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Assessment of Various Mandibular Divergence Pattern or Vertical Cephalometric Pattern in Bangladeshi Adult Patients

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ABSTRACT:

Introduction: Orthodontic diagnosis as well as the treatment planning of the patients are affected by vertical dimention of face. Lateral cephalometric radiographs are used by orthodontists to find out the norms of different skeletal, dental and soft tissue variables. Present study was undertaken with the aim to assess the various mandibular divergence pattern or vertical cephalometric pattern in Bangladeshi adult orthodontic patients.

Materials and methods : This cross sectional study was conducted with 120 pretreatment lateral cephalograms of Bangladeshi adult orthodontic patients who visited Dhaka Dental College Hospital (DDCH) for orthodontic treatment for the duration of six months. The angular measurement used in this study to assess the vertical divergence pattern or vertical cephalometric pattern was mandibular plane to anterior cranial base (MP-SN). Collected data were analyzed by SPSS software version 26 and statistical significance was set as p=0.05.

Results : The study result showed that out of 120 orthodontic patients hypodivergent vertical cephalometric pattern found in 26.6% patients having $<27^0$ MP-SN angle and normodivergent, hyperdivergent pattern found in (45.8%), (27.5%) patients having 27^0 to $< 37^0$ MP-SN angle and $> 37^0$ MP-SN angle respectively. Sex of the patient was not significantly associated with the vertical cephalometric pattern (as $p > 0.05$). It was also observed that age was not statistically significantly different between male and female patients within each mandibular divergence pattern and across the three mandibular divergence patterns.

Conclusion : Present study concluded that age and sex of Bangladeshi adult orthodontic patients were not significantly associated with different mandibular divergence pattern or vertical cephalometric pattern. In all the three vertical cephalometric pattern the MP-SN angle were greater in Bangladeshi female than Bangladeshi male patients.

KEYWORDS : Mandibular divergence pattern, Verticle cephalometric pattern, Orthodontic patients.

INTRODUCTION:

Orthodontic diagnosis as well as the treatment planning of the patients are affected by vertical dimention of face.[1] Verticle cephalometric pattern of a face can be determined by a number of factors. Lateral cephalometric radiographs are used by orthodontists to find out the norms of different skeletal, dental and soft tissue variables.[2] Based on verticle cephalometric pattern or mandibular divergence pattern orthodontic patients are categorized as hypodivergent, normodivergent and hyperdivergent.

Two measurements in lateral cephalogram are commonly used by the orthodontists to determine the vertical cephalometric pattern in relation to underlying skeletal features; these are mandibular plane inclination to anterior cranial base or to maxilla and percentage of lower anterior to total anterior face height.[3]

Mandibular growth plays an important role in facial growth and development.[4,5] The term hypodivergent and hyperdivergent vertical cephalometric pattern used by Schudy [6,7] for describing the vertical growth pattern where hypodivergent termed as short face and hyperdivergent pattern termed as long face. Other additional factors may influence that craniofacial growth and may alter the facial morphology.[8,9] Present study was undertaken with the aim to assess the various mandibular divergence pattern or vertical cephalometric pattern in Bangladeshi adult orthodontic patients.

MATERIALS AND METHODS :

