EVALUATION AND COMPARISON OF THE MORPHOLOGICAL DIMENSION OF MANDIBULAR SYMPHYSIS IN SKELETAL CLASS I AND CLASS II INDIVIDUALS WITH DIFFERENT GROWTH PATTERNS- A CEPHALOMETRIC STUDY

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INTRODUCTION:

Mandibular symphysis is an anatomical structure of the mandible in which the lower incisors and the anterior portion of the chin are found. It is morphologically divided into two regions, the dentoalveolar and basal symphyses.[1]

The dentoalveolar symphysis consists of alveolar process and lower incisors. Alveolar bone thickness varies according to location and facial type.[2] Generally, there is a greater bone thickness at the apex then in the cervical region and towards the lingual surface when compared to the labial surface.[2] The lingual side of cortical bone is thicker than the buccal and there is a closer approximation of the root apex to the lingual cortical.

The basal symphysis is a part of the main body of the mandibular symphysis with more apical location. The morphological variation of the menton has a strong genetic basis.

The relationship between the height and width of the mandibular symphysis is one of Björk's five criteria for establishing the mandibular rotation pattern during growth.[3,4,5,6] . For long and narrow symphyses, the tendency of mandibular rotation during growth is predominantly vertical; when short and wide, it is predominantly horizontal.

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.[7,8]

Mandibular symphysis also has been considered as one of the predictors for the direction of mandibular growth rotation. Ricketts[3] stated that symphysis morphology as a method to predict the direction of mandibular growth.

The aim of this study was to evaluate and compare the morphological dimension of mandibular symphysis in Skeletal Class I and Class II individuals with different growth patterns.

MATERIAL AND METHODS:

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 VSPM's Dental College & Research Centre, Nagpur.

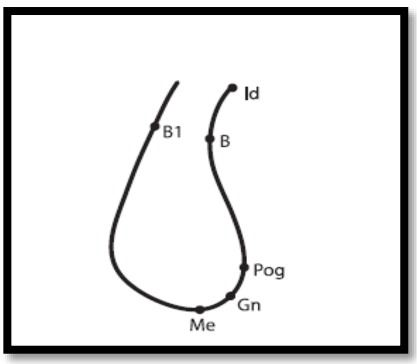
The radiographs were selected according to their skeletal AP jaw relationship (Class I, Class II). Class I skeletal relationship was considered when ANB - $3^{0}{}_{-}^{+}\ 1^{0.}$ and Class II skeletal relationship when ANB - >4^{0} . Skeletal Class II patients were grouped on the basis of SN-Mandibular plane into hypodivergent & hyperdivergent .

The radiographs were traced on acetate tracing paper with a 3H pencil on a view box. The linear and angular measurements were measured with the help of a scale and protractor.

The various parameters used for study were as follows:

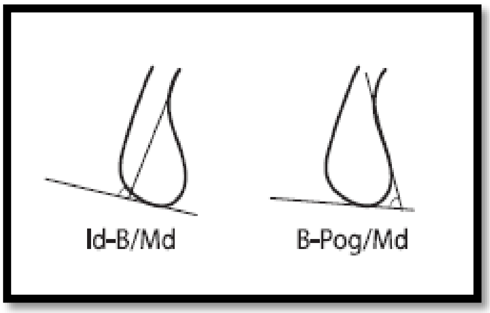
- **CEPHALOMETRIC LANDMARKS:**

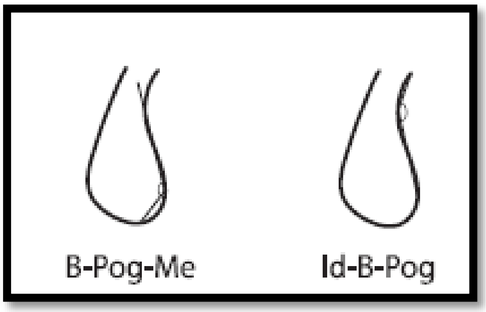
- **Point B** -The most posterior point on the profile of the mandible between the chin point and the alveolar crest.
- **Pogonion (Pog)-** The most anterior point of the mandibular symphysis in the midline.
- **Menton (Me)** -The lowermost point of the mandibular symphysis in the midline.
- **Gnathion (Gn)-** The most anterior inferior point of the mandibular symphysis in the midline between Pogonion and Menton.
- **Point Id** -The most anterior superior point of the labial mandibular alveolar crest, situated between the lower central incisors.



