The characteristics of profile facial types and its relation with mandibular rotation in a sample of Iraqi adults with different skeletal relations

Sara M. Al-Mashhadany, B.D.S., M.Sc. [1]
Nagham M.J. Al- Mothaffar, B.D.S., M.Sc. [2]

ABSTRACT

Background: Facial type plays an important role in the information of an orthodontic treatment plan and prognosis that is whether an individual has long, short or average face and it is not possible to apply the same norms and treatment objective to cases with different facial patterns. This study aims to determine the characteristics of Bimler's facial types (dolichoprosopic, mesoprosopic, leptoprosopic) and their relationship with mandibular rotation in Iraqi adults with different skeletal relations.

Materials and methods: The sample consisted of 230 digital true lateral cephalometric radiographs of age range between 18-30years (104 males and 126 females), the sample was classified according to ANB angle into three skeletal classes (class I, class II and class III) and each class was classified depended on PP-MP angle into three faces. Thirteen cephalometric measurements (five angular, seven linear and one ratio) were measured for each individual radiograph using AutoCAD program 2006.

Results: The mean values of all measurements for males were significantly higher than females, except for the GA, UGA and LGA, The mean values of GA, LGA, AFH and LAFH were high in leptoprosopic face, while their values decreased in dolichoprosopic face and the reversed were found with JR, PFH, RL and MAXL, moreover all these measurements revealed a highly significant difference between the three facial types.

Conclusions: The mandibular rotation was not changed in all skeletal classes that belong to the same facial type as it did not affected by the anteroposterior relation within the same profile

Keywords: Facial type, mandibular rotation, skeletal classes. (J Bagh Coll Dentistry 2012; 24(sp. Issue 1):135-139).

INTRODUCTION

Facial type plays an important role in the information of an orthodontic treatment plan and prognosis, of particular, is the vertical relationship that is whether an individual has long face (leptoprosopic) or short face (dolichoprosopic) or average face (mesoprosopic) and it is not possible to apply the same norms and treatment objective to cases with different facial patterns [1,2].

Dentofacial balance, harmony, and growth and development have been studied by many investigations in four dimensions: height, depth, breadth and time using lateral or profile radiograph [3]. A balanced profile should be one of the key factors in deciding on the methods of treatment for any form of malocclusion, as good occlusion does not necessarily mean good facial balance [4].

The rotation of the mandible resulting from an inharmony between vertical growth and anteroposterior or horizontal growth has important implication in orthodontic treatment, orthodontist must come to consider, understand and appreciate the value of the vertical growth as it relates to an anteroposterior growth. They must constantly seek a deeper understanding into how the total effect of growth in these two directions produces different facial types [5].

(1) MSc student, dep. of Orthodontics, collage of dentistry, university of Baghdad
(2) Professor, dep. of Orthodontics, collage of dentistry, university of Baghdad

The possible association between facial morphology and growth direction is important for two reasons: it would be possible to predict the direction of growth from a static analysis of facial form, if a certain morphological pattern is typically associated with specific growth directions of facial landmarks; and the more important reason is the possibility of predicting morphological changes that will occur during growth which are associated with specific known growth directions [6].

It is important for clinicians to be able to predict the pattern of mandibular rotation at a relatively early stage of craniofacial growth, independent of whether malocclusion has already developed or not. This is explained by the fact that the more the mandible rotates during growth, the more serious the clinical problems that may arise, and this should be seriously considered both at the initial diagnosis and the overall treatment planning [7].

MATERIALS AND METHOD

Sample

The sample consists of 230 digital true lateral cephalometric radiograph (104 males and 126 females) for under and postgraduate students in the College of Dentistry, University of Baghdad, and some patients attending the Orthodontic Department of the same college, that fulfill the following criteria:

1. The age ranged between 18-30 years.

2. No history of previous orthodontic treatment.
3. No craniofacial disorder, such as cleft palate.
4. Full permanent dentition regardless the third molars.
5. No history of facial trauma.

Every lateral cephalometric radiograph was analyzed by AutoCAD program 2006 to calculate angular and linear measurements.

