Original Article

Facial Morphology and Malocclusion Is there any Relation? A Cephalometric Analysis in Hazaribag Population

Lall R[1], Kumari S[2], Sahu A[3], Kumar V[4], Thakur S[5], Rai S[6], Bharti P[7]

[1-7]Department of Orthodontics and Dentofacial Orthopedics
Hazaribag College of Dental Sciences and Hospital
Hazaribag, Jharkhand, India
[1]Professor and Head of Department
Hazaribag College of Dental Sciences and Hospital, Hazaribag.
[2]Final Year Postgraduate Student
Hazaribag College of Dental Sciences and Hospital, Hazaribag.
[3-4]Reader, Hazaribag College of Dental Sciences and Hospital, Hazaribag.
[5]Final Year Postgraduate Student
Hazaribag College of Dental Sciences and Hospital, Hazaribag.
[6-7]Second Year Postgraduate Student
Hazaribag College of Dental Sciences and Hospital, Hazaribag.

To cite: Lall R, Kumari S, Sahu A, Kumar V, Thakur S, Rai S, Bharti P. Facial Morphology and Malocclusion Is there any Relation? A Cephalometric Analysis in Hazaribag Population. Journal of Contemporary Orthodontics, June 2018, Vol 2, Issue 2, (page 64-69).

Received on: 22/05/2018

Accepted on: 16/06/2018

Source of Support: Nil

Conflict of Interest: None

ABSTRACT

Introduction: Dentofacial disfigurement and its relation to facial morphology, with specific attention to self-image, personality, social acceptance, and behavior. The ability to predict the magnitude and direction of a patient's facial growth early in life would enable the clinician to identify those who require interceptive growth modification and to ensure that the appropriate treatment can be rendered while growth is possible.

Materials and method: 58 (30 female and 28 male) Subjects for the present study has been selected randomly from patient treated in Department of Orthodontics and Dentofacial Orthopedics, Hazaribag College of Dental Sciences and Hospital, Hazaribag, Jharkhand.

Results: Among the 58 subjects hyperdivergent pattern group found to be smallest (10.3%) with the neutral and hypodivergent patterns are 17.2% and 72.4 % show the distribution of malocclusion among morphological patterns.

Conclusion: This study found mean values of all linear measurements in males are larger than female. Relatively strong correlations are found between lower gonial angle, gonial angle, mandibular plane angle, palatal /mandibular plane angle, Frankfurt/ mandibular plane angle SNB, Y Axis , sum of saddle + articular + gonial angles and posterior facial height.

Key Words: Facial morphology, Hypodivergent, Hyperdivergent, Malocclusion.

INTRODUCTION

Face and dentition serve as a mirror of expression and emotion, an instrument of speech and communication as well as in the vital functions of breathing, mastication, and swallowing. Dentofacial disfigurement and its relation to facial morphology, with specific attention to self-image, personality, social acceptance, and behavior.[1] Similarly, lengthy attempt at orthopedic correction could be avoided in patients who ultimately would be best treated by surgery.[2]

In orthodontics, the assessment of facial morphology differs from other medical areas, especially by taking as reference the facial profile or side view, rather than the front view of the face. Therefore, the face width is not considered in most classification systems.

This trend can be understood in light of the importance of radiographic cephalometric in modern orthodontics, with the prevalence of analyses based on lateral cephalometric radio-

graph. Malocclusion can be defined as "A condition in which there is a deflection from the normal relation of the teeth to other teeth in the same arch and/or to teeth in the opposing arch"[3].

Patients with deformities may be physically, socially, or mentally challenged and comprise more marked oral health-related problems, either because of their authentic disability or because of associated medical conditions .[4] Malocclusion is irregularity which leads to disfigurement hampering the function of teeth, and this disfigurement or imperfection is likely to be an impediment to the patient's physical or emotional comfort.[5] Malocclusion compromises the health of oral cavity and also can lead to social problems to affected patients.[6]

The purpose of the present study was to seek possible identifiable associations between the different angle types of malocclusion and facial morphology as it is identified with hyperdivergent, neutral and hypodivergent facial patterns in Hazaribag population.

