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Evaluation of Mandibular Symphysis Morphology in Different Skeletal Malocclusions: A Retrospective Cephalometric Study.

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Abstract

Introduction: Mandibular symphysis is notable and obvious structure in craniofacial complex and serves as reference region for esthetic evaluation of face. In addition, it plays a role in indicating the possible direction for mandibular growth.

Material and method: 60 pretreatments lateral cephalogram age group 18-30 years, were divided into3 groups skeletal class I (ANB angle = 3° ±1°), class II (ANB angle >4°), class III (ANB angle <2). Cephalogram were traced and 5 angular and 6 linear measurements were measured. For all statistical analysis, the Statistical Package for the Social Science (SPSS version 21) was used.

Result: angle B-B1-Gn was significantly smaller in Class II than in Class I (P <.05) and Class III (P <.001) skeletal relationships. The MS concavity angle (Id-B-Pog), Inclination of the alveolar part of MS toward the mandibular plane (Id-B/MP), Total length of MS (Id-Me) significantly larger in class III group than class II and class I group.

Conclusion: Less concave anterior contour of mandibular symphysis exhibited by skeletal class III jaw relationship. Increase in vertical dimensions and more inclination of alveolar part towards mandibular plane than did the other AP relationships reflecting compensation for skeletal pattern of jaws. Strong correlation was found between anterior facial height and mandibular symphysial height. Larger dimensions of mandibular symphysis were found in class III followed by class I and class II skeletal relationship.

Keyword: Mandibular symphysis morphology, Skeletal malocclusion.

Introduction

Mandibular symphysis is a complex body part of the mandible which consists of lower incisors and anterior portion of chin. It's morphologically divided into two regions, alveolar ridge and basal symphysis.[6] Dentoalveolar symphysis consists of alveolar process and lower incisors. Alveolar bone thickness varies in a line with location and facial type.[7] Greater bone thickness within the cervical region at apex. It's more in lingual surface than in labial surface.[2] Lingual side of cortical bone is thicker than buccal and there's closer approximation of root apex on the lingual side[1]. For a clinical orthodontist, symphysis region is one among the foremost important regions of craniofacial complex. Mandibular symphysis is employed as primary reference, for determining esthetic aspect of lower third of face.[8] A vertical and sagittal position of mandibular incisor and mental protuberance are important determinants in planning occlusal and skeletal relation on orthodontic treatment and orthognathic surgical procedures.[9]

The basal symphysis could be the part of the most body of the mandibular symphysis with more apical location. The morphological variation of the menton includes a strong genetic basis.[1]

The relationship between the height and width of the mandibular symphysis is one amongst Bjork's five criteria for establishing the mandibular rotation pattern during growth.[10-8]For long and narrow symphyses, the tendency of mandibular rotation during growth is predominantly vertical; when short and wide, it's predominantly horizontal.[1]

The height and projection of the basal symphysis influence the position of the adjacent soft tissue and are significant in terms of aesthetic and facial harmony.[9]

Mandibular symphysis also has been considered in concert predictors for the direction of mandibular growth rotation. Ricketts[5] stated that symphysis morphology as a technique to predict the direction of mandibular growth.[1]

Previous studies by Akhare P. et al[1] have demonstrated the relationship morphological dimension of mandibular symphysis with different growth pattern. They concluded that skeletal class II hyperdivergent exhibited more concave anterior contour of mandibular symphysis.

No previous study reported the relationship of morphological dimension of mandibular symphysis with different skeletal pattern.

Aim: To evaluate the morphological dimensions of mandibular symphysis in different anteroposterior jaw relation.

Objectives

1. To evaluate size and shape of mandibular symphysis in skeletal class I malocclusion.
2. To evaluate size and shape of mandibular symphysis in skeletal class II malocclusion.
3. To evaluate size and shape of mandibular symphysis in skeletal class III malocclusion.
4. To compare size and shape of mandibular symphysis in skeletal class I, class II, class III malocclusion.

