ASSESSMENT OF MANDIBULAR SYMPHYSIS MORPHOLOGY AND ITS DIMENSIONS IN DIFFERENT ANTEROPOSTERIOR SKELETAL RELATIONSHIPS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: *The purpose of this study was to assess the mandibular symphysis morphology and its dimensions in different anteroposterior skeletal relationships, Class-I / Class-II/ Class III, in patients presented to orthodontics department of Rehman College of dentistry.*

Materials and Methods: *A total of 50 lateral cephalograms of patients (age > 18 years, mean age 22 years) irrespective of gender were randomly selected from patient's records of the department. Measurements were taken on software IC Measure version 1.3. All the radiographs were imported into the software and analyzed. The image was digitized on six points for linear and angular measurements. The main outcome measure was the "mandibular symphysis morphology and its dimensions in anteroposterior plane" in all skeletal malocclusion classes.*

Results: *The relationship between the variables was assessed by one way ANOVA test. A larger angle of concavity of the chin, and larger MS dimensions and area (P <0.05) were found with a Class III skeletal relationship compared to Class I and Class II relationships. Males had a decreased angle of concavity than females. There were, however, no significant differences in the vertical dimension of MS and angle of convexity between the three groups.*

Conclusion: *Class III skeletal jaw relationship exhibits a decreased concavity of anterior contour of MS as compared to the other groups. Larger dimensions and area of MS are found in Class III than in class I and class II part of MS. It is clear from the results that the alveolar part of MS compensated for the skeletal relationship in the Class III pattern.*

Keywords: *Mandibular symphysis, anteroposterior skeletal relationships, digital cephalometric*

INTRODUCTION

Mandibular symphysis (MS) is the most important region of the craniofacial complex, and it serves as a primary reference for determining esthetics of lower third of the face. Understanding its morphology helps in orthodontic diagnosis and treatment planning.[1] Additionally, MS has been considered as one of the best prognostic estimates of mandibular growth rotation.[2]

Different combinations of genetic, non-genetic and adaptive factors contribute to MS morphology.[3] The functional environment is one of the most important factors that influence the shape and size of MS.[4] However, vertical jaw relationship[5] and inclination of the lower incisors[6] are other factors to affect MS morphology. Dentoalveolar compensation occurring during the growth period as a result of anteroposterior (AP) jaw discrepancy might be associated with the morphology and dimension of MS.[7]

Al-Khateeb et al[7] studied the morphology and dimensions of the symphysis in anterior-posterior relations. They concluded that in Class III, malocclusions patient had a more concave jaw and a bigger symphysis. In another study, Tang et al[8] found morphological differences in skeletal Class II and Class

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III malocclusion symphysis area.

Most of the previous studies[9,10] carried out in our population were done for the morphological differences of mandibular symphysis between patients with short mandible versus those with the normal mandible in vertical dimensions. Using the same variables, this study will provide data for anteroposterior dimensions.

This study aims to assess the morphology and dimensions of the MS in different AP skeletal jaw relationships presenting to Orthodontic department of Rehman College of Dentistry.

MATERIALS AND METHODS

This study was carried out in the Department of Orthodontics at Rehman College of Dentistry. Ethical approval to access patients' files was sought. A total of fifty lateral cephalograms for adult subjects (30 females and 20 males with ages of >18 years, mean age 22 years) were selected for the participants in centric occlusion with lips in repose and Frankfort Plane Horizontal according to natural head position.

Cephalometric radiographs with reasonable clarity and contrast. Cephalometric radiographs of patients older than 18 years. Individuals with a history of previous orthodontic treatment, orthognathic surgery, craniofacial anomalies, trauma to the mandible were excluded from the study.

Data Collection Procedure

The measurements were directly taken on lateral cephalogram, according to the method described by Al-Khateeb et al[7], using software IC Measure 1.3. All the radiographs were imported into the software and analyzed. The image was digitized on six points for linear and angular measurements. The allocated points and measured parameters for the study are given in Table 1, 2 and 3. Illustrations are given in Fig 1, 2 and 3.

Statistical Analysis:

Data was entered and analyzed using the software SPSS version 22. Means and standard deviations were calculated for all quantitative variables. Frequencies & percentages were calculated for categorical variables like class I, II and III. One way ANOVA test was used to calculate the relationship between variables.