- **ANGULAR MEASUREMENTS:**

- **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 mandibularplane; It reflects the inclination of the skeletal part of the mandibular symphysis in relation to the mandibular plane.
- **Symphysis angle-** Posteriosuperior angle formed by the line through Me and point B and the mandibular plane.

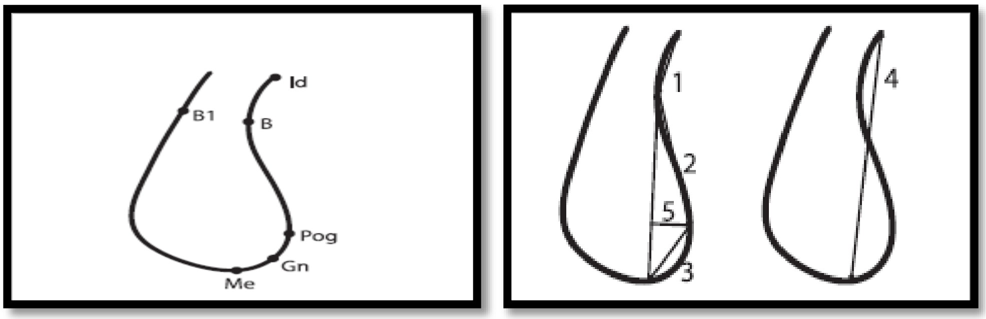




- **LINEAR MEASUREMENTS:**

- **Symphysis height:** A line tangent to point B was used as the long axis of the symphysis and a grid was formed with the lines of the grid parallel and perpendicular to the constructed tangent line.
- **Symphysis depth:** Distance from anterior to posterior limit of grid.
- **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.



RESULT:

Mean values of linear and angular measurements of the morphological dimensions of the MS symphysis in skeletal Class I and Class II individuals with different growth patterns were determined along with their standard deviations using descriptive statistics. **(table 1,2)**

The statistical analysis was done using the Statistical Package for the Social Science (SPSS version 22, Armonk, NY: IBM Corp). The recorded values were statistically evaluated using the one-way analysis of variance test (ANOVA), followed by Tukey post hoc test for multiple comparisons. The one-way analysis of variance (ANOVA) is used to determine whether there are any significant differences between the means of two or more independent (unrelated) groups.

Table 1. Mean Linear measurements

Variables	Sample (N)	Skeletal Class I (mean ± SD)	Skeletal Class II Hypodivergent (mean ± SD)	Skeletal Class II Hyperdivergent (mean ± SD)
Height	60	18.25 ± 1.8	18.95 ± 1.5	21.55 ± 3.0
Width	60	11.5 ± 1.4	10.2 ± 1.5	9.7 ± 1.8
Id-Me	60	28.7± 2.5	27.6 ± 1.9	32.6 ± 3.2
Perpendicular distance from Pog to B-Me line	60	4.3 ± 0.8	4.0 ± 1.1	4.3 ± 1.1

Table 2. Mean Angular measurements

Variables	Sample (N)	Skeletal Class I (mean ± SD)	Skeletal Class II Hypodivergent (mean ± SD)	Skeletal Class II Hyperdivergent (mean ± SD)
B-Pog-Me	60	130.6 ±3.6	131.5 ± 11.1	133.2 ± 10.1
Id – B-Pog	60	148.3 ± 3.1	146.9 ±6.5	149.2 ± 6.6
Id-B-Md	60	89.85 ± 5.0	95.3 ± 6.6	98.0 ± 7.4
B-Pog-Md	60	62.5 ± 3.3	62.1 ± 8.4	63.6 ± 6.8
Symphysis Angle	60	85.2 ± 3.6	86.5 ± 6.1	85.7 ± 6.0

