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"Facial Symmetry in Long Face Individuals- A Posterio-Anterior Cephalometric Study"

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Abstract:
Background and objectives:
The study was conducted with the following aims and objectives:
1. To determine and assess the extent of bilateral dentoalveolar asymmetries in long face individuals.
2. To determine and assess the skeletal asymmetry in long face individuals.
Methodology: *Individuals of age group 18-25 yrs as per the inclusion criteria and exclusion criteria were selected. Lateral cephalogram, frontal cephalogram and study casts were made. Total of 60 individuals with vertical growth pattern were considered for the study.*
16 cephalometric measurements and 6 dental cast measurements were made for evaluation. The data obtained was statistically evaluated using Student's t-test, and statistical analyses were performed with statistical software (SPSS for Windows, version 15.0).
Results: *All the cephalometric parameters showed right side dominance. All the parameters showed male dominance and the differences were statistically significant. All the values of arch chords (dental cast measurements) suggested left side dominance both in males and females except Mandibular 1-3 chord which suggested right side dominance. Significant difference was observed in relation to Maxillary and Mandiblar 1-6 chords both in males and females.*
Conclusion:
Significant asymmetry in facial skeleton and dental arches exists in the long face individuals and this fact must be taken into account during diagnosis and treatment planning. Further studies with large sample size comprising of different skeletal and dental malocclusions in various racial groups may be required for assessment of skeletal and dental asymmetries in males and females of different age groups.
Keywords: *Facial asymmetry; Postero-anterior cephalometric radiograph; Transverse dimension.*

I. Introduction

Dentofacial structures need to be evaluated in three planes of space (that is sagittal, transverse and vertical) which helps to differentiate between dentoalveolar and skeletal discrepancies and to evaluate their relative contribution towards the creation of malocclusion. It is also essential for evolving a comprehensive diagnosis and treatment plan.1

Most of the normative data have been based on sagittal aspects of dentofacial structures with the current emphasis on orthodontic diagnosis obtained from information from the postero-anterior (P-A) cephalometric radiograph films. However, evaluation also is needed in the transverse dimension for a comprehensive dentofacial evaluation.2

Transverse problems are a great concern to the orthodontist and have been mentioned as having great potential for relapse.3,4 Analysis of vertical components, although easily viewed from sagittal cephalometric radiographs, cannot be fully understood without the assistance of a P-A cephalometric radiograph as bilateral vertical asymmetries can only be evaluated from a frontal view.2

Review of the literature on orthodontic diagnosis provides only a sketchy treatment of transverse facial dimensions. Furthermore, facial growth studies that include the transverse component have been even fewer. In relation to diagnosis and treatment, the specialty has been overwhelmingly preoccupied with vertical and sagittal

relationships of the dentofacial structures. Those available do not include a detailed analysis of the P-A cephalometric radiographs.2

The long faced individuals are characterized by growth variation in the vertical plane. Vertical growth pattern include increased total facial height, especially the lower facial height, high mandibular plane angle, clockwise mandibular rotation, short mandibular ramus and high gonial angle.5

Vertical facial patterns might play a strong role in the transverse growth of the maxilla and the mandible.6

Hence this study is planned and designed for the assessment of skeletal and dental symmetry in long face individuals. The data obtained would give us an insight into the skeletal and dental relationships in the transverse plane in these individuals.

II. Materials And Methods

60 subjects, (30 males and 30 females) 18-25 years of age, visiting Department of Orthodontics and Dentofacial Orthopaedics, A. B. Shetty Memorial Institute of Dental Sciences were selected.

Inclusion Criteria

1. Clinically obvious long faced individuals.
2. Individuals in the age group of 18-25yrs.
3. Complete permanent dentition (with exception of 3rd molars).
4. Subjects willing to participate in the study.

Exclusion Criteria

1. Individuals with Prior orthodontic / surgical treatment.
2. Individuals with Craniofacial syndrome, cleft lip and palate.
3. Individuals with no history of chronic nasal or sinus infection.
4. Individuals with clinically obvious asymmetry.
5. Individuals having TMJ disorders or trauma.
6. Mutilated case, missing molar/ incisors.
7. Severe upper and lower anterior crowding.