Material And Method

It is a retrospective study. Pretreatment lateral cephalometric head films of 60 subjects were taken of age from 18 to 30 years who had visited the Department of Orthodontics & Dentofacial

Orthopedics at MGV'S KBH Dental college and Hospital, Nashik meeting the following inclusion criteria.

Inclusion criteria

1. Age group 18-30 years; both males and females.
2. Intact permanent dentition with or without third molars.
3. Standardized lateral cephalogram with adequate sharpness and resolution.

Exclusion criteria

1.Mixed/deciduous dentition.

2.History of orthodontic treatment and/or maxillary functional orthopedic treatment.

3.History of trauma to the mandible

4. Previous history of nasal respiratory complex surgery.
5. Neurological disorders.
6. Radiographs of adults with developmental problems affecting growth and development, for example, craniofacial syndromes, endocrine disturbances.

All the lateral cephalograms were traced by the same operator on an acetate sheet of 0.5 mm thickness with a 0.3-mm mechanical pencil.

The radiographs were divided according to their skeletal AP jaw relationship into three groups. (Class I, Class II, or Class III relationship).

Class I skeletal relationship was considered when ANB angle = 3° ±1°

Class II skeletal relationship was considered when ANB angle >4° and

Class III skeletal relationship was considered when ANB angle <2°

All the landmarks (**Table:1 and Fig:1**) were identified and marked. After that linear (**Table: 2 and Fig: 2**) and angular (**Table: 3 and Fig: 3)** parameters were measured.

Table 1: Definition of the Symphysis Points and Measured Parameters

Points	Definition
Point B	The most posterior point on the profile of the mandible between the chin point and the alveolar crest.
Pogonion (Pog)	The most anterior point of the mandibular symphysis in the midline
Gnathion (Gn)	The most anterior inferior point of the mandibular symphysis in the midline
Menton (Me)	The lowermost point of the mandibular symphysis in the midline
Point B1	A point formed by the intersection between a perpendicular line dropped from point B to the tangent drawn on the inner contour of mandibular symphysis at the shortest distance from point B
Point Id	The most anterior superior point of the labial mandibular alveolar crest, situated between the lower central incisors.

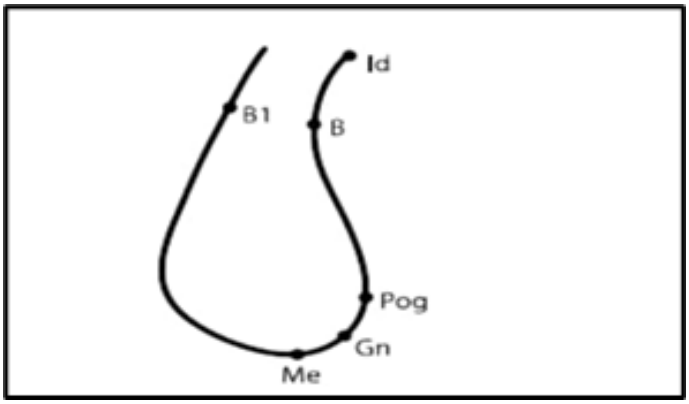

Figure 1: Landmarks identified on cephalograms.

Table 2: Linear measurements

Id-B	The linear distance from Id to point B
B-Pog	The linear distance from point B to Pogonion
Pog-Me	The linear distance from Pogonion to Me
Id-Me	The linear distance from Id to Me, representing the total length of MS
Perpendicular distance from Pog to B-Me line	The perpendicular distance from Pogonion to the line connecting point B and Menton to represent the anterior prominence of MS
Area, mm2	The total area confined within the outer border of MS and bounded superiorly by the line connecting Id and the most superior point of the lingual mandibular alveolar crest

