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Research Article

MANDIBULAR MORPHOLOGICAL TRAITS IN PATIENTS WITH DEEP AND SHALLOW ANTEGONIAL NOTCH DEPTHS - A CEPHALOMETRIC STUDY

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ABSTRACT

The purpose of this study was to evaluate dimensional differences in the mandibular morphologies of individuals with deep and shallow mandibular antegonial notching. This study was conducted on lateral cephalograms of a total of 80 subjects, which included 40 males and 40 females between the ages of 20-24 years. The sample was divided into deep and shallow notch groups based on the depth of the antegonial notch. Cephalometric parameters like Co-Gn, Co-B, Co-Go, Go-B, Go-Gn, Go-CF, Ar-Go, Xi-Pm, Ba-Gn, Ar-pg, AR-PR, Pg-LS-Go-Gn were compared between the deep and shallow notch groups and analyzed statistically. It was found that deep group subjects were associated with smaller ramus height , ramus width, mandibular length, mandibular depth and symphyseal thickness when compared with the shallow group subjects.In the deep notch group, data showed statistically significant difference between males and females for all the measurements except for AR-PR. All the Cephalometric measurements in shallow group were more in males than in females except Go-B, Ar-Go.

INTRODUCTION

The early recognisation and timing of the treatment of malocclusions, especially in subjects with vertically high angle malocclusions, which often depends on the pubertal growth spurt is important[1]. Extensive knowledge of facial morphology and development for individuals having deep and shallow mandibular antegonial notching is necessary for the successful treatment of orthodontic and orthognathic anomalies[2].The direction of mandibular growth rotation is reflected in the location and degree of remodeling on the inferior surface of the mandible[3-6] and the most pronounced area of remodeling is below the angular region[3]. The upward curving of the inferior border of the mandible anterior to the angular process is known as Antegonial Notch (AGN). Antegonial Notch is one of the seven structural signs for the identification of the mandibular growth rotation suggested by Bjork[4]. Thus, the aim of this study was to investigate the dimensional differences in the mandibular morphology of individuals with deep and shallow antegonial notch depths.

MATERIALS AND METHODS

The material consisted of 80 Pretreatment Lateral cephalograms of orthodontic patients (40 lateral cephalograms with deep and 40 with shallow antegonial notch depth) which were obtained from the files of the department of Orthodontics, Government Dental Collage and Hospital, Afzalgunj, Hyderabad. Among 80 lateral cephalograms that were used for this study 40 were males and 40 were females of which 20 males and 20 females were grouped under deep notch cases the 20 males and 20 females were considered for shallow notch cases. The age of the subjects included in the study ranged from 20-24 years. Cephalometric tracing was done on these Lateral cephalograms to find out the relationship between the antegonial notch depth and Mandibular morphology.

Inclusion criteria: Pretreatment Orthodontic patients who have completed the growth period with symmetrical face and no gross facial abnormalities.

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Exclusion criteria: 1) Those individuals in growing period 2) Those having prognathic mandible 3) Those required orthognatic surgery for acquired\congenital abnormalities of the mandible in combination with orthodontic treatment.

Standardization: The standardized method of production of skull radiographs is done using X-ray machine and a head holder called a cephalostat or cephalometer. All the cephalometric radiographs were taken by the same operator on the same apparatus after orienting the patient in Natural head position, with the teeth in centric occlusion. Kodak X-ray films (8 × 10 inches) were exposed at 72 KVP; 12 mA from a fixed distance of 60 inches and the enlargement factor was therefore accepted to be constant.

Lateral cephalograms, X-ray tracing box, Acetate tracing papers, 0.5mm lead pencil, metallic scale, and set-squares were used for tracing the Lateral cephalograms(Figure no: 1).Depth of the mandibular antegonial notch was measured on each subject's lateral cephalograms(Figure no: 2).A tangent drawn through the two points of the greatest convexity on the inferior border of the mandible on either side of the notch and another perpendicular line drawn from the deepest point antegonial notch concavity to the tangent. If the distance along the perpendicular line is 3mm or more should be considered as deep notch and if it is 1mm or less should be considered as shallow notch[2].