This study was a cross sectional study carried out on 120 pretreatment lateral cephalograms of Bangladeshi adult orthodontic patients among them 46 were male and 74 were female. These patients were selected from the patients coming to the Dept. of Orthodontics and Dentofacial Orthopedics of Dhaka dental College & Hospital (DDCH) within the time period January 2020 to June 2020.For selecting the study subjects the inclusion criteria set as, Bangladeshi adult orthodontic patients irrespective of sex, well defined of identifiable chin structures on radiograph. And the exclusion criteria were previous history of orthodontic treatment or orthognathic surgery, presence of any craniofacial anomaly like cleft lip and palate, temporomandibular joint abnormality. Prior taking written informed consent explaining the study procedures and purpose of the study data were collected from the study subjects and cephalograms were taken. Ethical clearance was taken from the institutional ethical committee of DDCH and the reference number is DDC/2019/2511. The cephalometric measurements used in this study were – S point (Sella), N point (Nasion), SN plane, Go point (Gonion), Gn point (Gnathion), Mandibular plane (MP), Mandibular plane angle (MP-SN) and these are shown in Figure 1. The mandibular plane was constructed by the line joining Gonion (Go) and Gnathion (Gn). SN plane was constructed by the line joining Sella (S point) and Nasion (N point). The angular measurement used in this study to assess the vertical cephalometric pattern or mandibular divergence pattern was mandibular plane to anterior cranial base (MP-SN). It is the angle formed between SN plane and mandibular plane (MP). In this study patients were stratified into four groups depending on the divergence pattern defined by the mandibular plane to cranial base angle in the following way.[10]

Low (L) = MP-SN $\leq 27^0$

Medium-low (ML) = $27^0 <$ MP-SN $\leq 32^0$

Medium-high (MH) = $32 \leq$ MP-SN $\leq 37^0$

High (H) = MP-SN $\geq 37^0$

Also in this study low MP-SN angle considered as hypodivergent face, medium low (ML) and medium high (MH) MP-SN angle considered as normodiveregnt face and high (H) MP-SN angle considered as hyperdivergent face. Tracing and measurement on ceaphalometric radiograph was done by the principal investigator in a standard manner. After collecting data from the cephalogram the statistical analysis was performed using SPSS software version 26 and the results were presented in the form of tables and figures. Statistical significance was set as p=0.05.

RESULTS:

Table 1: Socio demograp hic features of the study subjects (n=120)

Socio demographic features		n (%)
Age (in years)	18-23	96 (80.0)
	24-28	24 (20.0)
	Mean (± SD) : 21.3 (±2.8) , Range : 18 - 28	
Sex	Male	46 (38.3)
	Female	74 (61.7)

Table 1 shows the mean age of the study subjects was 21.3 years with range 18-28 years; majority 80% belonged to 18-23 years age group. More than half of the patients (61.7%) were female.

Figure 1 : Cphalometric points and angle

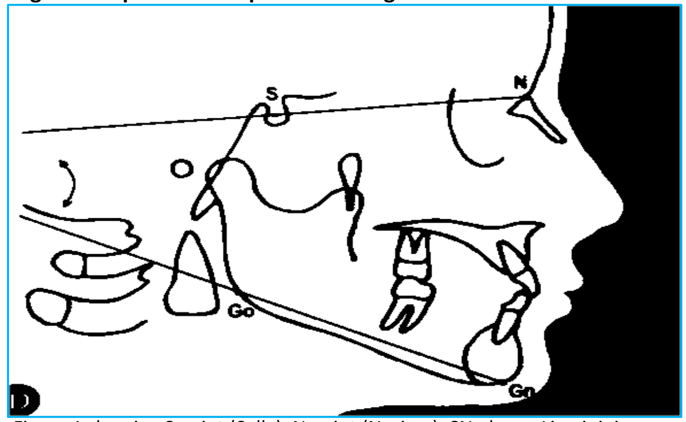

Figure 1 showing S point (Sella), N point (Nasion), SN plane : Line joining Sella and Nasion, Go point (Gonion), Gn point (Gnathion), Mandibular plane (MP): Line joining Gonion and Gnathion.

Table 2 : Vertical cephalometric pattern of the study subjects based on MP-SN angle (n=120)

Vertical cephalometric pattern based on MP-SN angle	n(%)
Low angle (< 27^0)	32 (26.7)
Medium low angle (27° to <32°)	29 (24.2)
Medium high angle (32° to <37°)	26 (21.7)
High angle (≥ 37^0)	33 (27.5)

MP-SN, Mandibular plane to anterior cranial base

Table 2 shows out of 120 patients majority (27.5%) patients MP-SN angle was high angle having (≥ 37^0) and 21.5% patients MP-SN angle was medium high angle having (32° to <37°).