Sample classification: The radiographs were classified depended on the sagittal skeletal relation according to **Foster (1990)** [16] into Table (1):

1. Skeletal Class I relation: 2° ≤ ANB ≤ 4°.
2. Skeletal Class II relation: ANB > 4°.
3. Skeletal Class III relation: ANB < 2°.

Each skeletal relation was classified depended on **Bimler's facial analysis** [17] according to palatal - mandibular plane angle into:

1. Dolichoprosopic facial type: PP-MP angle ranged from 0-15°.
2. Mesoprosopic facial type: PP-MP angle ranged from 15-30°.
3. Leptoprosopic facial type: PP-MP angle ranged from 30-45°.

Cephalometric Bony Landmarks: Include the following:

1. Point S (Sella): The midpoint of the hypophysial fossa [8].
2. Point N (Nasion): The most anterior point on the nasofrontal suture in the median plane [8].
3. Point ANS (Anterior Nasal Spine): It is the tip of the bony anterior nasal spine in the median plane [8].
4. Point PNS (Posterior Nasal Spine): This is a constructed radiological point, the intersection of a continuation of the anterior wall of the pterygopalatine fossa and the floor of the nose. It marks the dorsal limit of the maxilla [8].
5. Point Me (Menton): The lowest point on the symphyseal shadow of the mandible seen on a lateral cephalogram [9].
6. Point Go (Gonion): A point on the curvature of the angle of the mandible located by bisecting the angle formed by the lines tangent to the posterior ramus and inferior border of the mandible [9].
7. Point Ar (Articulare): The point of intersection of the external dorsal contour of the mandibular condyle and the temporal bone [10].
8. Point A (Subspinale): The deepest midline point on the premaxilla between the Anterior Nasal Spine and Prosthion [11].
9. Point B (Supramentale): The deepest midline point on the mandible between Infradentale and Pogonion [11].

Skeletal Angular Measurements (Figure 1):

1. Basal plane angle (PP-MP): This defines the angle of inclination of the mandible to the maxillary base, also serves to determine rotation of the mandible [8].
2. Gonial Angle (Ar-Go-Me): The angle between the posterior border of the ramus (Ar-Go) and the mandibular plane (Go-Me). Gonial angle was measured to determine the mandibular growth rotation [8].
3. Upper gonial angle (UGA): The angle formed by the ascending ramus and the line joining nasion and gonion [8].
4. Lower gonial angle (LGA): The angle formed by the mandibular plane (Go-Me) and the line joining nasion and gonion [8].
5. ANB angle: The angle between lines N-A and N-B, it measured directly as the angle ANB [12].

Skeletal Linear Measurements (Figure 2):

1. Total anterior facial height (AFH): It measured from N to Me [8].
2. Upper anterior facial height (UAFH): It is measured from N to ANS [13].
3. Lower anterior facial height (LAFH): It is measured from ANS to Me [5,14].
4. Posterior facial height (PFH): It measured from S to Go [8].
5. Jarabak ratio (JR) = (PFH / AFH) × 100 [8].
6. Maxillary base length (Maxillary length): It represents the distance from
7. Anterior Nasal Spine to Posterior Nasal Spine [15].
8. Mandibular body length (Mandibular length): It represents the distance from Gonion to Menton [15].
9. Ramus length (RL): It measured from Ar to Go [8].

Statistical analysis

All the data of the sample were subjected to computerized statistical analysis using SPSS version 15 (2006) computer program. The statistical analysis included:

1. **Descriptive Statistics:** Mean, Standard deviation (SD)
2. **Inferential Statistics:** Paired t-test, Independent samples t-test, One way analysis of variance (ANOVA), Pearson's correlation coefficient

In the statistical evaluation the following levels of significance are used:

P > 0.05	NS	Non-significant
0.05 ≥ P > 0.01	*	Significant
0.01 ≥ P > 0.001	**	Highly significant

RESULTS AND DISCUSSION

Balanced facial form and function are derived from a harmonious integration of the various components of the craniofacial complex. These components grow and develop throughout life in a sequential, predictable and orderly fashion, albeit with a wide range of variation in the amount and timing of growth [18]

This study dealt with lateral view of the face by using lateral cephalometric radiographs according to Bimler analysis, and study the relationship of profile facial type with some mandibular rotation parameters in class I, class II and class III skeletal relation which was determined according to ANB angle, Table 1 showed the Gender difference for different measurements in skeletal class I mesoprosopic facial type, it have been found that the mean values of all the measurements were significantly higher in males than females except GA, UGA and LGA which were a non significantly higher in females in all facial types and all skeletal relations, this is due to the fact that muscle traction exerts a considerable influence on the bony structure, which is stronger and heavier muscles mass in males than females.