Figure no 1 Arnamentarium used for cephalometric tracing

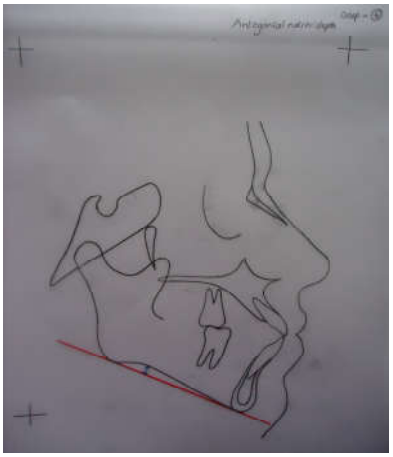

Figure no 2 Measurement of Antegonial notch depth

Definitions of skeletal landmarks correspond to those given by Riolo, Moyers, McNamara and Hunter,An Atlas and Manual of Cephalometric Radiography by Thomas Rakosi (1982), Orthodontic Cephalometry by Athanasios E Athanasiou (1997).

Definitions of cephalometric parameters which were used in this study

1. ***B (B point):*** The most posterior point on the anterior curve of the mandible between infradentale and pogonion.
2. ***Co (Condylion):*** The most posterior superior point on the curvature of the averaged outlines of the right and left condylar heads.
3. ***Pg (Pogonion):*** The most anterior point on the contour of the bony chin.
4. ***Go (Gonion):*** The midpoint of the mandibular angle.
5. ***Gn (Gnathion):*** The most inferior anterior point on the contour of the bony chin symphysis.
6. ***Ar (Articulare):*** Point of intersection of the inferior cranial base surface and the averaged surfaces of the mandibular condyles.
7. ***Ba (Basion):*** The most inferior posterior point on the anterior margin of the foramen magnum.
8. ***CF (Frankfort center):*** The intersection between Frankfort horizontal plane and a vertical line touching the digital margin of the Pterygomaxillary fissure.
9. ***Xi:*** The geometrical center of the mandibular Ramus (Ricketts).
10. ***Pm (Protuberance menti):*** The recessive area above point Pogonion where the curvature changes from convex to concave.
11. ***AR-PR:*** Anterior Ramus border – Posterior Ramus border through occlusal plane.
12. ***Pg-LS:*** Pogonion to Lingual part of the symphyseal point parallel to the Go- Gn plane. Linear measurements were made using metallic scale.

Table no 1 List of Linear Measurements

S.No	Linear measurements
1	Co-Gn
2	Co-B
3	Co-Go
4	Go-B
5	Go-Gn
6	Go-CF
7	Ar-Go
8	Xi-Pm
9	Ba-Gn
10	Ar-pg
11	AR-PR
12	Pg-LS-Go-Gn

RESULTS

The present study was undertaken in an attempt to assess the issue, does any dimensional difference occur in the Mandibular morphology of groups with deep and shallow mandibular antegonial notching, and is there any difference in these measurements between males and females within each group. The Means, Standard Deviations and p-values for the cephalometric measurements of deep and shallow notch groups, males and females within each group were tabulated and represented as bar diagrams.