MATERIALS AND METHOD

58 (30 female and 28 male) subjects **(Table 1)** for the present study have been selected randomly from patient treated in Department of Orthodontics and Dentofacial Orthopedics, Hazaribag College of Dental Sciences and Hospital, Demotand, Hazaribag.

Method: Radiographic method. All lateral cephalometric radiographs have been taken by the same operator with the subject standing in, with the head in natural position. Facial morphology has categorized on the basis of three distinct patterns defined by Jarabak Facial Height Ratio (FHR) or Jarabak quotient.[7] This is the ratio of posterior facial height to anterior facial height (S-Go$_c$/N-Me). These patterns **(Figures to and 3)** are commonly associated with rotational growth changes that tend to accentuate the pattern characteristics with growth, so even static evaluations are identifed in terms of

Table 1
Sample distribution

	Sex		*Total*
Malocclusion	*F*	*M*	
Class 1	16	20	36
Class II Div 1	10	6	16
Class II Div 2	3	1	4
Class III	1	1	2
Total	30	28	58

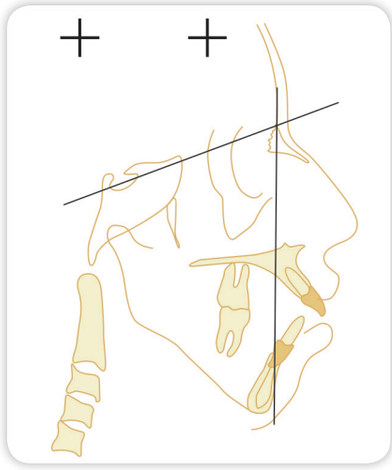

Figure 1 Facial morphology with posterior growth rotation (hyperdivergence)

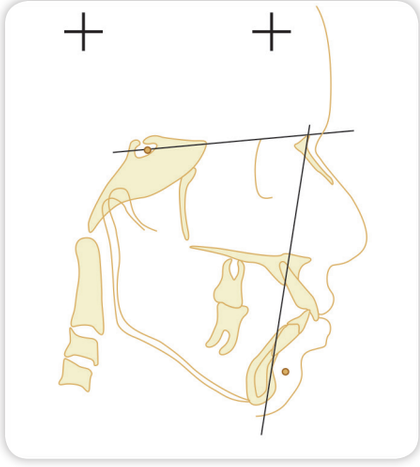

Figure 2 Facial morphology with neutral growth pattern

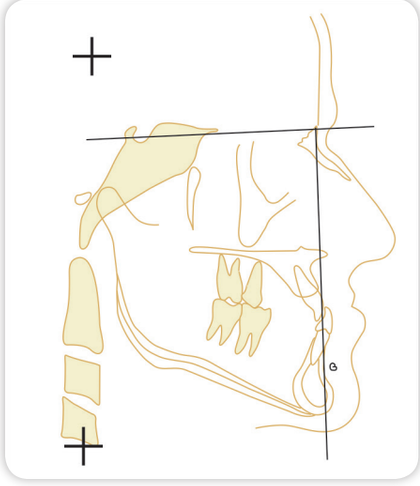

Figure 3 Facial morphology with anterior growth rotation (hypodivergence)

Table 2
Characteristics of facial pattern

Facial pattern	*FHR*	*Feature*
Hyperdivergent growth pattern	<59%	Face rotating downward and posteriorly with growth. Anterior facial height increases more rapidly than posterior height, and Downs's Y axis and some other angles tends to open.
Neutral growth pattern	59% 63%	Growth direction is downward and forward along Downs's Y axis, with about the same increments anteriorly and posteriorly, no progressive change in most angular relationship
Hypodivergent growth pattern	>63%	Predominant horizontal growth

Figure 4 Cephalometric measurement used in study: (1) Ramus length, (2) Lower gonial angle, (3) Saddle angle, (4) Articular angle, (5) Gonial angle, (6) SN/MP angle, (7) OP/MP angle, (8) PP/MP angle, (9) FH/MP angle, (10) Y-axis, (11) SNB, (12) Posterior cranial base, (13) Posterior facial height, (14) Anterior facial height

growth described in **Table 2**. Linear and angular measurement used in this study has been described in **Figure 4**.