The subjects fulfilling the above criteria were requested to participate in the study. The selected individuals were explained about the procedures and with their written consent, lateral cephalograms, postero-anterior (P-A) cephalogram taken for evaluation

The lateral cephalograms and postero-anterior (P-A) cephalograms were traced on 0.003 inch acetate paper with 2H lead pencil. All tracings were done by the same operator in order to avoid inter-operator errors.

Lateral cephalogram was traced and Jarabak's ratio and Y axis were measured. Individuals with Jarabak's ratio less than 56% and Y axis (N-S-Gn) more than 60° were selected for the study.

Figure1, 2, 3 shows landmarks were identified for Grummon's analysis7 in posterior-anyerior (P-A) cephalometric tracing.

Measurements:

Mandibular Morphology

Left – right triangles are formed from the heads of the condylar processes or condylion (Co), Antegonial notch (Ag) and Menton (Me). These are split by ANS-Me line and compared.

Volumetric Comparison

Two volumes are calculated from the area defined by each Co-Ag-Me and the intersection with a perpendicular from Co-MSR.

Maxillo – Mandibular Comparison of Asymmetry

Perpendiculars are drawn to MSR from J and Ag and connecting lines from Cg-to J and Ag. This produces 2 pairs of triangles, each is bisected by MSR.

Linear Asymmetries

The vertical offset as well as linear distance is measured from MSR to Co, J, Ag and Me.

Maxillo- Mandibular Relation

Distances are measured from buccal cusp of upper first molars along the J perpendiculars.

Dental arch midline in relation to MSR

Deviation of upper and lower arch midlines to the right side was given a positive sign and to the left side was given a negative sign.

Statistical analysis:

The mean and standard deviation for each measurement was calculated. Student's t-test for paired sample was used to test the significance (p= 0.05 or less) in the difference between the right and left sides of the face and for any gender difference.

III. Results:

Mandibular Morphology (Table 1)

In this study no significant difference was observed between right side and left side values in relation to Co-Ag and Ag-Me both in males and females. However in males, the values of Co-Me and gonial angle showed statistically significant difference but in females, the difference was not statistically significant.

Volumetric Comparison (Table 1)

In males, significant difference was observed between right side and left side values in relation to Co-MSR but in females, the difference was not statistically significant. However in males, the value of Me-MSR showed no significant difference but in females, the difference was statistically significant.

Maxillo- mandibular comparison of asymmetry (Table 2)

In this study no significant difference was observed between right side and left side values in relation to Cg-J, Cg-Ag, J-MSR, Ag-MSR, Cg-MSR(J') and Cg-MSR(Ag') both in males and females.

Linear Asymmetries (Table 2)

In males, no significant difference was observed between right side and left side values in relation to Me-MSR but in females, the difference was statistically significant.

Maxilla-Mandibular relation (Table 3)

1stmolar to jugal process: In this study no significant difference was observed between right side and left side values in relation to 1st molar to jugal process both in males and females.

Dental arch midline in relation to MSR (Table 4)

Upper midline: In this study no significant difference was observed between right side and left side values in relation to upper midline both in males and females.

Lower midline: No statistically significant difference was observed between right side and left side values in males but the midline was found to be significantly deviated towards right side in females.

IV. Discussion

The long faced individuals are characterized by growth variation in the vertical plane. Vertical growth pattern include increased total facial height, especially the lower facial height, high mandibular plane angle, clockwise mandibular rotation, short mandibular ramus and high gonial angle.5 Vertical facial patterns might play a strong role in the transverse growth of the maxilla and the mandible.6

Postero-anterior cephalograms were used to assess skeletal asymmetry. PA view is a valuable tool in the study of right and left structures since they are located at relatively equal distance from the film and X-ray source, as a result the effect of unequal enlargement by the diverging rays is minimized and the distortion is reduced. Comparison between sides is therefore more accurate since the midlines of the face and dentition can be recorded and evaluated.8

For the present study Grummon's analysis was used for the assessment of the asymmetry. Analysis proposed by Grummons and Kappeyne Van De Cappello (1987) contains quantitative assessment of vertical dimensions and proportions. This is a comparative and quantitative postero-anterior analysis. This type of analysis provides a practical, functional method of determining the location and amount of facial asymmetry.9

In the present study the following components of grummon's analysis were used - Mandibular Morphology, Volumetric Comparison, Maxillo-Mandibular Comparison of asymmetry, Linear asymmetry assessment and Maxillo-Mandibular Relation.

