Original Article

A Correlation between Symphyseal Morphology and Antegonial Notch Depth with Different Growth Patterns in Angle's Class II Division 1 Malocclusion: A Cephalometric Study

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Abstract

Background: To study the relationship between symphyseal morphology and antegonial notch depth in vertical, horizontal, and average growth pattern in patients with Class II Division 1 malocclusion. **Materials and Methods:** Pretreatment lateral cephalograms of 50 patients with angle's Class II Division 1 malocclusion requiring orthodontic treatment were traced. The sample was divided into average, horizontal, and vertical growth pattern based on Jarabak's ratio (Horizontal-16, Vertical-22, and Average-12). Symphysis depth, height, ratio (height/depth), and antegonial notch depth were evaluated and analyzed statistically. **Results:** In vertical growth pattern, symphysis ratio and symphysis height are correlated. In horizontal growth pattern, symphysis height is correlated to symphysis depth and symphysis ratio and antegonial notch depth is correlated with symphysis depth. In average growth pattern, symphysis height, and ratio are correlated with symphysis depth. **Conclusion:** Symphysis morphology and antegonial notch depth are highly correlated in horizontal growth pattern group.

Keywords: Antegonial notch, Symphyseal morphology, Class II Division 1 malocclusion.

Introduction

Several factors affect the Angle's Class II Division 1 malocclusion as stated by various authors. It varies considerably and of four types, that is, maxillary teeth protraction, maxillary base protrusion, short mandible, or mandibular base retrusion.[1] Some cases possess combination of these types.[2] A thorough knowledge of the skeletal and dental parameters contributing to Angle's Class II Division 1 malocclusion is necessary as these components may influence the approach toward the treatment.[3] Prediction of mandibular growth pattern has great influence on orthodontic treatment planning.[19] Several investigators have studied mandibular rotation types, and various factors have been found helpful in prediction of mandibular rotation.[4]Jarabak ratio can be used for prediction of the direction of mandibular growth from a ratio of posterior and anterior facial height which states that, 60–65% considered as average growth pattern, and above 65% is considered as horizontal growth pattern and below 60% is vertical growth pattern.[5] Studies shows mandibles with backward and downward growth rotation (vertical growth pattern), marked deposition under the mandibular angle with more resorption below the symphysis area is observed.[6] The antegonial notch is result of curving of the lower border of the mandible upward and anterior to the angular process.[7,8] The mandibular symphysis is considered as the primary reference point for esthetics in lower third of the face, as well as, it is one of the predictors for the direction of mandibular growth rotation.[6,10] Rickets in his study found that a thick symphysis is associated with an anterior growth of direction.[11] Thus, the purpose of this study was to compare and correlate antegonial notch depth, symphysis height, depth, and ratio in three different growth patterns in patients with Angle's Class II Division 1 malocclusion.

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Materials and Method

In this study, pretreatment lateral cephalograms of 50 patients with Angle's Class II Division 1 malocclusion patients were taken from the records of the patients undergoing orthodontic treatment in the Department of Orthodontics and Dentofacial Orthopaedics. All these lateral cephalograms were traced on acetate matte tracing paper manually by a single operator with a 3H pencil on an illuminating box. The measurements were taken with the help of a scale and protractor. The sample was divided into horizontal, vertical, and average growth pattern depending on the Jarabak's ratio. Various cephalometric parameters used for this study were as follows (Figures 1 and 2):

1. S: Sella – The geometric center of the pituitary fossa
2. N: Nasion – The most anterior point of the frontonasal suture in the midsagittal plane
3. Point B: Supramentale – The most posterior midline point in the concavity of the mandible between the most superior point on the alveolar bone overlying the mandibular incisors (infradentale) and the most anterior point on the chin