TRACING METHOD

The procedure, followed uniformaly for the entire samples, is describe below. Each cephalogram was traced by the same operator, on acetate tracing paper with 0.5 mm lead pencil.Each cephalogram was traced in the following order to outline. Soft tissue profile, cranial base, internal border of cranium, and ear rods. Maxilla and related structures including the nasal bone, pterygomaxillary fissure, lateral orbital margins, infraorbital ridges, 1st molars and incisors. Mandible including first molars and incisors.[8]

Result

Means and standard deviations were supplemented by coefficient of correlation r between FHR and other cephalometric variables. A value of $r < 0.2$ – slight correlation; negligible relationship, $r = 0.2\text{-}0.4$ – low correlation; weak relationship, $r = 0.4\text{-}0.7$ – moderate correlation; substantial relationship, $r = 0.7\text{-}0.9$ – high correlation; marked relationship. Facial height values and ratios are shown in **Table 3**. Distribution of growth pattern in male and female shown in **Figure 5**. Among the 58 subjects, 36 subjects were diagnosed with angle Class I, 16 are Class II Division 1, 4 are Class II Division 2 and 2 are class III.

Hyper divergent pattern group to be smallest (10.3%) with the neutral and hypodivergent patterns are 17.2 and 72.4 % show the distribution of malocclusion among morphological patterns **(Figure 6)**. Correlations of FHR ratio with other variables are shown in **Table 4**. Distribution of malocclusion in male and female are shown separately in **Figures 7 and 8**.

DISCUSSION

In the present study angle Class I and Class II Division 1 malocclusion is dominated malocclusion. Hypodivergent malocclusion is dominated in male and female sample. **Siriwat PP, Jarabak JR**[7] have done study of 500 randomly selected orthodontic patients finding marked correlations between angle class of malocclusion and vertical facial dimensions. In present study 58 (30 female and 28 male) subjects have been selected randomly and found relationship between facial pattern and malocclusion.

Yang[9] evaluated 3305 patients who had visited Department of Orthodontics, Seoul National University Hospital from 1985 to 1989. He reported that percentages of Class I, Class

Table 3

PFH, AFH and FHR comparison

	Females	*Males*	*p value of independent t test*
Class 1			
PFH	71.25 ± 5.96	80.2 ± 7.090	0.00**
AFH	112.88 ± 6.238	121.05 ± 10.947	0.012*
FHR	63.3 ± 6.16	66.5 ± 5.99	0.124#
Class II div 1			
PFH	72.6 ± 5.85	75.33 ± 6.532	0.401#
AFH	110.7 ± 9.322	116 ± 7.376	0.257#
FHR	65.91 ± 4 6.75	64.89 ± 2.403	0.729#
Class II div 2			
PFH	73.67 ± 8.145	76 ± 0	0.827#
AFH	104.67 ± 4.619	117 ± 0	0.147#
FHR	70.55 ± 9.48	64.65 ± 0	0.660#
Class III			
PFH	75 ± 0	90 ± 0	-
AFH	118 ± 0	127 ± 0	-
FHR	63.55 ± 0	70.86 ± 0	-