RESULTS

Baseline data

Lateral cephalograms of 50 patients(30 females and 20 males) with a mean age of 22 years (Range 18-35, SD 5 years) were included in this study. Records of patients were categorized into class I, class II and class III according to their skeletal malocclusions. Class I included 20 patients (14 females, six males), class II included 24 patients (13 females 11 males) while class III included six patients (3 females, three males).

Primary outcomes

Means and standard deviations for MS parameters for the anteroposterior groups are shown in Table 4. The mean differences of all measured MS parameters between the groups are shown in Table 5.

MS angular parameters:

The angle A1(B-B1-Gn), representing the vertical dimension of MS and angle A2 (B-Pog-Me), showing an angle of convexity displayed no significant differences between the three AP groups. The MS concavity angle A3 (Id-B-Pog), was significantly larger in Class III than in Class I and Class II skeletal relationships ($P < 0.05$).

MS linear parameters:

The distances from Id to point B(L1), point B to Pogonion (L2) and Pog to Me (L3), showed no significant differences between the three AP groups. However total length of MS (Id to Me), indicated by L4 was larger in the Class III group than in the other two groups ($p < 0.05$)

Gender-related differences

MS measured parameters for males and females, with the differences between them, are shown in Table 7. Males had a larger A3(Id-B-Pog), ($P < 0.05$) than females, indicating less anterior concavity of MS. All other linear and angular measurements differences were not significant between males and females ($P > 0.05$).

DISCUSSION

The purpose of this study was to assess the morphology and dimensions of mandibular symphysis in different anteroposterior jaw relationships, in patients presenting to the Orthodontics Department

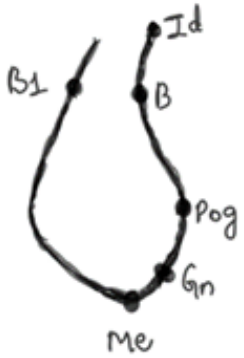

Fig 1: Mandibular Symphysis Points

Fig 2: Mandibular Symphysis Linear parameters

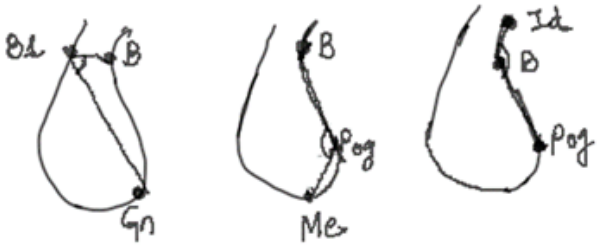

Fig 3: Mandibular Symphysis Angular Parameters

Table 1: Mandibular Symphysis Points and their definitions

MS Points	Definition
Point B	The deepest point on the concavity of labial cortical plate of most labially placed mandibular central incisor.
Pogonion (pog)	The anterior-most prominent point on the outer contour of the bony chin.
Gnathion (Gn)	The anterior & inferior point on the outer contour of the bony chin.
Menton (Me)	The inferior most point on the outer contour of the bony chin.
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.

Table 2: Mandibular Symphysis linear parameters and their definitions

MS linear Parameters	Definitions
L1 (Id-B)	The linear distance from Id to point B.
L2 (B-Pog)	The linear distance from point B to Pogonion.
L3 (Pog-Me)	The linear distance from Pogonion to Me.
L4 (Id-Me)	The linear distance from Id to Me, representing the total length of MS.

Table 3: Mandibular Symphysis angular parameters and their definitions

MS angular Parameters	Definitions
A1 (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.
A2 (B-Pog-Me)	The angle formed between point B, Pogonion, and Menton; It reflects the convexity of the mandibular symphysis.
A3 (Id-B-Pog)	The angle between point Id, point B, and Pogonion; It reflects the concavity of the mandibular symphysis.

