ORIGINAL ARTICLE

RELATIONSHIP OF VERTICAL PROPORTIONS AND ARCH FORMS IN SKELETAL CLASS II IN A SAMPLE OF LOCAL POPULATION

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ABSTRACT

A well-balanced face has its good proportions in all three planes of space, i.e. transverse, sagittal and vertical. The vertical proportions of the face are important in determining the esthetics and harmony of the face. Dental arch form is a reflection of underlying bone morphology, size and its shape. Correct identification of patient's arch form is an important aspect of achieving a stable, functional and esthetic orthodontic treatment result. The objective of current study was to determine a relationship between vertical proportions and arch form in skeletal class II in local Pakistani population. A sample of 100 nontreated skeletal class II patients fulfilling all the inclusion and exclusion criteria were selected.

Lateral head cephalograms and pre-treatment plaster study models were measured. For each subject, Sella Nasion- mandible plane angle (SN-MP) was measured. Angular measurements and linear relationships were measured manually on both dental arches. Intermolar, inter canine and anterior angle were measured. A weak but significant (r=0.23)correlation between anterior mandibular angle and SN-MP was observed, with increase in SN-MP, the intermolar and intercanine distance was decreased in maxilla and mandibular arch.

Intercanine, intermolar widths and anterior angle values calculated on the maxillary and mandibular casts of individuals with different facial forms show no significant difference statistically. A weak but significant correlation(r=0.23) was found between anterior mandibular angle and SN-MP.

Key Words: *Skeletal class II, vertical proportions, arch form.*

INTRODUCTION

Vertical proportion of an individual determines his/her facial form which in turn can determine the future growth direction and treatment selection as it can affect the type of anchorage required and goals of treatment.[1] A well-balanced face has its good proportions in all three dimensions of space, i.e. transverse, sagittal and vertical. The vertical proportions of the face are important in determining the esthetics and harmony of the face.[2] Vertical facial forms have been described as hypodivergent, hyperdivergent and normodivergent or short angle, long angle and normal angle by different authors.[3]

Hypodivergent showed an increased vertical condylar growth and diminished vertical growth of alveolar process and/or anterior facial sutures. On the other hand, hyperdivergent facial form is the result of backward mandibular rotation, decreased condylar growth and enhanced vertical growth of alveolar process and/or anterior facial sutures.[2]

Dental arch form is a reflection of underlying bone morphology.[4] Penrose described arch form as size and shape of the underlying bone.[5] Arch form has also been defined as the position and relationship of teeth to each other in all three dimensions.[6] Correct identification of patient's arch form is an important aspect of achieving a stable, functional and esthetic orthodontic treatment result. Furthermore, its importance lies in the fact that it helps to select individualized arch wires which helps to respect the individual's arch form to prevent relapse and iatrogenic damage to teeth moving beyond their bone edges.[7] A research conducted on Southern European population revealed that no preformed arch form exactly fit to the Patients.[8]

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Arch form can be determined by measuring linear distances, like intercanine and intermolar widths. It was concluded that dental arch width is associated with vertical morphology.[3]

Anwar & Fida conducted a study in 2010 postulated that the long face and short face individual predominantly had wide arches while normodivergent have variable arch forms.[4] It has been reported that, long face usually have decreased intermolar width in upper arch while increased intermolar widths were found in subjects with decreased vertical proportions.[9,10] Multiple epigenetic and environmental factors that come into play in the formulation of the ultimate arch form of an individual and therefore, a particular arch form for the particular face type could not be found.[4] A study conducted by Parsad on South Indian population concluded that there is difference in interarch width according to ethnicity and race.[11]

In previous studies the relationship of vertical dimension and various arch forms has been identified in Caucasians[7] but arch form and vertical proportion specifically in skeletal Class II has not been studied in Pakistani local population till date. In this study, the aim was to find out relation between the facial forms and transverse dimensions of arch forms in Angle's skeletal class II patients in a sample of Lahore population.

METHODOLOGY

A sample of 100 untreated Pakistani subjects with class II malocclusion (ANB ≥ 6°), aged between 11 and 30 years was collected from Outdoor Department of de,Montmorency College of Dentistry, Lahore, Pakistan. Subject fulfilling the inclusion criteria i.e; permanent dentition (except third molars), pre-treatment lateral cephalograms, dental casts and clinical photographs and subjects who had consented to participate in the study were selected for the study. While the exclusion criteria were subjects with dental malformations, craniofacial syndromes, edentulous spaces and previous history of orthodontic treatment.

The sample of subjects for descriptive purpose was divided into 3 groups according to value of angle SNMP. SNMP>35° was high angle subjects whereas ≤SNMP≤35° and SNMP<30° were medium angle and low angle subjects respectively.