In the present study, consistent right side dominance has been found in all cephalometric measurements both in males and females. Similar findings were reported by Haraguchi et al,10 Shah and Joshi,11 Peck et al12 and Oliver G13 in their asymmetry analysis. This finding is in contradiction to a study done by Giovanoli et al14 who had reported left sided dominance.

Right side dominance may occur naturally because of neuroanatomic development,15 might be caused by an imbalance in the growth of the right and left sides of the face7, handedness and unilateral chewing have been suggested to be additional causes of facial asymmetry.16

The comparison between right and left side Co-Me, Go angle, Co-MSR and Me-MSR showed mandibular asymmetry and the difference was statistically significant. This finding is in agreement with studies by Rossi M et al, 17 Haraguchi et al 10 and Server TR and Profit18 but is in contradiction to studies by Shore IL, 19 Shah and Joshi11 according to which there is a tendency for the maxilla to be more asymmetric than mandible.

There is a tendency for the mandible to be more asymmetric because (1) the mandible grows longer than the maxilla and thus is likely to show more deviation and (2) the mandible is a mobile apparatus whereas the maxilla is connected rigidly to its adjacent skeletal structures.18

In the our study, all the parameters showed male dominance and the difference was statistically significant. This finding is in accordance with studies by Giovanoli P et al,14 Farkas LG.20 This is thought to be because of greater growth of the facial musculature and skull of males compared with females.14

In the present study, lower dental arch midline was found to be shifted to right side in females. This finding is in accordance with a study done by Debra.G et al.1

The measurements - Cg-J, Cg-Ag, J-MSR, Ag-MSR, Cg-MSR (J') and Cg-MSR (Ag') showed no significant difference both in males and females. These findings were in contradiction to a study done by Kelvin M Cassidy et al.21

On comparing the maxillo-mandibular relation i.e. the linear measurement between 1st molar to jugular processes, no statistically significant difference was observed between the right and left side values both in males and females.

The present study showed that the asymmetries decrease in magnitude, as we approach higher in the craniofacial skeleton. The upper facial region presents with asymmetries having the least magnitude, whereas the mandibular region (lower facial region) shows asymmetries of highest magnitudes. This finding is in accordance with a study done by Sumit et al22 but is contradictory to a study done by Farkas LG23 according to which the largest amount o f asymmetry was observed in upper third o f face.

The clinical implication of the present study is:

Significant asymmetry in facial skeleton exists in the long face individuals and this fact must be taken into account during diagnosis and treatment planning.

Further studies with large sample size comprising of different skeletal malocclusions in various racial groups may be required for assessment of skeletal asymmetries in males and females of different age groups.

V. Conclusion

The following conclusions can be drawn from the study:

- Variations in facial symmetry exist on right and left sides in long face individuals.
- The mandible is found to be more asymmetric than maxilla.
- Consistent right side dominance has been found in all the cephalometric mandibular measurements, in both males and females.
- All the parameters showed male dominance.
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Table1. Mandibular morphology and volumetric comparison