Figure 2: Verticle cephalometric pattern or mandibular divergence pattern of the study subjects. [n=120]

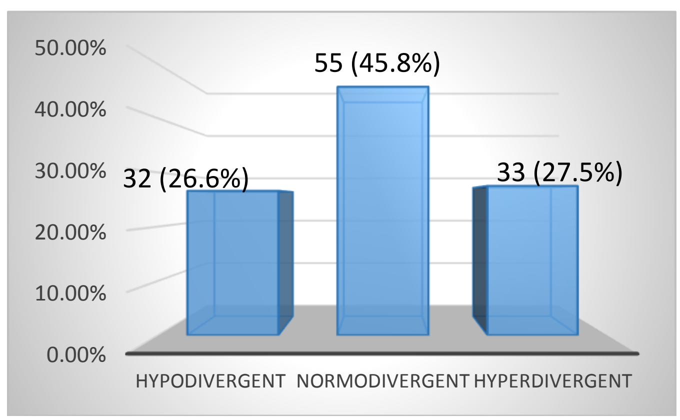

Figure 2 shows out of 120 patients majority (45.8%) patients were normodivergent verticle cephalometric pattern; where as 27.5%, 26.6% patients were hyperdivergent and hypodivergent pattern respectively based on MP-SN angle

Table 3 : Distribution of the vertical cephalometric pattern by sex.

Vertical cephalometric pattern	Sex of study subjects		p value
	Male n(%)	Female n (%)	
Hypodivergent (MP-SN angle < 27^0)	**16 (34.8)**	**16 (21.6)**	0.408 ^{ns}
Normodivergent (MP-SN angle 27^0- < 37^0)	**20 (43.5)**	**35 (47.3)**	
Hyperdivergent (MP-SN angle ≥ 37^0)	**10 (21.7)**	**23 (31.1)**	

MP-SN, Mandibular plane to anterior cranial base; p-value derived from chi square test ns= Not significant, p-value significant at <0.05

Table 3 shows vertical cephalometric pattern by sex. Here MP-SN angle < 27° hypodervigent pattern consisted of thirty two patients (16 male and 16 female); MP-SN angle 27^0- < 37^0 normodivergent pattern consisted of fifty five patients (20 male and 35 female) and MP-SN angle ≥ 37^0 hyperdivergent pattern consisted of thirty three patients (10 male and 23 female). No significant association of vertical cephalometric pattern exists with male and female patients (as p value >0.05).

Table 4 : Mean and SD of MP-SN angle of the study subjects

Vertical cephalometric pattern based on MP-SN angle		Mean(± SD)	Range
Overall sample (n=120)	Hypodivergent (MP-SN angle < 27^0)	22.09 ± 4.26	12 - 26
	Normodivergent (MP-SN angle 27^0- < 37^0)	31.61 ± 3.13	27 - 36
	Hyperdivergent (MP-SN angle ≥ 37^0)	40.42 ± 3.68	37 - 52
Male (n=46)	Hypodivergent (MP-SN angle < 27^0)	21.57 ± 5.04	12-26
	Normodivergent (MP-SN angle 27^0- < 37^0)	31.00 ± 3.37	27-36
	Hyperdivergent (MP-SN angle ≥ 37^0)	40.20 ± 3.91	37-49
Female (n=74)	Hypodivergent (MP-SN angle < 27^0)	22.81 ± 3.31	15-26
	Normodivergent (MP-SN angle 27^0- < 37^0)	31.97 ± 2.98	27-36
	Hyperdivergent (MP-SN angle ≥ 37^0)	40.52 ± 3.66	37-52

MP-SN, Mandibular plane to anterior cranial base

Table 4 shows the descriptive statistics of MP-SN angle of Bangladeshi adult orthodontic patients total study sample, as well as the male and female sample separately.