Table 4: Mean and Standard Deviation (SD) for MS Parameters

MS Parameters	Class-I		Class-II		Class-III	
	Mean	SD	Mean	SD	Mean	SD
L1	5.099	1.78	7.73	3.06	5.94	2.42
L2	12.82	2.65	11.37	2.80	12.63	3.31
L3	9.76	3.16	8.51	1.95	8.42	2.96
L4	24.10	2.15	23.27	3.22	24.37	4.05
A1	52.75	10.17	42.65	11.70	47.11	12.09
A2	135.11	9.94	136.77	10.49	135.45	7.91
A3	146.21	11.58	142.67	10.26	151.07	6.5

Table 5: Mean differences between different skeletal anteroposterior MS Parameters

MS Parameters	Difference Class I to Class II	Significance	Difference Class I to Class III	Significance	Difference Class II to Class III	Significance
L1	-2.63	0.09	-0.844	0.06	1.79	0.12
L2	1.45	0.26	0.194	0.98	-1.25	0.49
L3	1.25	0.33	1.34	0.39	0.09	0.99
L4	-0.13	0.04*	0.06	0.01*	0.20	0.04*
A1	10.09	0.19	5.64	0.37	-4.45	0.55
A2	-1.65	0.58	-0.33	0.99	1.32	0.93
A3	-0.48	0.02*	-10.16	0.02*	-5.29	0.03*

P-value ≤ 0.05 is considered significant.

*Significant

Table 6: Mean, and Standard Deviation (SD) for the Mandibular Symphysis Measured Parameters in Males and Females and the Differences Between Them

MS Parameters	Males Mean ± SD	Females Mean ± SD	Difference	Significance
L1	6.76 ± 2.69	5.90 ± 2.65	0.86	0.274
L2	12.40 ± 2.91	12.17 ± 2.91	0.23	0.789
L3	8.81 ± 2.76	9.14 ± 2.78	-0.33	0.679
L4	25.16 ± 3.69	24.05 ± 24.09	1.11	0.204
A1	48.27 ± 12.42	47.63 ± 11.65	0.64	0.855
A2	135.77 ± 8.42	135.79 ± 10.36	-0.02	0.994
A3	154.68 ± 8.16	147.44 ± 11.18	7.24	0.018*

P-value ≤ 0.05 is considered significant

*Significant

of Rehman College of Dentistry. Dentoalveolar compensation is usually observed clinically to overcome underlying AP skeletal discrepancy.[11] Mandibular symphysis morphology is affected by changes in the inclination of lower incisors, the reason being AP relationships might cause surface remodelling of MS.[12] Accordingly this study evaluated some of the characteristics of MS in three AP relationships and investigations compared with the compensatory changes in the morphology of MS.

Mean ages of 21 ± three years for males and 20 ± three years for females were considered in this study, which represented a stable period in the growth and development of the craniofacial complex. Skeletal malocclusions were classified according to ANB angle.

In the present study, there were more females than males, and the reason could be that females are more esthetically concerned with their appearance and seek orthodontic treatment in greater percentage.[13] There were more class I and II patients than III patients as the prevelance of this malocclusion is low in our population.

The outcomes of this study displayed that class III subjects showed less anterior concavity of MS (represented by large A3 angle) than did class I and class II subjects. This finding was correlated with the results reported with Yamada et al.[6] This may be due to the inclination of alveolar part of MS to a mandibular plane in class III subjects which have compensated for MS morphology.[14] The retroclination of lower incisors would result in surface remodelling of the outer surface of the dentoalveolar part of MS. These compensatory mechanisms provide good occlusion along with acceptable facial balance.[6,12]

The other two angular measurements (A1 and A2) and linear measurements (L1, L2, L3), showed no statistical differences between three AP skeletal groups, this finding is in contradiction to a study reported by Al-Khateeb et al,[7] that showed significant differences between the three groups.

However, L4, which represents a general increase in mandibular size, was larger in class III subjects than class I and class II. This finding demonstrates a compensatory increase in chin prominence in class III skeletal relationship.[15]

Although symphysis morphology and dimension were relatively small as compared to the whole of the dentofacial structures, clinically chin has no significant role in the aesthetics of the lower face. It also contributes to the anteroposterior skeletal relationship and their treatment outcome. Hence, mandibular symphysis should be considered during other cephalometric findings and mandibular growth prediction relating to size and direction.

LIMITATIONS

1. The results of the present study are limited to small sample size. Studies with larger sample size are needed to evaluate the mandibular symphysis compensation with the different anteroposterior skeletal relationship.
2. Sample distribution was not equal among groups, and there were more class I and class II patients than class III patients.
3. In our study, the sample includes more females than males.

CONCLUSIONS

Following conclusion can be drawn from this study:

1. Class III skeletal jaw relationship exhibits a decreased concavity of anterior contour of MS as compared to the other groups.
2. Larger dimensions and area of MS are found in Class III than in class I and class II part of MS.

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