Table no 2 Comparative statistics for Cephalometric measurements that represent mandibular size

	Group				p-value
	Deep		Shallow		
	Mean	SD	Mean	SD	
Co-Gn	114.65	7.93	114.3	7.24	0.837
Co-B	102.2	6.38	104.1	6.51	0.191
Co-Go	56.55	6.35	57.18	5.47	0.639
Go-B	71.17	5.15	73.7	4.95	0.028
Go-Gn	74.65	5.92	75.78	5.48	0.381
Go-CF	62.15	6.31	62.4	4.64	0.841
Ar-Go	44.68	5.26	47.25	6.1	0.047
Xi-Pm	68.75	5.21	69.93	4.81	0.298
Ba-Gn	108.75	8.22	109.88	6.81	0.507
Ar-Pg	106.33	7.81	107.55	6.91	0.46
AR-PR	31.53	3.33	33.27	3.21	0.019
PG-LS-Go-Gn	13.87	2.07	14.47	2.12	0.204

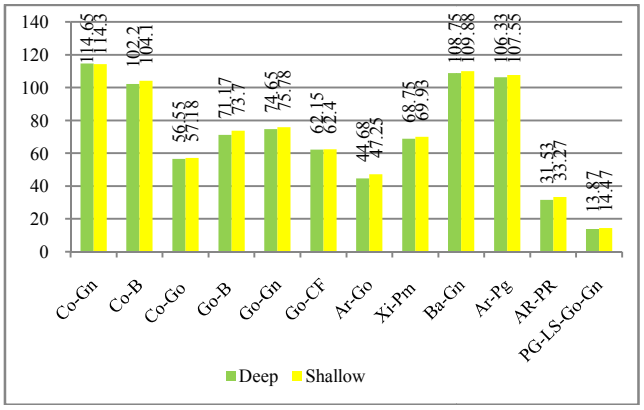

Chart no 1 comparative statistics for Cephalometric measurements that represent mandibular size

- ***Effective mandibular length:*** The difference in mean values of Co-B, Xi-Pm, Ar- Pg were 1.9mm, 1.18mm, 1.22mm respectively. The values are more in shallow notch group compared with deep notch group.
- ***Mandibular body length:*** Represented by Go-Gn whose value was 1.13mm more in shallow notch group compared with deep notch group
- ***Mandibular body length-mental process:*** Represented by Go-B whose value was 2.53 mm significantly more in shallow notch group compared with deep notch group.
- ***Height of ascending Ramus:*** The difference in mean values of Co-Go, Go-CF and Ar-Go were 0.63 mm, 0.25 mm and 2.57 mm respectively which were more in shallow notch group compared with deep notch group. Significant difference P<0.05was observed for Ar-Go.
- ***Width of ascending Ramus:*** The AR-PR line represents the width of ascending Ramus which was 1.74 mm less in deep notch group compared to shallow notch group.
- ***Symphyseal thickness:*** Represented by Pg-LS-Go-Gn whose value was 0.6 mm more in shallow notch group compared with deep notch group.

Comparison of Cephalometric measurements between females and males with in deep notch group

Table no 3 Cephalometric measurements within deep notch group based on gender

Group		Gender				p-value
		F		M		
		Mean	SD	Mean	SD	
Deep	Co-Gn	110.25	5.14	119.05	7.88	<0.001
	Co-B	99.2	4.02	105.2	6.96	0.002
	Co-Go	53.45	3.71	59.65	6.99	0.002
	Go-B	69.5	3.89	72.85	5.79	0.038
	Go-Gn	71.75	3.95	77.55	6.23	0.001
	Go-CF	59.05	3.49	65.25	7.03	0.001
	Ar-Go	41.85	3.57	47.5	5.22	<0.001
	Xi-Pm	66.4	3.78	71.1	5.47	0.003
	Ba-Gn	104.05	5.09	113.45	8.15	<0.001
	Ar-pg	102.6	5.75	110.05	7.94	0.002
	AR-PR	31.4	3.08	31.65	3.63	0.816
	Pg-LS-Go-Gn	13.1	2.02	14.65	1.84	0.016