MEASUREMENTS

Lateral head cephalograms and pre-treatment plaster study models were measured. For each subject, SN-MP angle was measured. The shape of dental arches was measured on patients' plaster models. The evaluation of dental arch was done on the basis of angular measurements and linear relationships measured manually. The analysis was performed on both dental arches, upper and lower independently. Intercanine width was measured with divider tips placed on cusp tips of canines of same arch and measured on a ruler. While, for intermolar width, divider tips are placed on central fossa of molars in the same arch and measured on a ruler (Fig 1).[12] Anterior angle is measured by placing 2 rulers on cusp tips of canines and interincisal contact point and the angle formed between the 2 rulers is measured.

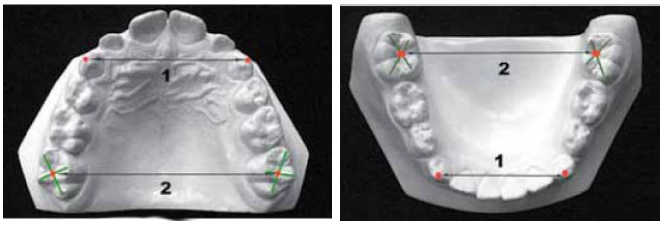
Descriptive statistics, including the mean and standard deviation were calculated for all measurements. Pearson correlation was used to analyze the relationship between the arch form and the facial vertical dimension. The differences between the three groups were identified through an analysis of variance (ANOVA) followed by post hoc Bonferroni tests.

RESULTS

A total of 100 subjects were identified according to inclusion and exclusion criteria. The sample for, descriptive purpose was divided in three groups according to SN-MP angles. SN-MP>35°= 21 subjects, 30° ≤ SN-MP ≤ 35°= 34 subjects and SN-MP<35°= 45 subjects. Descriptive statistics was done for all the measured values in maxilla and mandibular arch (Table 1). The mean anterior angle in maxillary and mandibular arch was 110.84±12.48° and 123.91±13.41° respectively. Whereas intercanine-intermolar distance ration in maxilla was 0.68± 0.09 and 0.76±0.08 in mandible.

While Table 2 revealed that anterior angle is high in high SN-MP (126±15.03º) in mandibular arch but in maxillary arch the higher values were observed in maxillary arch. A higher intercanine intermolar distance ratio was observed in low angle subjects in mandible arch (0.75 ±0.05) while 0.77±0.12 ratio values were observed for medium angle subjects in maxillary arch. Intercanine and intermolar distance increase in mandibular arch as SN-MP decreased and in maxillary arch intermolar and intercanine distance decreased as SN-MP increased.

In Table 3 variance analysis was performed which show an insignificant angular values among the three groups in maxillary and mandibular arch. The value for significance was <0.05. Table 4 showed Pearson cor-



A B

Fig 1: Maxillary and mandibular arch A) 1. intercanine width 2. intermolar width B) 1. intercanine width 2. intermolar width

TABLE 1: DESCRIPTIVE ANALYSIS FOR ANTERIOR ANGLE, INTERCANINE DISTANCE AND INTERMOLAR WIDTH

	Anterior Angle(°)	Intercanine Distance(mm)	Intermolar Distance (mm)	Intercanine-Intermolar Distance Ratio	SN-MP(°)
Mandible					
Number		100	100	100	100
Mean		27.27	40.52	0.76	34.80
Median		27.00	41.00	0.75	35.00
Standard Division		3.51	3.41	0.08	5.92
Minimum		19	28	0.65	21
Maximum		44	50	1.38	49
.Maxilla					
Number		100	100	100	100
Mean		33.94	44.73	0.68	34.80
Median		34.00	45.00	0.66	35.00
Standard Division		3.02	3.80	0.09	5.92
Minimum		27	26	0.49	21
Maximum		42	52	1.10	49

TABLE 2: ANTERIOR ANGLE, INTERCANINE DISTANCE AND INTERMOLAR DISTANCE AMONG THREE VERTICAL PATTERNS IN BOTH ARCHES

	Low SN-MP angle (<30.5°), n = 21			Medium SN-MP angle (30.5° 35.5°), n = 34			High SN-MP angle (>35.5°), n = 45		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Mandible									
Anterior Angle	120.24	121.00	11.53	122.15	125.00	11.54	126.96	126.00	15.03
Intercanine Distance	27.62	27.00	3.63	27.65	27.00	4.19	26.82	27.00	2.86
Intermolar Distance	41.62	42.00	2.91	40.91	41.00	3.05	39.71	40.00	3.73
Intercanine Intermolar Distance Ratio	0.75	0.76	0.05	0.68	0.66	0.10	0.68	0.66	0.09
Maxilla									
Anterior Angle	108.10	104.00	15.00	114.18	110.00	13.05	109.60	109.00	10.33
Intercanine Distance	34.14	34.00	3.23	34.62	34.00	2.94	33.33	33.00	2.92
Intermolar Distance	45.19	45.00	3.43	44.94	46.00	4.48	44.36	44.00	3.44
Intercanine Intermolar Distance Ratio	0.66	0.64	0.07	0.77	0.76	0.12	0.75	0.74	0.59

relation of the relationship between the arch form and the facial vertical dimension. The angle that expresses the anterior arch form is correlated with the variation in facial vertical dimension. The value of negative sign indicated an inverse correlation, for which increasing vertical dimension decreased the value of the ratio, and then the arch appeared narrower in the intercanine area.

