

Cephalometric Characteristics of Class III Malocclusion of Bangladeshi Adult Population

Tamanna Begum^{1*} Md. Zakir Hossain² Suraiya Islam Dina³
Manjur-E-Mahmud⁴ Sarah Fatima Sumaiya⁵ Farhana Hoque Chowdhury⁶

Abstract

Background: Class III malocclusion is one of the most complicated orthodontic problems to diagnose & treat. There is a large phenotypic variation of this malocclusion. The purpose of this study was to observe the different characteristics of the malocclusion by cephalometric analysis which will be useful for diagnosis and treatment planning of such cases.

Materials and methods: This cross sectional descriptive study was conducted in the Department Orthodontics and Dentofacial Orthopedics, Dhaka Dental College. A total of 50 adult patients were selected. Cephalometric analysis was done by Steiner's method. Data analysis was done by using micro soft office Excel 2007 program. Quantitative data were compared by student's t-test.

Results: Maxilla showed significant Prognathism ($p=0.0441$) in relation to Class I norm. Mandibular Prognathism was also highly statistically significant ($p=0.0001$). The ANB value was significantly ($p=0.0001$) reduced in Class III adults. The mean of SND angle was significantly larger than class I norm ($p=0.003$). Mandibular plane was also found to be significantly ($p=0.003$) larger. Maxillary incisors were found to be protruded and mandibular incisors retruded significantly.

Conclusion: Significant differences were observed in several Cephalometric characteristics in between class III malocclusion and class I norm of Bangladeshi adult population.

Key words: Cephalometry; Malocclusion; Steiner's analysis.

1. Assistant Professor of Orthodontics and Dentofacial Orthopedics Chittagong Medical College, Chattogram.
2. Principal University Dental College, Dhaka.
3. Assistant Professor of Orthodontics, Dental Unit Ibrahim Medical College, Dhaka.
4. Assistant Professor of Oral and Maxillofacial Surgery Chittagong Medical College, Chattogram.
5. Lecturer of Oral Microbiology Chittagong Medical College, Chattogram.
6. Assistant Professor of Conservative Dentistry, Dental Unit Chittagong Medical College, Chattogram.

***Correspondence: Dr. Tamanna Begum**
Cell : 01718 20 36 66
E-mail: tamannad36@gmail.com

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Introduction

According to Angle's Classification, Class III malocclusion is defined in cases that mandibular first molar is positioned mesially relative to the first molar of maxilla.¹ Prevalence of malocclusion varies among different races and populations. The prevalence is highest in the South East Asian countries (15.80%)²⁻⁵. Mean prevalence in the Middle East, Europe and Africa were 10.18%, 4.88% and 4.59% respectively.⁷⁻¹³ Lowest prevalence were found in Indian population (1.19%) out of 1595 individuals.^{2,3,14} In Bangladesh the prevalence of class III malocclusion were reported as 8.46%.¹⁵ It is one of the most complex Dentofacial abnormalities to diagnose and treat. Many studies have been conducted to assess morphologic characteristics of the malocclusion.¹⁶⁻²² Class III malocclusion can result from various combination of skeletal and dental components. In these studies the Cephalometric evaluation showed maxillary retrusion and mandibular protrusion in most cases.¹⁶⁻²⁰ Only Moukaeh reported a normal mandibular position in Class III malocclusion.²² From the dentoalveolar aspect many studies showed protrusion of maxillary incisors and retrusion of mandibular incisors.^{16,17,22} In the assessment of vertical components in class III patients Ellis and McNamara, Guyer et al and Ishii et al reported an increase in lower facial height where Moukaeh & Kao et al showed decrease in lower facial height in individuals with class III malocclusion.^{16,17,21,22,20} The determination of prevalence and characteristics of the special components of class III have special importance as the facial beauty is affected most by this malocclusion compared to other discrepancies. Different Cephalometric characteristics of class I and class II malocclusion of Bangladeshi population were described by different authors.^{23, 24, 25} But so far the Cephalometric characteristics of class III adult Bangladeshi population had not been investigated.

The purpose of this study was to investigate the dental and craniofacial characteristics of Bangladeshi adults with class III malocclusion in directive to express cephalometric linear and angular dimensions and to associate their mean variances with the proven values of cephalometric norms of class I Bangladeshi adults.