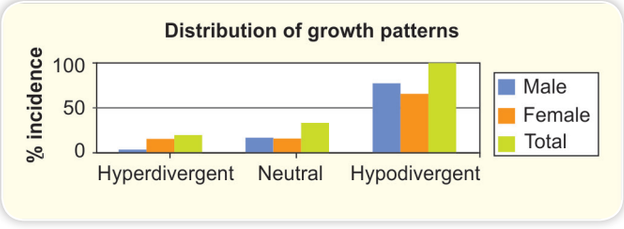

Figure 5 Distribution of growth patterns among male and female

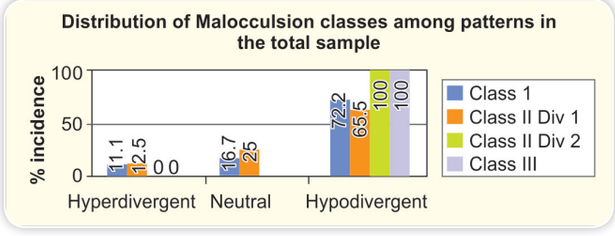

Figure 6 Distribution of malocclusion classes among pattern in the total sample

II, division 1, Class II, division 2, and Class III were 35.9%, 13.4%, 1.5%, and 49.1%, respectively. The higher reported frequency of Class III malocclusion is noticeable and may be because of the ethnic differences.

In present study, angle Class I malocclusion 11.1 % demonstrate hyperdivergent 16.7 % neutral and 72.2% hypodivergence. For Class II Division 1 malocclusion 12.5% were hyperdivergent, 25 % neutral and 62.5 % hypodivergent Class II Division 2 and Class III both show 100 % hypodivergent pattern of growth.

Fields HW, Proffit WR[10] found that skeletal differences that lead to disproportionate lower face height in long-faced and short-faced children are related to mandibular morphology. The length of the body and ramus of the mandible is similar to that of normal children, but the gonial angle is greatly increased or decreased, respectively. In this study we find that in hypodivergent facial form gonial angle is less than hyperdivergent facial form.

In present study showed L strong correlations were found between lower gonial angle, gonial angle, mandibular plane angle, palatal /mandibular plane angle, Frankfurt/ mandibular plane angle SNB, Y-axis, sum of saddle + articular + gonial angles and posterior facial height **(Table 4)**.

Nielsen IL[11] found that vertical malocclusions develop as a result of the interaction of many different etiological factors; one of the most important of these factors is mandibular growth. Variations in growth intensity, function of the soft tissues and the jaw musculature as well as the individual dentoalveolar development further influence the evolution of these malocclusions. **Romani KL, Agahi F, Nanda R, Zernik**[12] conducted a study andresults indicate that in judging realistic color video images, both orthodontists and lay people

Table 4
Correlation coefficients with FHR

	Females				*Males*				*Total*			
	I	*II1*	*II2*	*III*	*I*	*II1*	*II2*	*III*	*I*	*II1*	*II2*	*III*
Ramus height	0.690	0.555	0.991	—	0.427	0.434	—	—	0.596	0.483	0.902	—
Lower gonial angle	-0.882	-0.618	-0.851	—	-0.768	-0.505	—	—	-0.794	-0.612	-0.762	—
Saddle angle	0.382	0.186	-0.920	—	-0.409	0.226	—	—	-0.105	0.141	-0.926	—
Articular Angle	-0.356	-0.200	1.00	—	-0.082	-0.110	—	—	-0.165	-0.215	0.868	—
Gonial angle	-0.639	-0.417	-0.983	—	-0.705	-0.896	—	—	-0.662	-0.365	-0.932	—
Total	-0.850	-0.632	-0.988	—	-0.868	-0.836	—	—	-0.837	-0.643	-0.986	—
SN/MP Angle	-0.850	-0.747	-0.851	—	-0.920	-949	—	—	-0.831	-0.718	-0.869	—
OP/ MP Angle	-0.734	-0.628	-0.160	—	-0.60	0.402	—	—	-0.661	-0.486	-0.363	—
PP/MP Angle	-0.771	-0.851	-0.910	—	-0.698	-0.014	—	—	-0.713	-0.811	-0.863	—
FH/MP Angle	-0.884	-0.722	-0.956	—	-0.673	0.357	—	—	-0.729	-0.636	-0.824	—
Y axis	-0.711	-0.779	-0.782	—	-0.638	-0.579	—	—	-0.613	-0.746	-0.782	—
SNB	0.552	0.760	0.987	—	0.485	0.575	—	—	0.508	0.658	0.940	—
Posterior cranial base	0.633	0.559	0.920	—	0.344	0.618	—	—	0.498	0.491	0.380	—
Posterior facial height	0.824	0.614	0.960	—	0.532	0.732	—	—	0.662	0.538	0.831	—
Anterior facial height	-0.558	-0.649	-0.632	—	-0.497	0.410	—	—	-0.329	-0.490	-0.600	—