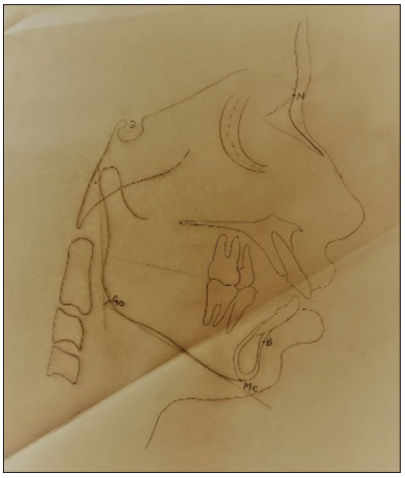

Figure 1: Cephalometric landmarks

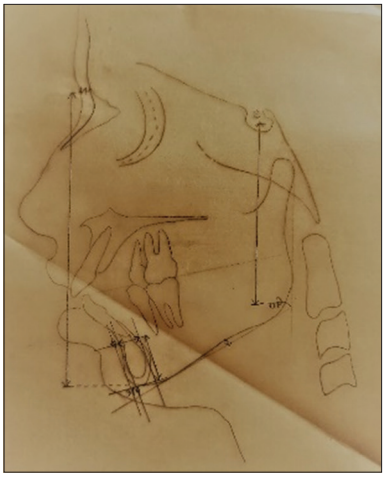

Figure 2: Parameters used in the study

4. Me: Menton – The lowest point on the symphyseal shadow of the mandible seen on a lateral cephalogram
5. Go: Gonion – A point on the curvature of the angle of the mandible located by bisecting the angle formed by lines tangent to the posterior ramus and the inferior border of the mandible.

Cephalometric linear and angular measurements:

1. Anterior facial height – The linear distance measured between Nasion and Menton
2. Posterior facial height – The linear distance measured between Sella and Gonion
3. Jarabak's ratio – Measured as posterior facial height divided by anterior facial height
4. Antegonial notch depth – The linear distance measured along a perpendicular drawn from deepest part of convexity to a tangent through two points on either side of the notch on the lower border of the mandible.[12,13]
   Symphysis height – calculated as follows: A grid was constructed with the parallel and perpendicular lines to the tangent line drawn to point B which was taken as the long axis of the symphysis. The point B was taken as superior limit of the symphysis with inferior, anterior, and posterior limits were taken at the most inferior, anterior, and posterior borders of the symphysis outline, respectively. The symphyseal height is measured as linear distance measured from the superior to the inferior limit on the grid.[6]
5. Symphysis depth – The linear distance measured from anterior to posterior limit on the grid
6. Symphysis ratio – Measured as symphysis height divided by symphysis depth.

Results

Patients with vertical growth pattern shows correlation between symphysis ratio and symphysis height. Patients with Horizontal growth pattern, shows correlation between symphysis height and symphysis depth. Also symphysis ratio and antegonial notch depth is correlated with symphysis depth (Table 3). In patients with average growth pattern, symphysis height and ratio are correlated with symphysis depth (Table 4).

Discussion

The mandibular symphysis morphology is important in orthodontic treatment planning for adult or non-growing patients. The cortical bone in the symphysis region is thinner than the other mandibular parts, and this becomes an anatomically limiting factor for movement of tooth. Patients with narrow symphysis have higher chances of iatrogenic injuries, that is, gingival recession or dehiscence; hence, tooth movement should be meticulously done during orthodontic treatment. Subsequently, it is important to consider the morphology of their mandibular symphysis during treatment planning.[4]

This cephalometric study was conducted to compare and correlate antegonial notch depth and symphysis morphology in three different growth patterns in patients with Angle's

Table 1: Comparison of all variables among three groups

Variable	Horizontal	Vertical	Average	*P* value
SH	15.25±2.56	15.34±2.69	15.00±1.69	0.92
SD	10.93±0.77	10.70±1.49	10.66±1.62	0.83
SR	1.31±0.22	1.42±0.22	1.41±0.18	0.33
AN	1.40±0.66	1.20±0 0.90	1.04±0.89	0.51