TABLE 3: COMPARISION OF ANTERIOR ANGLE, INTERCANINE DISTANCE AND INTERMOLAR DISTANCE IN THREE VERTICAL PATTERNS IN BOTH ARCHES

		Sum of Squares	df	Mean Square	F	Sig.
Mandible						
Anterior Angle	Between Groups	806.205	2	403.102	2.301	.106
	Within Groups	16989.985	97	175.154		
	Total	17796.190	99			
Intercanine Distance	Between Groups	16.415	2	8.208	.663	.518
	Within Groups	1201.295	97	12.384		
	Total	1217.710	99			
Intermolar Distance	Between Groups	60.028	2	30.014	2.674	.074
	Within Groups	1088.932	97	11.226		
	Total	1148.960	99			
Intercanine-Intermolar Distance Ratio	Between Groups	.005	2	.003	.293	.746
	Within Groups	.859	97	.009		
	Total	.864	99			
Maxilla						
Anterior Angle	Between Groups	605.889	2	302.945	1.983	.143
	Within Groups	14815.551	97	152.738		
	Total	15421.440	99			
Intercanine Distance	Between Groups	33.039	2	16.520	1.845	.164
	Within Groups	868.601	97	8.955		
	Total	901.640	99			
Intermolar Distance	Between Groups	12.278	2	6.139	.420	.659
	Within Groups	1419.432	97	14.633		
	Total	1431.710	99			
Intercanine-Intermolar Distance Ratio	Between Groups	.015	2	.007	1.047	.355
	Within Groups	.689	97	.007		
	Total	.704	99			

TABLE 4: RELATIONSHIP BETWEEN SN-MP AND ANTERIOR ANGLE, INTERCANINE WIDTH AND INTERMOLAR WIDTH IN BOTH ARCHES

	SN-MP		
	R	**Sig.**	**R2**
Mandible			
Anterior Angle	0.270*	0.007	0.073
Intercanine Distance	-0.021	0.834	0.0004
Intermolar Distance	-0.164	0.104	0.027
Intercanine-Intermolar Distance Ratio	0.098	0.333	0.010
Maxilla			
Anterior Angle	-0.029	0.773	0.0008
Intercanine Distance	-0.066	0.512	0.004
Intermolar Distance	-0.072	0.479	0.005
Intercanine-Intermolar Distance Ratio	0.000	0.997	0.000

DISCUSSION

This study focused on finding the relation between facial form and arch forms in class II subjects in the local sample.

The present study concluded that mandibular anterior angle increases from 120.2 to 126.9° as the SNMP angle increases; which is in contrast to the results found in previous literature, e.g, by Popa[13], who related narrow arch forms with hyperdivergent facial form. Reason for this contrast was small sample size and racial difference.

Previous literature shows similar studies on Caucasians and mostly concluded that long faces usually have narrower arches. Similar results were obtained in South Indian population.[11] But, in our study no such relation was found in the particular population studied. The results revealed an association between the dental upper arch and the vertical facial pattern.

A weak linear relationship between posterior intermolar width and arch dimensions was noted in a study conducted by Anwar & Fida. These results are similar to the results of the current study as there is no strong relationship can be established therefore, predictability of vertical dimension by posterior intermolar and intercanine width was not achievable.[4]

Previous studies lead to the conclusion that the preformed arch wires do not fit for most of our patients, and their use can produce unfavorable side effects, such as excessive intercanine width.[7] Current study specifically focused on Class II subjects to establish, intercanine and intermolar widths and anterior angle in relation to vertical dimension of face are more accurate for patient inherent muscular balance and, in most cases, dictate the limits of arch expansion in these areas during treatment. Knowledge of individual's facial and arch form is still essential for esthetically improved and stable orthodontic treatment results. Further studies are also required in this aspect on the local population with a greater sample size and with subjects collected from a population sample.

CONCLUSION

The intercanine, intermolar widths and anterior angle values calculated on the maxillary and mandibular casts of individuals with different facial forms show no significant difference statistically. A weak but significant correlation (r=0.23) was found between anterior mandibular angle and SN-MP.

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3 Hareem Sultan:	Conception, data collection and literature review.
4 Ansar Bilal:	Provided substantial help in various aspects.