Table. 3. Comparison of mean linear measurements amongst the three groups

Variable	Sum of squares	Df	Mean square	F	p-value
Height Between groups Within groups	120.933 281.650	2 57	60.467 4.941	12.237	0.000*
Width Between groups Within groups	36.633 146.100	2 57	18.317 2.563	7.146	.002*
Id-Me Between groups Within groups	282.100 401.550	2 57	141.050 7.045	20.022	.000*
Perpendicular distance from Pog to B-Me line Between groups Within groups	1.200 62.400	2 57	.600 1.095	.548	.581

*p≤0.001, highly statistically significant difference using ANOVA test

Table. 4. Comparison of mean angular measurements amongst the three groups

Variable	Sum of squares	Df	Mean square	F	p-value
B-Pog-Me Between groups Within groups	67.433 4526.750	2 57	33.717 79.417	.425	.656
Id – B-Pog Between groups	53.733 1820.850	2 57	26.867 31.945	.841	.437

Within groups					
Id-B-Md Between groups Within groups	689.433 2356.750	2 57	344.717 41.346	8.337	.001*
B-Pog-Md Between groups Within groups	24.633 2452.100	2 57	12.317 43.019	.286	.752
Symphysis Angle Between groups Within groups	18.300 1669.300	2 57	9.150 29.286	.312	.733

*p≤0.001, highly statistically significant difference using ANOVA test

Table 5. Difference amongst the groups (Linear measurements)

Variable	Difference Class I to Class II hypodivergent	Difference Class I to Class II hyperdivergent	Difference Class II hypodivergent to Class II hyperdivergent
Height	-0.7 (NS)	-3.3*	-2.6*
Width	1.35*	1.85*	0.50 (NS)
Id-Me	1.10 (NS)	-3.95*	-5.05*
Perpendicular distance from Pog to B-Me line	0.30 (NS)	0.0 (NS)	-0.30 (NS)

*the mean difference is significant at p<0.05 level; NS – not significant

Table 6. Difference amongst the groups (Angular measurements)

Variable	Difference Class I to Class II hypodivergent	Difference Class I to Class II hyperdivergent	Difference Class II hypodivergent to Class II hyperdivergent
B-Pog-Me	-0.85 (NS)	-2.55 (NS)	-1.7 (NS)
Id – B-Pog	1.40 (NS)	-0.90 (NS)	-2.30 (NS)
Id-B-Md	-5.45*	-8.15*	-2.70 (NS)
B-Pog-Md	0.35 (NS)	-1.15 (NS)	-1.5 (NS)
Symphysis Angle	-1.35 (NS)	-0.60 (NS)	0.75 (NS)