SH: Symphysis height, SD: Symphysis depth, SR: Symphysis ratio, AN: Antegonial notch depth

Table 2: Correlations of parameters in vertical growth pattern group

	sh1	sd1	sr1	an1
sh1				
Pearson correlation	1	0.210	0.617*	−0.396
Sig. (2-tailed)		0.435	0.011	0.129
N	16	16	16	16
sd1				
Pearson correlation	0.210	1	−0.215	−0.207
Sig. (2-tailed)	0.435		0.423	0.441
N	16	16	16	16
sr1				
Pearson correlation	0.617*	−0.215	1	−0.316
Sig. (2-tailed)	0.011	0.423		0.233
N	16	16	16	16
an1				
Pearson correlation	−0.396	−0.207	−0.316	1
Sig. (2-tailed)	0.129	0.441	0.233	
N	16	16	16	16

*Correlation is significant at the 0.05 level (2-tailed)

Table 3: Correlations of parameters in horizontal growth pattern group

	sh2	sd2	sr2	an2
sh2				
Pearson correlation	1	0.456*	0.641**	−0.351
Sig. (2-tailed)		0.033	0.001	0.109
N	22	22	22	22
sd2				
Pearson correlation	0.456*	1	−0.374	−0.497*
Sig. (2-tailed)	0.033		0.087	0.018
N	22	22	22	22
sr2				
Pearson correlation	0.641**	−0.374	1	0.064
Sig. (2-tailed)	0.001	0.087		0.777
N	22	22	22	22
an2				
Pearson correlation	−0.351	−0.497*	0.064	1
Sig. (2-tailed)	0.109	0.018	0.777	
N	22	22	22	22

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

Class II Division 1 malocclusion. As shown in the Table 1, the depth of the antegonial notch and symphysis depth was found to be highest in horizontal growth pattern group followed by

Table 4: Correlations of parameters in average growth pattern group

	sh3	sd3	sr3	an3
sh3				
Pearson correlation	1	0.635*	0.118	0.211
Sig. (2-tailed)		0.026	0.715	0.510
N	12	12	12	12
sd3				
Pearson correlation	0.635*	1	−0.679*	0.245
Sig. (2-tailed)	0.026		0.015	0.442
N	12	12	12	12
sr3				
Pearson correlation	0.118	−0.679*	1	−0.160
Sig. (2-tailed)	0.715	0.015		0.620
N	12	12	12	12
an3				
Pearson correlation	0.211	0.245	−0.160	1
Sig. (2-tailed)	0.510	0.442	0.620	
N	12	12	12	12

*Correlation is significant at the 0.05 level (2-tailed)

vertical and average growth pattern group. Symphysis height and symphysis ratio were highest in vertical growth pattern.

Roy *et al.*[15] found in his study that the amount of external symphysis increases in size as the growth pattern differ from vertical to horizontal. An anterior growth direction of the mandible has been related to the thicker symphysis as reported by Ricketts.[11] Sassouni and Nanda[16] and Björk[7] have found pronounced apposition below the symphysis area with excessive concavity of the lower border of mandible related to the tendency of mandible to rotate backwards.

An esthetically acceptable protrusion of the incisors which is correlated to the pronounced symphysis, and therefore, a greater chance of non-extraction approach of treatment can be considered in these cases. On the contrary, in patients with greater symphyseal height and small chin, an extraction approach is considered for compensation of arch length discrepencies.[17] These findings are correlated with our results as deepest symphyseal depth is found in horizontal growth pattern group and thus non extraction approach can be considered in such patients whereas in vertical growers, it is better to prefer extraction approach as the symphyseal depth is lesser in such patients.[6]

Kolodziej *et al.* (2002)[18] found statistically significant negative relationship between mandibular antegonial notch depth and horizontal growth pattern and concluded that antegonial notch depth fails to warrant its application to predict mandibular growth in a nonextreme population. Thus, mandibular symphysis morphology can be considered in growth prediction and treatment planning of orthodontic patients.[19]

Conclusion

From clinical point of view, in individuals seeking orthodontic treatment for Angle's Class II malocclusion, the decision of

extraction, anchorage requirement, biomechanics used and retention protocol are dependent on growth pattern of patients which is influenced by of mandibular symphysis morphology and antegonial notch depth.