Table 2 showed the descriptive statistics and the comparison between the three facial types in skeletal class I. it have been found that There was a significant difference in all the measurements between the three facial types , except in UGA, UAFH and MANL in which there was a non-significant difference between the three facial types

The mean values of GA, LGA, AFH and LAFH were high in leptoprosopic individuals, while their values decreased in dolichoprosopic individuals, and within normal limits in mesoprosopic ones, while the mean values of Jaraback ratio, PFH, RL and MAXL decreased in leptoprosopic individuals and increased in dolichoprosopic individuals.

Table 3 showed the comparison between skeletal class I, II and III for different measurements in mesoprosopic facial type, it have been found that there was a non significant difference between the three skeletal relations within the same facial type in all the measurements except in MAXL and MANL in mesoprosopic face in which there was a significant difference between the three skeletal relations.

The mandibular rotation was not changed in all skeletal classes (class I, II and III) that belong to the same facial type giving a picture that the mandibular rotation did not affected by the anteroposterior relation within the same profile facial type and there was anterior mandibular rotation in dolichoprosopic face, while there was a posterior mandibular rotation in leptoprosopic face in all skeletal classes. The correlation coefficient between the measurements expressed a considerable amount of variations, some of them showed positive correlation, while the others showed negative correlation with varying degrees of significant, but the best correlation was found in mesoprosopic facial type compared with dolichoprosopic and leptoprosopic facial type, Table 4 described the correlation coefficient in mesoprosopic facial type. There was a highly significant positive correlation almost between all the different measurements, on the other hand GA and RL, GA and MANL, GA and JR, GA and PFH, UGA and RL, UGA and PFH, UGA and AFH, UGA and UAFH, UGA and LAFH, UGA and LGA, LGA and MANL and between LGA and JR found to have a high significant negative correlation with each other.

REFERENCES

1. Christie TE. Cephalometric patterns of adults with normal occlusion. Angle Orthod 1977; 47(2): 128-35.
2. Collet AR, West VC. Terminology of facial morphology in the vertical dimension. Aust Dent J 1993; 38(3); 204-9.
3. Downs WB. Analysis of the dentofacial profile. Angle Orthod 1956; 26(4): 191-212.
4. Bergman RT .Cephalometric soft tissue facial analysis. Am J Orthod 1999; 116: 373-89.
5. Schudy FF. Vertical growth versus anteroposterior growth as related to function and treatment. Angle Orthod 1964; 34(2): 75-93.
6. Bergersen EO. The direction of facial growth from infancy to adulthood. Angle Orthod 1966; 36: 18-43.
7. Björk A. Prediction of mandibular growth rotation. Am J Orthod 1969; 55(6): 585-99.
8. Rakosi T. An atlas and manual of cephalometric radiography. 2nd ed. London: Wolfe medical publications Ltd.; 1982. p. 7, 35, 40, 43, 45, 47-53, 61, 65, 85- 86, 135.
9. Caufield PW. Tracing technique and identification of landmarks. In Jacobson A (ed). Radiographic cephalometry from basics to videoimaging. 1st ed. Chicago: Quintessence publishing Co.; 1995. p. 60.
10. Björk A. The face in profile. An anthropological X-ray investigation on Swedish children and conscripts. Svensk tandläkare-Tidskrift. 40(5B), Suppl. 1947.
11. Downs WB. Variations in facial relationship: their significance in treatment and prognosis. Am J Orthod 1948; 34(10): 812-40.
12. Steiner CC. Cephalometrics for you and me. Am J Orthod 1953; 39(10): 729-55.
13. Biggerstaff RH, Allen RC, Tuncay OC, Berkowitz J. A vertical cephalometric analysis of the human craniofacial complex. Am J Orthod 1977; 72(4): 397-405.
14. Björk A, Skieller V. Normal and abnormal growth of the mandible. A synthesis of longitudinal cephalometric implant studies over period of 25 years. Eur J Orthod 1983; 5(1): 1-46.