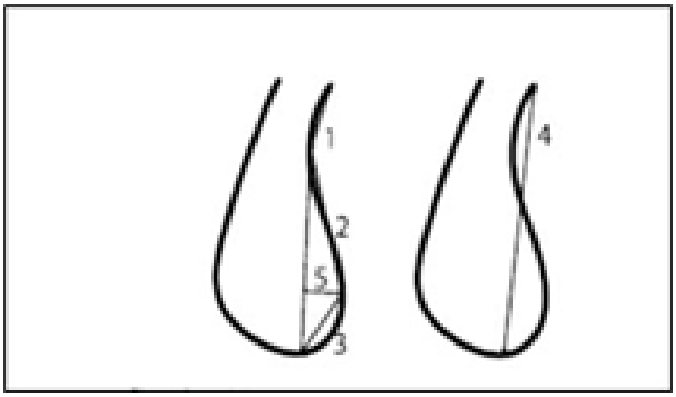

Figure 2: Linear parameters measured on mandibular

Table 3: Angular measurements

B-B1-Gn	The angle between point B, point B1, and Gnathion; It gives an indirect reflection of the vertical dimension of the mandibular symphysis.
B-Pog-Me	The angle formed between point B, Pogonion, and Menton; It reflects the convexity of the mandibular symphysis.
Id-B-Pog	The angle between point Id, point B, and Pogonion; It reflects the concavity of the mandibular symphysis.
Id-B/Md	The angle between a line connecting Id to Point B and the mandibular plane; It reflects the inclination of the alveolar part of the mandibular symphysis in relation to the mandibular plane.
B-Pog/Md	The angle between a line connecting Point B to Pogonion and the mandibular plane; It reflects the inclination of the skeletal part of the mandibular symphysis in relation to the mandibular plane

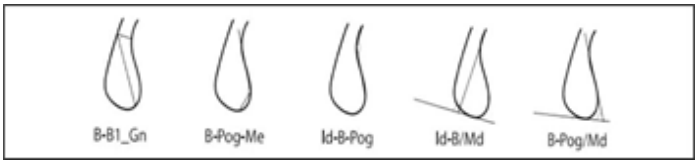

Figure 3: Angular parameters measured on the mandibular symphysis

Statistical Analysis:

Mean and standard deviations for the cephalometric parameters and those describing MS were calculated. For all statistical symphysis. Analysis, the Statistical Package for the Social Science (SPSS version 22) was used. One-way analysis of variance (ANOVA) was performed to determine whether there was a difference between the three groups

Result

Table 4: Mean and Standard Deviation (SD) for the Mandibular Symphysis Measured Parameters in the Different Anteroposterior Skeletal Jaw Relationships and the differences between them.

Mandibular symphysis parameters	Class I Mean ±SD	Class II Mean ± SD	Class III Mean ± SD	Difference Class I to class II	Difference Class I to class III	Difference class II to class III
B-B1Gn	63.21 ± 6.08	61.15±5.93	64.44±6.55	2.06*	-1.23	-3.27***
Id-BPog	147.73±7.08	147.30±7.77	152.18±8.52	0.43	-4.45***	-4.88***
B-PogMe	124.52±7.22	127.29±8.99	126.66±10.85	-2.77	-2.14	0.63
Id-B/Md	110.16±8.52	111.94±7.82	104.76±7.93	-1.77	5.40***	7.18***
B-Pog/Md	67.77±6.77	68.74±8.41	66.91±6.51	-0.97	0.86	1.83
Id-B	10.72±0.24	10.29±0.25	11.40±0.25	0.43	-0.68	-1.11**
B-pog	14.35±0.31	13.65±0.30	15.13±0.31	0.70	0.78	-1.48**
Pog-me	10.41±o.19	10.43±0.18	10.71±0.18	-0.02	-0.30	-0.28
Id-Me	32.78±0.39	32.73±0.34	33.98±0.37	0.05	-1.20*	-1.25*
Pog to B-Me line	2.59±0.16	2.14±0.17	2.84±0.17	0.045*	0.25	0.70**
Area	36.7±6.32	36.60±7.33	39.02±5.61	0.10	-2.23**	-2.42**

The mean difference is significant at the 0.05 level; ** The mean difference is significant at the 0.01 level, * The mean difference is significant at the 0.001 level.**

The angle B-B1-Gn (vertical dimension of MS) was significantly smaller in Class II than in Class I (P <.05) and Class III (P <.001) skeletal relationships.