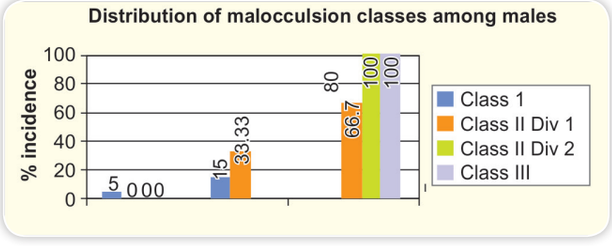

Figure 7 Distribution of malocclusion classes among pattern in male orthodontic patients

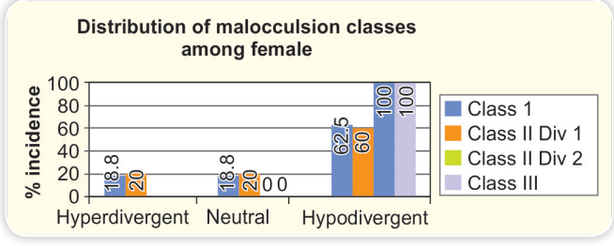

Figure 8 Distribution of malocclusion classes among pattern in female orthodontic patients

are sensitive to relatively small horizontal changes in the facial profile. In contrast, orthodontists are less sensitive to relatively large vertical changes but more sensitive to horizontal mandiublar changes. **Karlsen AT**[13] craniofacial characteristics in two groups of children were compared. In one group (n=22) the children had angle Class II division 2 malocclusion combined with extreme deep bite. The other group (n=25) was composed of children with ideal occlusion. The mean ages

of the children were 12.8 and 12.9 years respectively. In the Class II-2 group the distance between gonion and B-point was underdeveloped, causing B-point to have a retruded position in relation to both A-point and cranial base. The Class II-2 children also had a retroclination of the symphysis, which gave the B-point a retruded position in relation to pogonion. As for vertical dimensions, Class II-2 children had a smaller anterior lower facial height than normal. Furthermore, Class II-2 had a discrepancy between the maxillary incisal and molar heights, i.e. a slightly larger incisal height and a slightly smaller molar height. Finally, children with Class II-2 had a high lip line and a very large interincisal angle. **Dibbets JM** [14] conducted a study and found the association between the angle classification and craniofacial form has been analyzed with the aid of multiple linear regression analysis in a sample of 170 children, before orthodontic treatment had started. It was found that part of the differences between Class II, Class I, and Class III was accounted for by systematical variation in a coherent set of midface and cranial base dimensions. These variations were in harmony with each other: the cranial base angle Ba-S-N closed and the legs S-N and S-Ba shortened systematically from Class II, over Class I, to Class III. The juvenile mandible notably was not systematically different. Because the cranial base provides the framework for the maxilla to be built upon, it is concluded that in juveniles the midface above anything else creates the characteristic difference between the three Angle classes, not the mandible. The Angle classification of malocclusion, therefore, represents three arbitrary markers on a morphological continuum. **Mouakeh M**[15] study was undertaken to investigate the morphologic characteristics of craniofacial structures in Syrian children with Class III malocclusion. Lateral cephalometric radiographs of 69 patients with Class III malocclusion were analyzed and compared with a group of Class I normal occlusion matched for age, sex, and ethnic origin. The findings support the lower anterior facial height was smaller in patients with Class III malocclusion. Present study match with **Nielsen IL,**[11] **Romani KL, Agahi F, Nanda R, Zernik,**[12] **Karlsen AT,**[13] **Dibbets JM,** [14] **Mouakeh M**[15] studies**.**