15. Dhopatkar A, Bhatia S, Rock P. An investigation into the relationship between the cranial base angle and malocclusion. Angle Orthod. 2002; 72(5):456-63.
16. Foster TD. A textbook of orthodontics. 3rd ed. Oxford: Blackwell Scientific Publications; 1990. p. 12, 95.
17. Bimler HP. Bimler Therapy: Part 1 Bimler cephalometric analysis. J Clin Orthod. 1985; 19(7): 501–23.
18. Nanda RS. The contribution of craniofacial growth to clinical orthodontics. 2000.

Table 1: Gender difference for different measurements in skeletal class I mesoprosopic facial type.

variables	Total (n=72)		Male (n=30)		Female (n=42)		Gender difference d.f.=70	
	Mean	SD	Mean	SD	Mean	SD	t-value	p-value
GA	123.97	4.47	123.6	4.84	124.23	4.23	-0.59	0.55
UGA	50.77	3.3	50.46	3.2	51	3.39	-0.67	0.5
LGA	73.16	4.02	72.96	4.08	73.3	4.02	-0.35	0.72
UAFH	51.55	3.23	53.51	2.97	50.14	2.63	5.06	0.000
LAFH	65.52	5.42	68.91	5.11	63.1	4.23	5.26	0.000
AFH	115.2	7.11	120.2	5.75	111.4	5.53	6.6	0.000
PFH	77.26	6.5	82.22	5.86	73.71	4.25	7.13	0.000
JR	67.01	3.38	68.26	3.52	66.12	3.02	2.76	0.007
MAXL	51.6	3.36	54.2	2.95	49.74	2.22	7.31	0.000
MANL	69.5	4.47	72.33	4.62	67.48	3.08	5.34	0.000
RL	47.18	4.87	50.29	4.51	44.96	3.82	5.408	0.000

Table 2: Comparison between the three facial types in skeletal class I.

variables	Dolicho (n=9)		Meso (n=72)		Lepto (n=10)		ANOVA test d.f.= 90	
	Mean	SD	Mean	SD	Mean	SD	F-value	p-value
GA	117.33	3.31	123.97	4.47	132.4	4.22	28.95	0.000
UGA	50	2.82	50.77	3.3	50.4	2.59	0.27	0.76
LGA	67.22	2.16	73.16	4.02	82	3.46	36.79	0.000
UAFH	52.62	3.15	51.55	3.23	53.05	4.41	1.159	0.31
LAFH	61.28	4.86	65.52	5.42	73.24	5.91	12.57	0.000
AFH	113.16	8.36	115.24	7.11	124.06	9.02	6.87	0.002
PFH	82.57	7.54	77.26	6.5	74.04	4.65	4.26	0.02
JR	72.91	2.7	67.01	3.38	59.75	2.07	40.32	0.000
MAXL	54.92	3.02	51.6	3.36	51.53	2.3	4.26	0.02
MANL	72.7	4.24	69.5	4.47	69.07	4.02	2.24	0.11
RL	53.11	5.37	47.18	4.87	45.14	2.66	7.69	0.000

Table 3: Comparison between skeletal class I, II and III for different measurements in mesoprosopic facial type.

variables	CL I (n=72)		CL II (n=50)		CL III (n=34)		ANOVA test d.f.= 155	
	Mean	SD	Mean	SD	Mean	SD	F-value	p-value
GA	123.97	4.47	124.28	4.52	125.44	5.82	1.09	0.33
UGA	50.77	3.3	50.7	3.74	51.61	3.77	0.8	0.44
LGA	73.16	4.02	73.58	3.06	73.79	4.47	0.35	0.7
UAFH	51.55	3.23	51.24	3.35	51.53	3.26	0.14	0.86
LAFH	65.52	5.42	66.26	4.87	65.94	4.96	0.3	0.73
AFH	115.24	7.11	114.77	5.81	117.21	6.85	1.46	0.23
PFH	77.26	6.5	76.04	5.9	78.57	6.153	1.68	0.18
JR	67.01	3.38	66.22	3.45	67.05	3.87	0.89	0.41
MAXL	51.6	3.36	53.05	3.157	51.16	4.12	3.75	0.03
MANL	69.5	4.47	68.53	4.94	72.35	4.83	6.93	0.0013
RL	47.18	4.87	46.29	4.469	48	4.99	1.32	0.26

Table 4: Correlation between the different measurements in skeletal class I mesoprosopic facial type.