The MS concavity angle (Id-B-Pog) was significantly larger in Class III than in Class I and Class II skeletal relationships (P < .001), while the angle of MS convexity showed no significant difference between the three groups.

Inclination of the alveolar part of MS toward the mandibular plane (Id-B/MP) was significantly more (indicated by a smaller angle) in the Class III group than in the other two groups (P < .001).

Inclination of the skeletal part (B-Pog/MP) of MS, however, showed no significant difference among the three groups.

The distances from Id to point B and from point B to Pogonion were significantly larger in the Class III (P < .01) than in the Class II group.

Total length of MS (Id-Me) was larger in the Class III group than in the other two groups (P < .05).

Perpendicular distance from Pog to B-Me line was significantly smaller in the Class II than in the Class I (P < .05) and Class III (P <.01) groups.

MS area in the Class III group was significantly larger than in the Class I and Class II groups (P < .01).

Discussion

Dentoalveolar compensation usually observed clinically, is to overcome the underlying anteroposterior skeletal discrepancy.[10,11]

Change in inclination of lower incisors to compensate skeletal discrepancy in different anteroposterior relationships might cause surface remodeling of mandibular symphysis affecting its morphology.[12]

Accordingly, this study evaluated some characteristics of mandibular symphysis in anteroposterior relationships and compared with compensatory changes in morphology of mandibular symphysis.

In this study class III subjects showed less anterior concavity of MS and greater inclination of alveolar part of MS towards the mandibular plane than class I and class II subjects. The same finding with result reported by Yamada et al.[13] It indicates that retroclination of mandibular incisor in class III subjects act as compensatory mechanism provide good occlusion along

with acceptable facial balance related to various skeletal apical bases.[14]

It has been observed that retroclination of lower incisors would result into surface remodeling of outer surface of dentoalveolar part of MS.[15] Such retroclination of alveolar part of symphysis would result in less concavity of anterior contour of MS.[3]

The convexity of contour of skeletal part of MS was evaluated by angular and linear measurements; angle B-Pog-Me and Pog to B- Me line respectively. B -pog-me was smaller in class III group than class II group. The difference between group did not reach significant level. Liner measurement significantly larger in class III group which show MS have larger vertical dimension as compared class I and class II group. Class II group showed smallest distance. This finding demonstrates a compensatory increase in chin prominence in class III skeletal relationship. The general increase in mandibular size in class III discrepancy could be one explanation for that.[16] Angular measurement and linear distance that expresses the vertical dimensions of MS and area of MS were larger in class III compared to class I and class II group. Several studies[16-18] reported a larger mandible in class III relationship including its symphysis than in other anteroposterior relationships. In this study, a strong correlation was found between vertical dimension of mandibular symphysis and anteroposterior relationship. As lower facial height increase, upper and lower anterior teeth may continue their eruption in attempt to maintain a positive overbite, bringing their alveolar bony support with them, resulting in increase in total MS length.[19,20] Other studies[13,21]reported a stronger correlation between lower incisor inclination and mandibular symphysis inclination. But in this study reported a weak but significant co-relation between these two parameters. This was because of difference in reference point and line were used to express inclination of alveolar part of MS. In this study reference line for inclination of alveolar part of mandibular symphysis passed through point B. Therefore, any variation of this point in different skeletal pattern would affect skeletal pattern would affect involved angular measurements.[22]

Conclusion

Less concave anterior contour of mandibular symphysis exhibited by skeletal class III jaw relationship.

Increase in vertical dimensions and more inclination of alveolar part towards mandibular plane than did the other AP relationships reflecting compensation for skeletal pattern of jaws.

Strong correlation was found between anterior facial height and mandibular symphysial height.

Larger dimensions of mandibular symphysis were found in class III followed by class I and class II skeletal relationship.

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