References

1. Sassouni V. A classification of skeletal facial types. Am J Orthod 1969;55:10923.
2. Jacobson A, Jacobson RL. Tracing technique and identification of landmarks. In: Radiographic Cephalometry: From Basics to 3D Imaging. Chicago: Quintessence Publishing Co. Inc.; 2007. p. 4951.
3. Schudy FF. Vertical growth versus anteroposterior growth as related to function and treatment. Angle Orthod 1964;34:7593.
4. Muller G. Growth and development of the middle face. J Dent Res 1963;42:3859.
5. Kim SJ, Son WS. A study on the relationship of the mandibular symphysis and anterior alveolar and skeletal morphology according to the rotational growth pattern of mandible in skeletal Class III malocclusion. Korean J Orthod 1999;29:30315.
6. Kar B, Aggarwal I, Mittal S, Bhullar M, Singla D, Sharma A. Antegonial notch and mandibular symphysis as indicators of growth pattern. Dent J Adv Stud 2018;6:80-8.
7. Aki T, Nanda RS, Currier GF, Nanda SK. Assessment of symphysis morphology as a predictor of the direction of mandibular growth. Am J Orthod Dentofac Orthop 1994;106:609.
8. Gupta S, Dhingra PS, Chatha S. A study of comparison and correlation between antegonial notch depth, symphysis morphology, and ramus morphology among different growth patterns in angle's Class II Division 1 Malocclusion. Indian J Dent Sci 2018;10:21.
9. Singer CP, Mamandras AH, Hunter WS. The depth of the mandibular antegonial notch as an indicator of mandibular growth potential. Am J Orthod Dentofac Orthop 1987;91:117-24.
10. Moshfeghi M, Nouri M, Mirbeigi S, Baghban AA. Correlation between symphyseal morphology and mandibular growth. Dent Res J 2014;11:3759.
11. Ricketts RM. Cephalometric synthesis. Am J Orthod 1960;46:64773.
12. Kolodziej RP, Southard TE, Southard KA, Casko JS, Jakobsen JR. Evaluation of antegonial notch depth for growth prediction. Am J Orthod Dentofac Orthop 2002;121:35763.
13. Mangla R, Singh N, Dua V, Padmanabhan P, Khanna M. Evaluation of mandibular morphology in different facial types. Contemp Clin Dent 2011;2:2006.
14. Ahn MS, Shin SM, Yamaguchi T, Maki K, Wu TJ, Ko CC, *et al*. Relationship between the maxillofacial skeletal pattern and the morphology of the mandibular symphysis: Structural equation modeling. Korean J Orthod 2019;49:170-80.
15. Roy AS, Tandon P, Chandna AK, Sharma VP, Nagar A, Singh GP. Jaw morphology and vertical facial types: A cephalometric appraisal. J Orofac Res 2012;2:1318.
16. Sassouni V, Nanda S. Analysis of dentofacial vertical proportions. Am J Orthod 1964;50:80123.
17. Esenlik E, Sabuncuoglu FA. Alveolar and symphysis regions of patients with skeletal class II division 1 anomalies with different vertical growth patterns. Eur J Dent 2012;6:123-32.
18. Björk A. Prediction of mandibular growth rotation. Am J Orthod 1969;55:58555:
19. Tweed CH. The Frankfortmandibular plane angle in orthodontic diagnosis, classification, treatment planning, and prognosis. Am J Orthod Oral Surg 1946;32:175230.