Materials and methods

The study was conducted in the Department of Orthodontics & Dentofacial Orthopedics, Dhaka Dental College Hospital from October 2015 to May 2016. A total number of 50 patients with Class III malocclusion of age range 16-30 years were selected on the basis of clinical examination (Figure 1). Inclusion criteria were class III molar and incisor relationship, both patients and parents were Bangladeshi origin. Patients with previous orthodontic treatment or any craniofacial syndrome, history of facial trauma and the patients unwilling to be included in the study were excluded. All participants had a case number to maintain their confidentiality. Ethical clearance was approved by ethical review committee. Lateral Cephalogram (Figure 2) of the patients were taken by maintaining standard protocol with same cephalostat machine. The subject's head was positioned in the roentgenographic cephalostat maintaining an object film distance of 15.0 cm and an X-ray object distance of 152.4 cm. The Photo stimulable Phosphor plate (PSP) that is enclosed in a light tight cassette was positioned parallel to the midsagittal plane of the subject such that the X-ray beam was directed perpendicular to it. The ear rods were used to stabilize the head in a vertical plane. The subject's head was positioned so that the Frankfort horizontal plane would be parallel to the floor. Each subject was instructed to look straight and maintain a relaxed posture with teeth in centric occlusion and lips relaxed during X-ray exposure. X-ray films were exposed to an electric current of 61-85 Kvp and 4-10 mA for 1.2 s.

Cephalogram were traced (Figure 3) upon an A4 size acetate paper with 2B hard lead pencil over a well illuminated viewing screen. Each cephalogram was traced twice at one week interval by the same investigator and the average measurement taken into account to minimize method error and inter examiner variability. The linear measurements were recorded with a

measuring scale up to a precision of 0.5. The angular measurements were recorded with a protractor up to a precision of 0.5 degree. Data analysis was done by using Microsoft office Excel 2007 program. Mean, standard deviation and standard error were calculated. Means of angular and linear measurements of Class III patients were compared with Class I Bangladeshi norms by using student's t-test. p value of less than 0.05 was considered to be statistically significant.



Figure 1 Clinical presentation of class III malocclusion



Figure 2 Lateral cephalogram

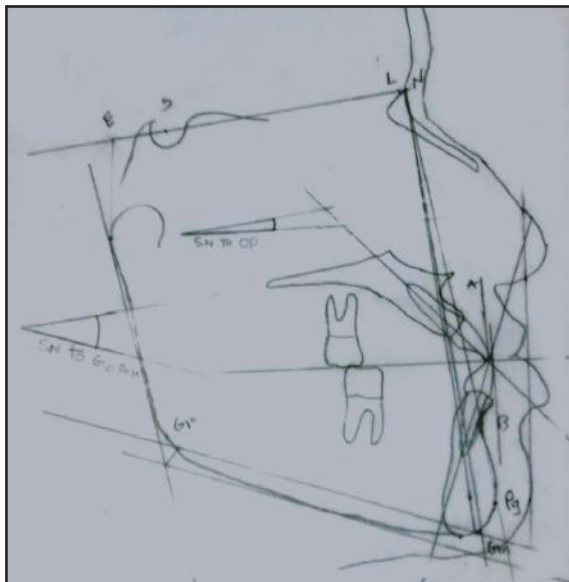


Figure 3 Cephalometric tracing

Results

A total of 50 cases of class III malocclusion (20 male and 30 female) with age ranged from 16 to 30 years were enrolled into the study. 60% patients were female.

Table I Descriptive statistics of the variables of the present study (n=50)

Cephalometric Variables	Maximum	Minimum	Mean	Standard Deviation	Standard Error
SNA	89	74	82.22	3.796024	0.536839
SNB	94	76	85.84	4.188712	0.592373
ANB	-1	-9	-3.6	2.047896	0.289616
SND	92	72	82.24	4.341588	0.613993
U1 to NA ⁰	45	11	31.9	7.515969	1.062919
U1 to NA mm	13.5	4	8.74	1.863287	0.263509
L1 to NB ⁰	41	16	27.02	5.666731	0.801397
L1 to NB mm	12	3	6.49	2.186438	0.309209
Interincisal Angle	165	109	124.33	10.52093	1.487884
SN to OP	25	4	13.76	5.250112	0.742478
SN to GoGn	41	17.5	29.64	6.56913	0.929015
SE mm	28	14	19.74	3.061012	0.432893
SL mm	86.5	50.5	64.31	9.041226	1.278623

Highly significant difference (p< 0.001) was observed in 7 variables and significant difference (p<0.05) was observed in 3 variables between class III norms of present study and the proven Bangladeshi class I norms.