*the mean difference is significant at p<0.05 level; NS – not significant

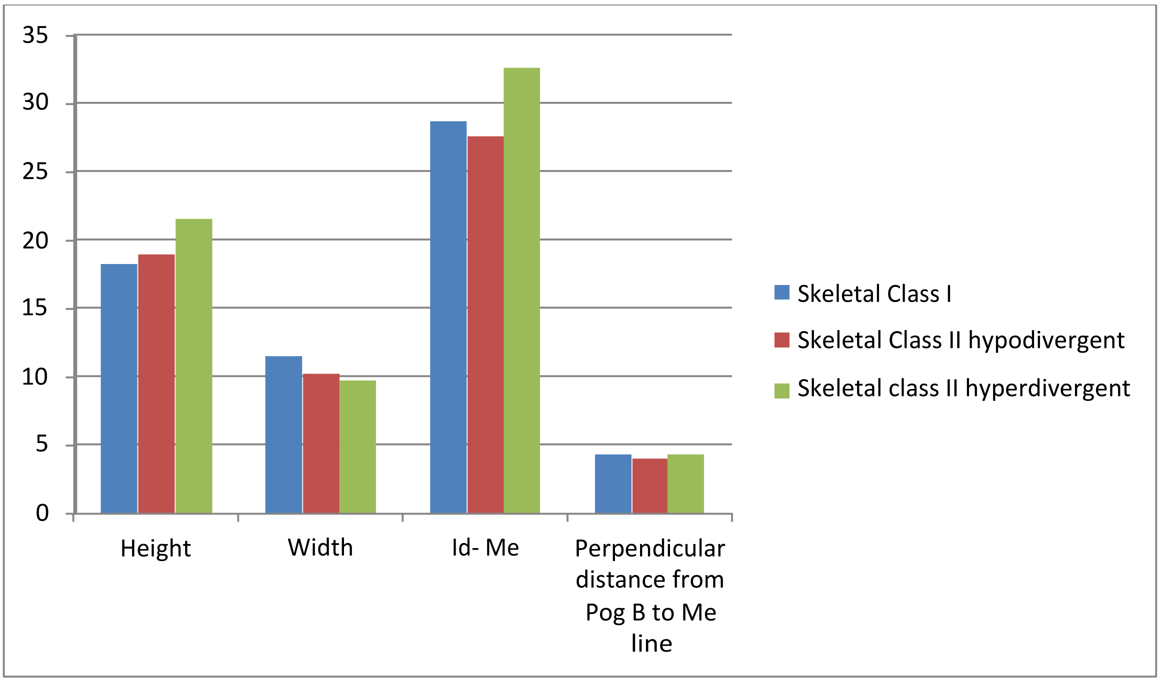


Fig 1.**Comparison of mean linear measurements amongst the three groups**

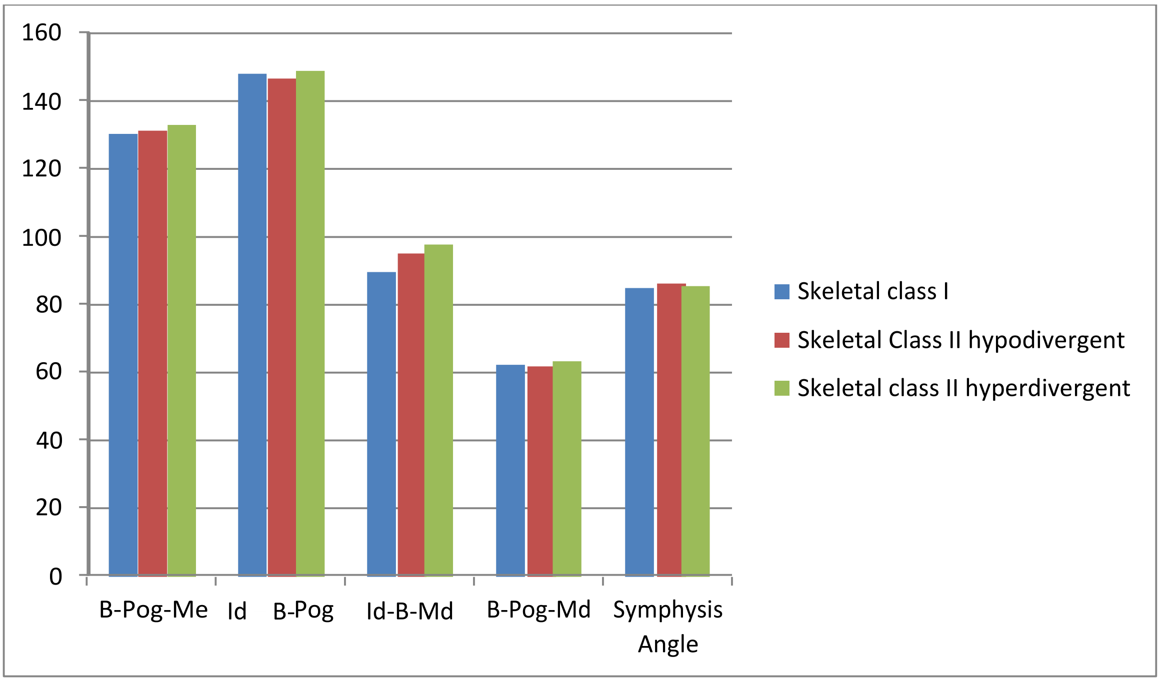


Fig 2.**Comparison of mean angular measurements amongst the three groups**

DISCUSSION:

The morphology of mandibular symphysis is a salient feature of clinical relevance. Its measurement can establish the extent of safe orthodontic movement of the lower incisors, such as projection and retraction. This will help in making decisions for borderline cases undergoing orthodontic treatment with or without tooth extraction or in the treatment of skeletal sagittal discrepancies with compensation or with orthognathic surgery. Buccal and lingual corticals at the level of the incisor apex may represent the lower anatomic limits for orthodontic movement[9,10].