Table 5 : Distribution of mandibular divergence pattern by age in male and female sample

Parameter	Mandibular divergence pattern				p value (Significance)
Total sample	**Total**	Hypodivergent (MP-SN angle < 27^0)	Normodivergent (MP-SN angle 27^0- < 37^0)	Hyperdivergent (MP-SN angle ≥ 37^0)	
N	120	32	55	33	.398^{ns}
Age in years Mean ±SD (Range)	21.3 ±2.8 (18-28)	21.9±2.50 (18-28)	21.3±2.63 (18-28)	21.0 ± 2.26 (18-25)	
Male					
N	46	16	20	10	.281^{ns}
Age in years Mean (Range)	21.7 ±2.47 (18-28)	22.8 ± 1.97 (19-26)	21.2 ± 2.74 (18-28)	21.2 ± 2.29 (18-25)	
Female					
N	74	16	35	23	.189^{ns}
Age in years Mean (Range)	21.1 ±2.51 (18-28)	21.0 ± 2.70 (18-28)	21.4 ± 2.60 (18-27)	20.9 ± 2.29 (18-25)	

ns= Not significant, p-value significant at <0.05

Table 5 shows the mean age and the range of the age of overall patients in each mandibular divergence group. Also the mean age of male and female patients within each of the three mandibular divergence group. Here age was not statistically significantly different between male and female patients within each group and across the three mandibular divergence groups.

DISCUSSION:

The aim of the study was to assess the various mandibular divergence pattern or vertical cephalometric pattern in Bangladeshi adult orthodontic patients. According to the study results the mean age of the orthodontic patients was 21.3 years with range 18-28 years, out of 120 orthodontic patients majority (61.7%) were female and the male female ratio was 1: 1.16. Based on MP-SN angle (cephalometric mandibular plane inclination to anterior cranial base) the vertical cephalometric pattern found hypodivergent in 26.6% patients having <27^0 MP-SN angle. The normodivergent cephalometric pattern found in less than half (45.8%) patients having 27^0 to < 37^0 MP-SN angle, which covers the medium low MP-SN angle (27^0-<32^0) and medium high MP-SN angle (32^0-37^0), close to one fourth (27.5%) orthodontic patients vertical cephalometric pattern found hyperdivergent having ≥ 37^0 MP-SN angle. Present study result revealed that the mean MP-

SN angle of hypodivergent vertical cephalometric pattern was 22.09 $\pm$ 4.26 with range 12^0-26^0; where as in normodivergent and hyperdivergent pattern these mean MP-SN angle found 31.61 $\pm$ 3.13 with range 27^0-36^0 and 40.42 $\pm$ 3.68 with range 37^0-52^0 respectively. Similar observations have been reported in studies conducted by Sattar et al.[10] in Pakistan, Somaiah et al.[11] in India. Also in the study Sattar et al.[10] reported that the mean difference of MP-SN angle of the three groups of vertical cephalometric pattern was statistically highly significant (p=0.001). Present study showed that sex of the patient was not significantly associated with the vertical cephalometric pattern (as p >0.05). Current study also reported that the mean age of different vertical cephalometric pattern was almost same with the mean age of total sample. Also from the mean age of male and female patients within each of three mandibular divergence pattern – it was observed that age was not statistically significantly different between male and female patients within each mandibular divergence pattern and across the three mandibular divergence patterns. Vertical cephalometric pattern group differences were evaluated with analysis of variance (ANOVA). This finding was in agreement with the study by Sattar et al.[10] and oppose the study finding by Somaiah et al.[11]

CONCLUSION:

Present study concluded that age and sex of Bangladeshi orthodontic patients were not significantly associated with different mandibular divergence pattern or vertical cephalometric pattern. Almost half of the orthodontic patients in the study sample were normodivergent vertical cephalometric pattern, where as almost equal portion of the sample found normodivergent and hyperdivergent. In all the three vertical cephalometric pattern the MP-SN angle were greater in Bangladeshi female than Bangladeshi male patients.

CONFLICT OF INTEREST: The authors declare no conflict of interest.
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DATA AVAILABILITY STATEMENT: The data presented in this study are available on reasonable requestfrom the corresponding author.

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