Table II Comparison between Bangladeshi Class III and Bangladeshi Class I norms by using Student's t- test

Parameters	Bangladeshi Class III (n=50)		Bangladeshi Class I (n=52)		t value	p value
	Mean	SD	Mean	SD		
SNA	82.22	3.796024	83.8	4.02	2.0392	0.0441*
SNB	85.84	4.188712	81.5	3.52	5.6734	<0.0001**
ANB	-3.6	2.047896	2.3	2.7	12.3977	<0.0001**
SND	82.24	4.341588	79.3	3.58	3.7375	0.0003**
U1 to NA ⁰	31.9	7.515969	29.8	6.6	1.5010	0.1365
U1 to NA mm	8.74	1.863287	8	2.18	1.8395	0.0688
L1 to NB ⁰	27.02	5.666731	30.6	8.08	2.5813	0.0113*
L1 to NB mm	6.49	2.186438	8	3.08	2.8450	0.0054**
Interincisal Angle	124.33	10.52093	117.7	10.3	3.2159	0.0018**
SN to OP	13.76	5.250112	13.3	4.42	0.4794	0.6327
SN to GoGn	29.64	6.56913	25.8	6.33	3.0066	0.0033**
SE mm	19.74	3.061012	23	3.1	5.3422	<0.0001**
SL mm	64.31	9.041226	59.8	9.61	2.4390	0.0165*

In this study most of the patients (15) presented with the combination of neutral maxilla and protruded mandible.

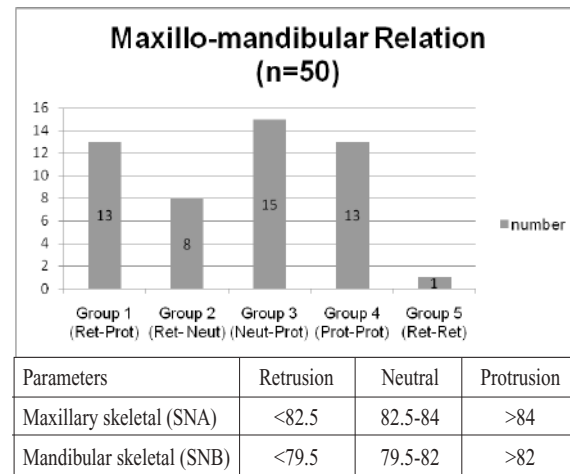


Figure 4 Maxillo-mandibular Relationship of present study samples

Discussion

Class III malocclusion is a disorder with morphological characteristics that are variable in different ethnic groups. Knowledge of these characteristics in different groups is fundamental for a customized diagnosis and accurate treatment planning. The purpose of this study was to investigate the dental and craniofacial characteristics Bangladeshi adult population with class III malocclusion in directive to express Cephalometric linear and angular dimension and to associate their mean variances with the proven values of Cephalometric norms of Bangladeshi adults. Lateral cephalogram of 50 adult patients

with class III malocclusions were traced and analyzed by using Steiner's analysis. Among 50 patients 30 patients were male and 20 patients were female. The present study revealed that the means for the Bangladeshi class III sample were significantly different in most measurement items from the mean of Bangladeshi class I norms.²³ (Table II)

Skeletal measurement

Concerning maxillary antero-posterior positioning (SNA) in the class III group presented statistically significant ($p=0.0441$) maxillary retrognathism in relation to the sagittal positioning of this bone base in the class I group²³ (Table II). This result corroborate the findings of Elis and McNamara, Guyer et al, Clerk et al, Moyers et al.^{16,26,27}