When tooth movement exceeds the limits imposed by the alveolar symphysis morphology, there could be a risk of instability or iatrogenisis. Hence, severe skeletal discrepancies in narrow alveolar symphyses limit orthodontic compensation and require orthognathic surgery[3].

Orthodontists have traditionally evaluated lower incisor positioning using angular and linear cephalometric measurements. It is important that a morphological analysis of the dentoalveolar symphysis[10,11,12] be added to this simplistic geometric analysis. Considering these facts and recognizing the undeniable importance of the mandibular symphysis for orthodontic treatment, this study has emphasized the need for individualization.

In this study, the sample consisting of 60 subjects was divided according to their skeletal AP jaw relationship and on the basis of SN-Mandibular plane. Symphysis in skeletal Class II hypodivergent facial type have short height, large depth and larger angle. In contrast, a symphysis in skeletal Class II hyperdivergent group have larger height, smaller depth and smaller angle. These results were consistent in the finding of Aki et al, Ricketts, Viazis who found a thick symphysis to be associated with an anterior growth direction.

It has been suggested that retroclination of the lower incisors would lead to surface remodeling of the outer surface of the dentoalveolar part of MS to follow the inclination of the lower central incisors, leading to its retroclination as well. Such retroclination of the alveolar part of the symphysis would result in less concavity of the anterior contour of MS.The angle between point Id, point B, and Pogonion; the concavity of the mandibular symphysis was more for skeletal class II hyperdivergent growth pattern followed by skeletal class I and skeletal class II hypodivergent growth pattern, although this difference was not statistically significant.

Several factors were thought to affect the shape and size of MS, such as genetic factors and ethnicity, inclination of the lower incisors and facial type. As the lower face height increases, upper and lower anterior teeth may continue their eruption in an attempt to maintain a positive overbite, bringing their alveolar bony support with them, resulting in an increase in total MS length. The linear distance from Id to Me, representing the total length of MS was found to be more for skeletal class II hyperdivergent growth pattern followed by skeletal class I growth pattern.

There was a weak but significant correlation between the lower incisor inclination and MS inclination. Other studies reported a stronger correlation between these two parameters. In those studies different reference points and lines were used to express the inclination of MS. The reference line for the inclination of the alveolar part of MS in this study passed through point B. Therefore, any variation of this point in the different skeletal patterns would affect the involved angular measurements. Additionally, point B has been used to measure a dentoalveolar parameter when it represents the demarcation between dentoalveolar and skeletal structures. The angle between a line connecting Id to Point B and the mandibular plane; the inclination of the alveolar part of the mandibular symphysis in relation to the mandibular plane was more for skeletal class II hyperdivergent growth pattern followed by skeletal class II hypodivergent and skeletal class I growth pattern. The angle between a line connecting Point B to Pogonion and the mandibular plane; the inclination of the skeletal part of the mandibular symphysis in relation to the mandibular plane was almost equivalent in all the three growth patterns.

Facial type classification has some advantages for diagnosis, prognosis, and treatment planning objectives as well as for distinguishing between dental and skeletal disturbances. The key role of the incisors and the complicated anatomical relationship of this area play a significant role in orthodontic treatment planning.

CONCLUSIONS:

The skeletal Class II hyperdivergent exhibited more concave anterior contour of MS, an increase in its vertical dimension, and more inclination of the alveolar part toward the mandibular plane than did the other AP relationships, reflecting compensation for the skeletal pattern of the jaws.

The symphysis with an anterior growth direction of the mandible had a short height, larger depth and large angle. In contrast, a symphysis with large height, small depth and small angle demonstrated a posterior growth direction.

A strong correlation was found between anterior facial height and MS length.

A weak but significant correlation was found between the inclination of the lower incisors and the alveolar part of symphysis.

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