Variables	RL	MANL	MAXL	JR	PFH	AFH	LAFH	UAFH	LGA	UGA
GA	-0.3**	-0.39**	-0.12	-0.55**	-0.35**	-0.03	0.09	-0.14	0.7**	0.5**
UGA	-0.32**	-0.13	-0.04	-0.02	-0.39**	-0.5**	-0.41**	-0.43**	-0.24*	
LGA	-0.09	-0.35**	-0.12	-0.61**	-0.09	0.36**	0.43**	0.17		
UAFH	0.57**	0.51**	0.53**	0.11	0.65**	0.8**	0.5**			
LAFH	0.62**	0.21	0.56**	0.06	0.69**	0.88**				
AFH	0.69**	0.45**	0.6**	0.1	0.8**					
PFH	0.87**	0.51**	0.7**	0.67**						
JR	0.6**	0.3**	0.42**							
MAXL	0.59**	0.5**								
MANL	0.39**									

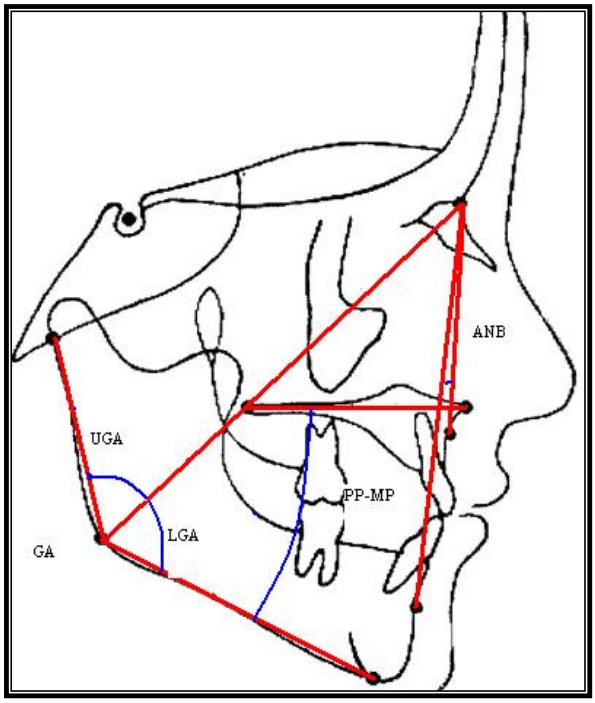

Figure 1: Cephalometric angular measurements

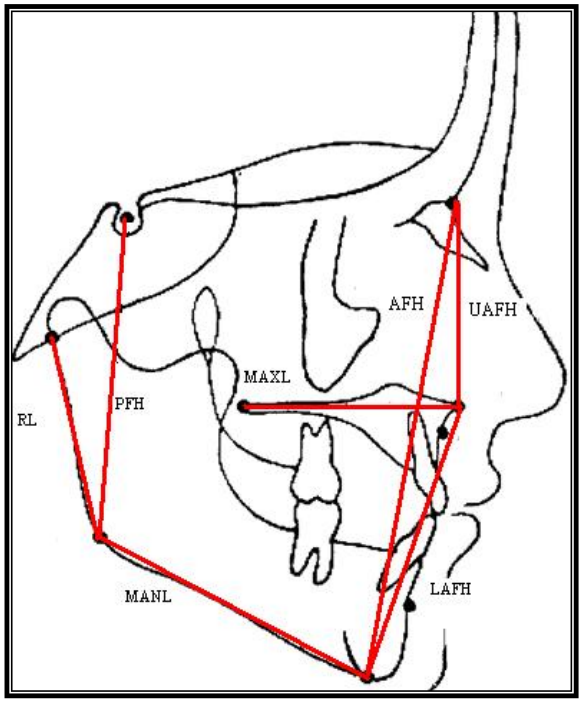

Figure 2: Cephalometric linear measurements.