Regarding mandibular antero-posterior position in relation to cranial base (SNB) statistically highly significant ($p=0.0001$) mandibular prognathism was observed in class III Bangladeshi adult in comparison with class I Bangladeshi norms. The findings of the present study agree with the reports of several authors who demonstrated that the mandible was protruded in relation to the cranial base in class III subjects.^{16,17,27,29,,30,31} Whereas Mouakeh did not find significant difference between mandibular skeletal positions in class I and class III cases.²² In the study of Mouakeh the patients were 5-12 years old in whom growth of lower jaw may have not been completed, where in present study, sample aged 16-30 years had attained maximum mandibular growth. Nobuyuki Ishii et al indicated that Asian skeletal class III patients have a relatively larger mandible to the cranial base and maxilla. The antero-posterior relationship between the maxilla and mandible was evaluated ANB angle. The ANB value found to be significantly reduced ($p=0.0001$) in Bangladeshi class III group compared to class I norm. These findings are similar to the results of Guyer et al, Toms Rak, Ishii et al, Mouakeh, Baratali Ramezanzadeh et al.¹⁷⁻¹⁹ Differential diagnosis of the skeletal pattern should be considered for treatment planning. Class III malocclusion may involve several different maxillo-mandibular relationships. In this study the samples were found to be distributed in 5 different combinations: Retrognathic maxilla and prognathic mandible (Group 1) Retrognathic

maxilla and well positioned mandible (Group 2) Well positioned maxilla and prognathic mandible (Group 3) Prognathic maxilla and prognathic mandible (Group 4) Retrognathic maxilla and retrognathic mandible (Group 5). In this study, the percentages were 26% (13), 16% (8), 30% (15), 26% (13) and 2% (1) respectively (Fig: 4). These results are close to those described by Ellis and McNamara Jr.¹⁶ Most individuals (30%) presented Class III malocclusion due to antero-posterior mandibular excess. This morphology of the Angle Class III malocclusion impairs the treatment and worsens the prognosis, even in patients with growth potential.

The mean of SND angle found to be significantly larger in Bangladeshi class III group which indicates that the center of mandibular symphysis is placed more anteriorly ($p=0.003$) than the Bangladeshi class I group (Table II).

Mandibular plane to cranial base of class III malocclusion (SN to GoGn) was significantly larger ($p=0.0033$) than class I Bangladeshi norm (Table II). These indicated that class III subjects were having a more prominent vertical growth pattern than class I subjects. Mean SE distance was significantly smaller in class III group than class I group in this study (Table II). In addition, the SL distance in relation to cranial base was significantly larger in class III group than class I group I (Table II). This indicates anteroposterior length of the mandible in relation to cranial base is larger in class III than class I group.

Dento-alveolar measurements

U1 to NA (Both angular and linear) values were greater in class III group than in class I group but the difference was not statistically significant positioned in Bangladeshi subjects (Table II).

On the other hand L1 to NB (Both angular and linear) values were significantly smaller in class III group than class I group (Table II). This indicates that mandibular incisors were retruded and lingually tipped in class III group. This fact demonstrates the natural compensation of the inadequate maxillomandibular relation, which is expected in individuals with this malocclusion. These results corroborate previous findings in the literature.^{16, 17, 31} Mean inter-incisal angle of the class III group is significantly greater ($p=.0018$) than the class I group (Table II). More obtuse inter-incisal angle is expected in class III individuals.

Limitation

In this study the sample size was small because of limited duration of the study. Cephalograms were traced manually and only Steiner's method of analysis was employed.

Conclusion

This study was undertaken to compare class III skeletal and dental relation to class I norm in a Bangladeshi sample. The findings support the following conclusions regarding the characteristics of class III subjects:

- Mandible showed prognathism in relation to cranial base anteroposteriorly.
- Maxilla showed retrognathism in relation to cranial base anteroposteriorly.
- Dento-alveolar measurements showed maxillary incisor proclination and mandibular incisor retroclination, suggestive of dental compensation to skeletal discrepancy.
- Increased Interincisal angle and
- Mandibular plane angle tended to be greater in class III subjects.

Recommendation

From the results of this study it can be recommended that anteroposterior and vertical position of facial components as well as dental relationship must be considered while treating class III patients orthodontically, so that the excess or deficiency is treated where it actually exists. Cephalometric analysis of skeletal class III malocclusion of Bangladeshi population with larger sample size considering method error, preferably using digital tracing and including more relevant parameters is highly recommended.

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Contribution of authors

TB-Conception, design, drafting, acquisition of data, interpretation of data, manuscript writing and final approval.

MZH-Conception, critical revision, manuscript writing and final approval.

SID-Data collection, manuscript writing and final approval.

MEM-Data analysis, critical revision and final approval.

SFS-Acquisition of data, manuscript writing, critical revision and final approval.

Disclosure

All the authors declared no competing interest.

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