Variables	Gender	N	Side	Mean (mm)	Std. Deviation	t	p
Co-Ag	M	30	Right	66.3000	6.64442	-1.076	.291
			Left	65.5000	4.99482		
	F	30	Right	60.2000	4.99482	-.045	.964
			Left	60.1667	5.73605		
Ag-Me	M	30	Right	53.1000	3.89828	.636	.529
			Left	53.4333	3.82986		
	F	30	Right	49.3000	3.37486	1.073	.292
			Left	50.3000	4.20304		
Co-Me	M	30	Right	105.2667	7.91303	-1.962	0.05 sig
			Left	104.2667	7.42286		
	F	30	Right	99.5000	7.82459	-.466	.645
			Left	99.2000	6.35935		
Go ang	M	30	Right	124.1333	12.14775	-2.495	0.019 Sig
			Left	122.7667	12.13625		
	F	30	Right	128.8000	7.14577	-1.039	.307
			Left	127.8000	6.10483		
Co-MSR	M	30	Right	54.2667	3.37264	-2.175	0.038 Sig
			Left	53.0667	3.10654		
	F	30	Right	51.9333	3.64770	-1.194	.242
			Left	50.8333	3.96609		
Me-MSR	M	30	Right	91.8333	8.04335	-.721	.477
			Left	91.4667	7.18107		
	F	30	Right	85.3000	8.00496	-2.340	0.026 Sig
			Left	84.4000	7.57764		

***The mean difference is significant at the level .05 level**

Table2. Maxillo-mandibular comparision and linear measurements

Variables	Gender	N	Side	Mean (mm)	Std. Deviation	t	p
Cg-J	M	30	Right	72.9000	4.48253	-1.297	.205
			Left	69.8333	12.5919		
	F	30	Right	70.5667	6.53206	-.602	.552
			Left	70.2000	6.75890		
Cg-Ag	M	30	Right	116.9333	6.94775	-.728	.473
			Left	116.5667	7.07927		
	F	30	Right	109.3333	6.42373	.879	.387
			Left	109.7667	5.80537		
J-MSR	M	30	Right	37.1333	3.94561	.073	.942
			Left	37.1667	3.50451		
	F	30	Right	35.8500	3.36091	-1.670	.106
			Left	35.1833	2.97253		
Ag-MSR	M	30	Right	43.3000	7.91398	1.564	.129
			Left	45.6000	2.54070		
	F	30	Right	42.9500	2.67282	-.731	.471
			Left	41.8333	7.64778		
Cg-MSR(J')	M	30	Right	66.8333	15.71971	1.383	.177
			Left	67.3667	15.99026		
	F	30	Right	58.8500	8.34509	1.006	.323
			Left	59.4833	9.13546		
Cg-MSR(Ag')	M	30	Right	105.8000	15.62580	1.135	.266
			Left	106.4000	15.44423		
	F	30	Right	100.5333	7.48209	-.204	.840
			Left	100.4000	6.38209		
Me-MSR	M	30	Right	.9833	1.42927	-1.273	.213
			Left	.5167	.96921		
	F	30	Right	1.2833	1.57394	-2.478	0.019 sig
			Left	.3667	.80872		

***The mean difference is significant at the level .05 level**

Table3. Maxillo-Mandibular relation

Variables	Gender	N	Side	Mean (mm)	Std. Deviation	t	p
1st Molar to Jugal process	M	30	Right	25.6667	4.19633	-.337	.738
			Left	25.5000	3.63650		
	F	30	Right	22.9667	5.08197	-.867	.393
			Left	22.5667	6.08380		

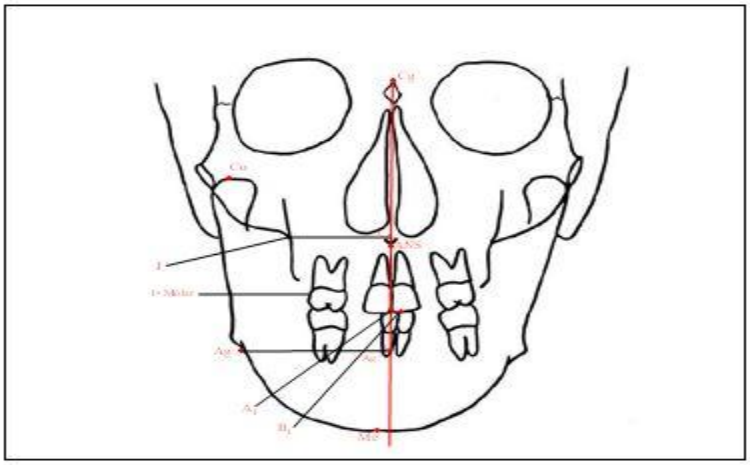
***The mean difference is significant at the level .05 level**