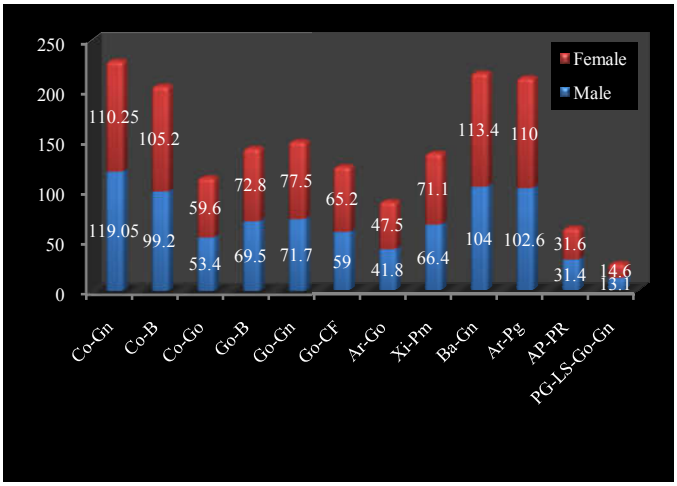

Chart no 2 Cephalometric measurements within deep notch group based on gender

Mean, SD, P-values of all the Cephalometric measurements for males and females with in deep notch group was shown in table no: 3 chart no: 2.

The data showed statistically significant difference P<0.05 between males and females for all the measurements except for AR-PR which did not showed significant sexual dichotomy. All the Cephalometric measurements in deep group were more in males than in females.

Comparison of Cephalometric measurements between females and males with in shallow notch group

Table no 4 Comparison of Cephalometric measurements between females and males with in shallow notch group

Group		Gender				p-value
		F		M		
		Mean	SD	Mean	SD	
Shallow	Co-Gn	112.4	7.43	116.2	6.7	0.098
	Co-B	103.05	6.68	105.15	6.33	0.314
	Co-Go	56.7	5.36	57.65	5.68	0.59
	Go-B	73.85	5.25	73.55	4.76	0.851
	Go-Gn	75.3	5.87	76.25	5.17	0.59
	Go-CF	61.2	5.03	63.6	3.98	0.103
	Ar-Go	47.55	7.71	46.95	4.11	0.76
	Xi-Pm	69.7	5.26	70.15	4.43	0.771
	Ba-Gn	108.9	6.37	110.85	7.25	0.372
	Ar-pg	106.3	6.55	108.8	7.2	0.258
	AR-PR	32.45	2.72	34.1	3.51	0.105
	Pg-LS-Go-Gn	13.95	1.99	15	2.18	0.119

Mean, SD, P-values of all the Cephalometric measurements for males and females within shallow notch group was shown in table no: 4,chart no: 3. All the measurements mean values were more in males than that of females except Go-B, Ar-Go which were less in males than that of females. But statistically no significant difference was observed.

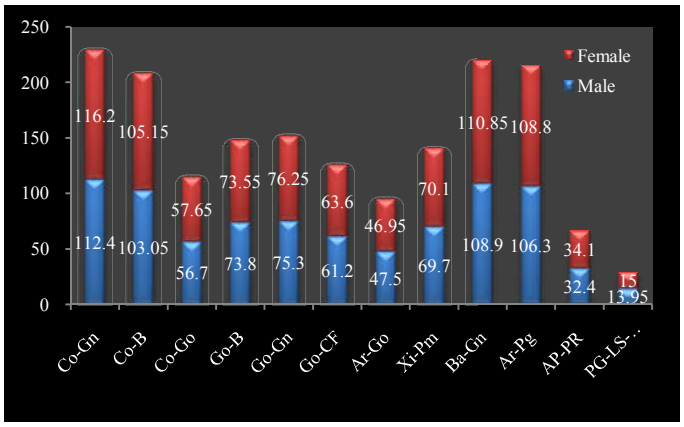

Chart no 3 Cephalometric measurements within shallow notch group based on gender

DISCUSSION

In this study, the sample consisting of 80 Pretreatment Lateral cephalograms of orthodontic patients (40 lateral cephalograms with deep and 40 with shallow antegonial notch depth). Subjects falling within 20–25 years were selected because of the fact that most of the growth would have been completed by that time. Also a constant skeletal pattern gets established, as Brodie[7] said that the facial patterns once established did not change much.