CONCLUSION

This study examined associations between facial morphology and malocclusion. Hypodivergent growth pattern was dominant in Class II Division 2 and Class III malocclusion. Mean values of all linear measurements in males were larger than female.Relatively strong correlations were found between lower gonial angle, gonial angle, mandibular plane angle, palatal/mandibular plane angle, Frankfurt/mandibular plane angle SNB, Y Axis, sum of saddle + articular + gonial angles and posterior facial height.

Address for Correspondence
Lall Rajeev
Professor and Head of Department
Hazaribag College of Dental Sciences and Hospital
Hazaribag, Jharkhand, India ,rajeevlall03@gmail.com

REFERENCES

1. Macgregor FC. Social and psychological implications of dentofacial disfigurement, Angle Orthodont. 1970;40:231-3.
2. Ishii N, Deguchi T, Hunt NP. Morphological differences in the craniofacial structure between Japanese and Caucasian girls with Class II division 1 malocclusions. Eur J Orthod. 2002;24(1):61-7.
3. Vellappally S, Gardens SJ, Al Kheraif AA, Krishna M, Babu S, Hashem M, etal. The prevalence of malocclusion and its association with dental caries among 12-18-year-old disabled adolescents. BMC Oral Health. 2014;14(1):123.
4. Ibrahim HA, Abuaffan AH. Prevalence of malocclusion and orthodontic treatment needs among Down syndrome Sudanese individuals. Brazilian Dental Science. 2015;18(1):95-101.
5. Kumar D, Rana, M, Dahiya A, Sharma, R. Orthodontic camouflage management of a class II malocclusion with impacted canine—A case report. Int J Adv Case Rep. 2015;2:1442-4.
6. Arslan SG, Genç C, Odabaş B, Kama JD. Comparison of facial proportions and anthropometric norms among Turkish young adults with different face types. Aesthetic Plast Surg. 2008;32(2):234-42.
7. Siriwat PP, Jarabak JR. Malocclusion and facial morphology. Is there a relationship? An epidemiologic study. Angle Orthod. 1985;55(2):127-38.
8. Rakosi T. An atlas and manual of caphalometric radiograpy. Philadelphia 1982: Lea & Febiger Publishers.
9. Yang WS. The study on the orthodontic patients who visited department of orthodontics, Seoul National University Hospital [abstract]. Taehan Chikkwa Uisa Hyophoe Chi. 1990;28:811-21.
10. Fields HW, Proffit WR. Facial pattern difference in long faced children and adults. Am J Orthod. 1984;85:217-23.
11. Nielsen IL. Vertical malocclusions: etiology, development, diagnosis and some aspects of treatment. Angle Orthod. 1991;61(4):247-60.
12. Romani KL, Agahi F, Nanda R, Zernik JH. Evaluation of horizontal and vertical differences in facial profiles by orthodontists and lay people. Angle Orthod. 1993;63(3):175-82.
13. Karlsen AT. Craniofacial Characteristics in children with Angle Class II div. 2 malocclusion combined with extreme deep bite. Angle Orthod. 1994;64:123-30.
14. Dibbets JM. Morphological associations between the Angle classes. Eur J Orthod. 1996;18:111-8.
15. Mouakeh M. Cephalometric evaluation of craniofacial pattern of Syrian children with Class III malocclusion. Am J Orthod Dentofacial Orthop. 2001;119:640-9.