Table 4. Measurement of Dental arch midline

Variables	Gender	N	Side	Mean (mm)	Std. Deviation	t	p
Upper midline	M	30	Right	.50	.974	-.763	.452
			Left	.73	1.143		
	F	30	Right	.40	.855	1.262	.217
			Left	.73	.980		
Lower midline	M	30	Right	.63	1.033	1.229	.229
			Left	1.10	1.447		
	F	30	Right	.97	1.033	2.318	.028 Sig
			Left	.33	.884		

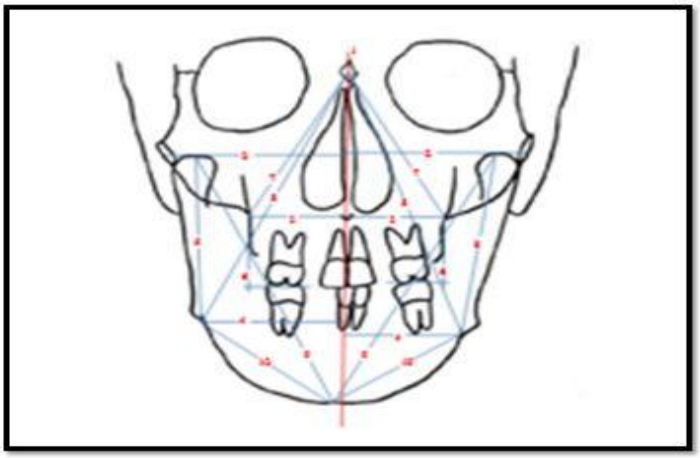
***The mean difference is significant at the level .05 level**

Figure 1.



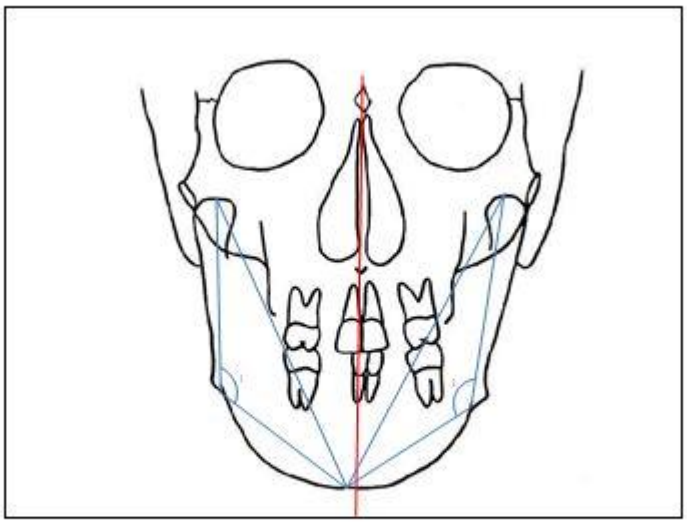
- Ag - Antegonial Notch
- ANS - Anterior Nasal Spine
- Cg - Crista Galli
- Co - Condylion
- J - Jagal process
- Me - Menton
- A_1 - Upper central incisal edge
- B1 - Lower central incisal edge
- Ag' - Constructed point at MSR
- J' - Constructed point at MSR

Figure 2



1. MSR – Mid-sagittal reference plane
2. Co-MSR – Condylion - Mid-sagittal reference plane
3. J-MSR – Jugal Process - Mid-sagittal reference plane
4. Ag-MSR – Antegonial notch - Mid-sagittal reference plane
5. Co-Ag – Condylion - Antegonial notch plane
6. Buccal surface of 1st molar - J – Buccal surface of 1st molar – Jugalar process
7. Cg-J – Crista galli - Jugal Process plane
8. Cg-Ag – Crista galli - Antegonial notch plane
9. Co-Me – Condylion - Menton plane
10. Ag- Me – Antegonial notch- Condylion plane

Figure 3



1. Gonial angle (Go ang)