically significant value of 0.048 while in mandibular arch normodivergent group shows highest value but are statistically insignificant in both male and female groups.

As per the results of this study mean inter-canine width decrease as the vertical angle increases hence individualized arch forms should be used in patients with variable vertical pattern. This confers to the basic law of stability according to which arch dimensions should not be changed especially across the canines [11, 12].

Comparison of interpremolar and intermolar width the normodivergent groups shows highest value but is statistically insignificant. When interpremolar and intermolar are compared between two groups it shows that first interpremolar width is higher in female group and intermolar width is higher in male group.

This shows that, in maxillary and mandibular arches, there was a statistically significant inverse relationship between vertical facial height and dental arch widths among the first premolars and first molars in male and female samples.

Musculature has been considered as the possible link in this close relationship between the transverse dimension and vertical facial morphology. A number of studies have illustrated the influence of masticatory muscles on craniofacial growth. The general consensus is that individuals with strong or thick mandibular elevator muscles tend to exhibit wider transverse head dimensions. Strong masticatory musculature is often associated with a hypodivergent groups. This muscular hyper-function causes an increased mechanical loading of the jaws. This in turn may cause an introduction of sutural growth and bone apposition which then results in increased transverse growth of the jaws and bone bases for the dental arches. Spronsen *et al*., found that long-faced subjects have significantly smaller masseter and medial pterygoid muscles than normal subjects [13-16].

Comparison of arch length between three subgroups shows that hyperdivergent group has the highest value with a statistically significant p value of 0.005 in females and in males normodivergent groups shows statistically significant with p value of 0. 013. Comparison of arch length between two groups shows that arch length is higher in female group with at value of 0.03 and is statistically non-significant with a p value of 0.976.

Comparison of overjet between subgroups shows that normodivergent group has the highest value but is statistically insignificant also comparison of overjet between groups shows highest value in male group but is statistically insignificant.

The association between extreme overjet and a vertical facial pattern may be the result of abnormal muscle function such as altered tongue posture related to mouth breathing and tongue thrust swallowing [17].

Overbite is more in hypodivergent groups which indicates that there is increase in overbite with decrease vertical dimension also the hyperdivergent subjects were associated with longer anterior and posterior alveolar heights that will result in dental open bite or reduced overbite in these subjects [18, 19].

Palatal height shows highest value in normodivergent females and hyperdivergent Males but are statistically insignificant. Bone growth and osseous. Remodelling of the palatal base are important to compensate for the increase in height and transverse loss in the long term. With regard to orthodontic therapy, Mechanical procedures for widening the palatal base associated with vertical Control are beneficial for class II treatment and stability over the long term [20, 21].

Curve of spee is highest in hyperdivergent groups and Jarabak’s ratio is significant in hypodivergent groups. Schudy (1968) described the importance of dentoalveolar dimension to establish the overbite. The possible explanation for increase curve of spee in hyperdivergent subjects was that, because of vertical skeletal dysplasia’s, the natural dentoalveolar compensation in mandibular anterior region will take place to establish a normal overbite [2].

A possible explanation to our findings regarding the different influence of the vertical facial pattern on arch dimensions for both the sexes can be attributed to the different impact of genetic factors on males and females (Carels C 2001) [7].

The results of present study provide normative data for the arch dimensions of hypodivergent, normodivergent and hyperdivergent male and female subjects the study also provides a comparative evaluation of arch dimension in different vertical facial pattern which is an important adjunct for selection of treatment plan.

People from different ethnic groups present with different physiologic conditions, and clinician should anticipate the difference in size and form rather than treating all cases to a single ideal.

The limitations of present study must be acknowledged because of the large individual variation encountered and dental arch dimensions are certainly a multifactorial phenomenon. The general theory is that individuals with strong or thick mandibular elevator muscles tend to exhibit wider transverse head dimensions.

This study can be more exhaustive by observing the effect of the muscle activity (Using ultrasonography) on arch dimensions in different dentofacial patterns.

CONCLUSION

From the total observations and measurements from the study, it was concluded that:

1. Arch perimeter in normodivergent group of maxillary and mandibular arch shows the highest value followed by hypodivergent and hyperdivergent in males as well as females.
2. Maxillary and mandibular intercanine, first interpremolar, first intermolar, is highest in normodivergent groups of both males and females.
3. Maxillary and mandibular arch length is highest in hyperdivergent females while in males it is highest in normodivergent groups.
4. The overbite has negative correlation with vertical facial height for both the sexes. This concludes that overbite was more in hypodivergent as compared with hyperdivergent subjects.
5. Palatal height is more in hyperdivergent males and shallow in hypodivergent male groups.
6. Curve of spee is highest in hyperdivergent female groups, while when compared with total group curve of spee is more in male groups.
7. Palatal height and Jarabak's ratio are more in female groups while Jarabak's ratio is significant in hypodivergent groups.

From this study it is concluded that the relationship exist between the dental arch dimensions and vertical facial morphology and gender. Thus, individualized arch wires according to each patient's pre-treatment arch form and width is suggested for better treatment outcome during orthodontic treatment.

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