A well-established sexual dimorphism in the facial dimension had been found to exist by various researchers in the various facial types (Jarabak and Siriwat[8], Schudy[9]). So there was a need to segregate the sample according to sex to maintain the homogeneity of the sample.

Lambrechts *et al*[2] reported significant difference in the various cephalometric measurements indicating the nature of mandibular growth in two groups with extreme notch depth. Kolodziej *et al*[10] however, found statistically significant negative relationship between mandibular antegonial notch depth and subsequent horizontal jaw growth.

Ramus width measured at the level of occlusal plane was found to be increased in shallow notch individuals when compared with deep notch individuals. No significant sexual dichotomy was found in both deep and shallow notch groups. This is contradicting to the study of Mangla *et al* [11] where sexual dichotomy was found in hyperdivergent group.

Ramus height was found to be significantly increased in Shallow notch group compared to deep notch group. The findings were in agreement with the observation of Swinehart[12], Sassouni[13] Schudy[14] and Sassouni[15] all of whom reported a considerable deficiency in dimension in hyperdivergent group. Significant sexual dichotomy was found in the deep notch individuals.

Mandibular depth represented by Ar-pog was found to be significantly increased in shallow notch group compared to deep notch group. The results were in agreement with the studies of Hellman[16] who found shorter corpus in open bite.
The general length of the mandibles in the two groups (Go-Gn, Ar-Pg) showed statistically significant differences. The average values of Go-Gn and Ar-Pg were significantly shorter in the deep notch sample by 1.13mm and 1.22mm respectively. The results were in agreement with the studies of Lambrechts *et al*[2], who found shorter mandibles in deep notch sample.

Symphyseal thickness represented by Pg-LS-Go-Gn was 0.6 mm more in shallow notch group compared with deep notch group. The results were in agreement with the studies of Lambrechts *et al*[2], Karine Evangelista Martins *et al*[17] who reported that the brachyfacial group showed broader symphysis in the dentoalveolar and basal areas when compared with Dolichofacial group.

Clinical Perspective

Prediction of growth pattern by the morphology of mandible of an individual had clinical implications in treatment planning for the patient. Extraction decision, type of anchorage preparation, mechanics, and retention period are influenced by the growth pattern which an individual possesses[11].

With the increase in ramus height, there was an increase in mechanical advantage of the masseter muscle. Hence, the patients with short facial type overall have a significantly large mechanical advantage than compared with the long face group. Some surgical procedures used to correct facial disharmonies may have a significant effect on the mechanical advantage of the jaw muscles. Mandibular advancement, for example, will decrease mechanical advantage of adductor muscles.

The short ramus height associated with long face and skeletal open bite does not permit the mandibular ramus surgery to be carried out alone to correct the problem. This rotation lengthens the ramus and stretches the muscles of the pterygoid sling, causing the relapse to occur, and hence should be combined with maxillary intrusion to avoid any ramus lengthening.

The thickness of the dentoalveolarsymphysis is another feature of clinical relevance and its evaluation can establish the extent of safe orthodontic movement of the lower incisors, such as protraction and retraction. The possibility or lack of possibility of this orthodontic movement helps in making decisions for borderline cases undergoing orthodontic treatment with or without tooth extraction[17].

CONCLUSION

The ramus height was found to be significantly smaller in deep notch group than shallow notch group. Sexual dimorphism was significantly evident with males having greater ramus height than females. The ramus width was also found to be smaller in deep notch group. Mandibular depth showed smaller values in deep notch group and definite sexual dichotomy with greater values in males were found. The mandibular length was smaller in deep notch individuals showing significant sexual dichotomy. Symphyseal thickness was more in shallow notch group compared with deep notch group.

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