ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2022; 8(1): 318-321

www.oraljournal.com
Received: 19-11-2021
Accepted: 23-12-2021

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Correlation between symphyseal morphology and mandibular length in class 1 malocclusion between males and females: A radiographic study

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DOI: https://doi.org/10.22271/oral.2022.v8.i1e.1446

Abstract
Mandibular symphysis (MS) morphology is a valuable diagnostic and treatment-planning tool in orthodontics. MS is affected by a number of factors that include neuromuscular factors, vertical jaw relationships, inclination of lower incisors and genetic factors among others. 80 lateral cephalograms (40 – males and 40 – females) were used in the study and mandibular lengths (Schwarz analysis) were measured for males and females separately. Pearson correlation coefficient showed no statistically significant correlation between symphyseal morphology and mandibular length both in males and females. The inter-examiner reliability (IER) showed Cronbach's Alpha for mandibular length shows a value of .70 implying good agreement. The study concludes there is no correlation between mandibular length and symphysis morphology. Although sexual dimorphism exists.

Keywords: Mandibular symphysis, mandibular length, Schwarz analysis

1. Introduction
Facial growth and development are of deep concern to the clinician, because the amount and direction of growth will significantly alter the need for orthodontic biomechanics. The morphology of natural reference structures is accurate and effective as a basis for cephalometric research [1, 2]. Although the ability to predict growth of the entire face would be most desirable, in orthodontics, knowledge of mandibular growth would be highly beneficial in diagnosis and treatment planning and is critical in the development of balanced dentofacial structures [3]. According to Bjork [1], not all the morphologic features would be found in a particular individual, but the greater the number present, the more reliable the prediction would be. Although related, multiple morphologic factors were most useful in explaining the clinical vertical evaluation of facial patterns (Fields HW *et al.*) [4]. Successful evaluation of facial balance and harmony includes a study of the facial profile. The relationships of nose, lips and chin are important considerations. Cephalometric norms for well balanced and attractive faces have been suggested by Riedel [5] and Peck and Peck [6]. The data also demonstrated that a pleasing facial profile depends on the size of the chin [7]. Knowledge of the mandibular growth pattern is a great advantage for establishing an accurate diagnosis and treatment plan. Hence this study is aimed to determine whether there is a significant relationship between symphyseal morphology and mandibular length. And also to correlate this relationship between males and females in skeletal Class I subjects. Hence it validates the need for this study.

2. Material and Methodology
A total of 80 subjects (40 males and 40 females) above 18 years of age were selected.

Exclusion Criteria
Patients with craniofacial abnormalities, prior orthodontic or orthognathic treatments, asymmetries, less visibly identifiable anatomic landmarks (especially symphyseal region, point B) and patients who present a severe alteration of the growth pattern.

2.1 Material used for the study

- Lateral cephalograms
- KODAK 8000C digital panoramic and cephalometric system
- 0.3mm graphite pencil
- 0.7mm acetate sheet of 8x10" size
- The films for panoramic radiographs & lateral cephalograms were of size 8x10'' and the magnification was around 1.3x. The software used for this was Kodak software.

Radiograph	KVP	mA	Exposure Time in SEC
Lateral Cephalogram	78	12	1

2.2 Methodology

A total of 80 adult patients presenting with class I malocclusion above 18 years of age were selected and grouped into 40 males and 40 females. Pre-treatment cephalograms were obtained and traced. The cephalograms were taken in maximum intercuspation position and with natural head position. Measurements were made manually by a single person and repeated by the same person within 6 hours to assess intraobserver error. To assess interobserver error, all measurements was repeated by a second observer in a single day.

2.3 Skeletal and Dentoalveolar cephalometric landmarks:

Point B (B): The most posterior point of the anterior outline of the chin.

Pogonion (Pg): The most anterior point of the mandibular symphysis

Menton (Me): The most inferior point of the mandibular symphysis

Nasion (Na): The most anterior point of the frontonasal suture

Gonion (Go): The midpoint of the mandibular angle between the mandibular ramus and corpus.

Nasion-point B (N-B line): Line joining N (Nasion) and point B

Sella (S): centre of sella turcica.

Anterior carnial base: line joining S-Na.

Mandibular plane (Go- Me): Line joining Menton with Gonion

Extent of mandibular length (Go-tangent to pog): ideally anterior cranial base length +3mm.

SNA: angle between SN line and N-pt. A line.

SNB: angle between SN line and N-pt.B line.

ANB angle: difference between SNA and SNB.

Steiner analysis [8] was used to determine the skeletal relationship in patients. ANB angle was determined and it should be within the range of 2˚± 2˚. Aki analysis [9] was used to determine symphyseal morphology in terms of symphyseal ratio (height/width) and symphyseal angle (the intersection of the point B- menton line and the mandibular plane). To assess mandibular length Schwarz analysis [10] was used measured along the mandibular tangent (Go-Pog). The average "ought-to-be" length of the mandibular body is the same as the distance from Nasion to Sella (anterior cranial base), plus 3 mm.

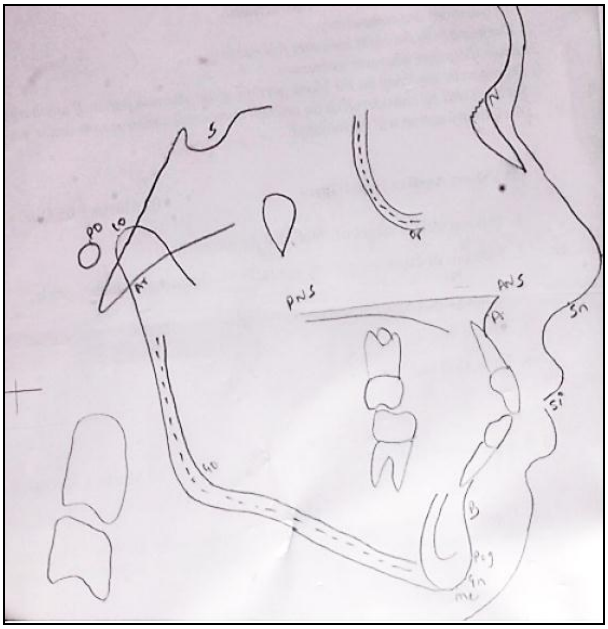


Fig 1: Cephalometric tracing showing land marks

3. Statistical Analysis

Intraclass correlation coefficient will be estimated for different parameters on cephalogram including symphyseal morphology and mandibular length. Cronbach's Alpha will be used to calculate intraexaminer & interexaminer reliability. Pearson correlation coefficeint will be used to compare the mean values of parameters based morphology of symphysis. Level of significance (P-value) will be set at $P < 0.001$.

4. Results

Descriptive statistics shows mean, standard deviation and the standard error of mean for all the parameters.

Table 1: Descriptive statistics of the data set

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Symphyseal ratio	Females	40	1.29	0.17	0.03
	Males	40	1.44	0.15	0.02
Symphyseal angle	Females	40	78.38	7.17	1.13
	Males	40	80.45	4.79	0.76
	Males	40	0.66	0.06	0.01
Mandibular length	Females	40	72.23	4.14	0.65
	Males	40	77.40	4.53	0.72

The examiner was calibrated with a trained orthodontist on 40 female subjects and 40 male subjects. Symphyseal ratio,

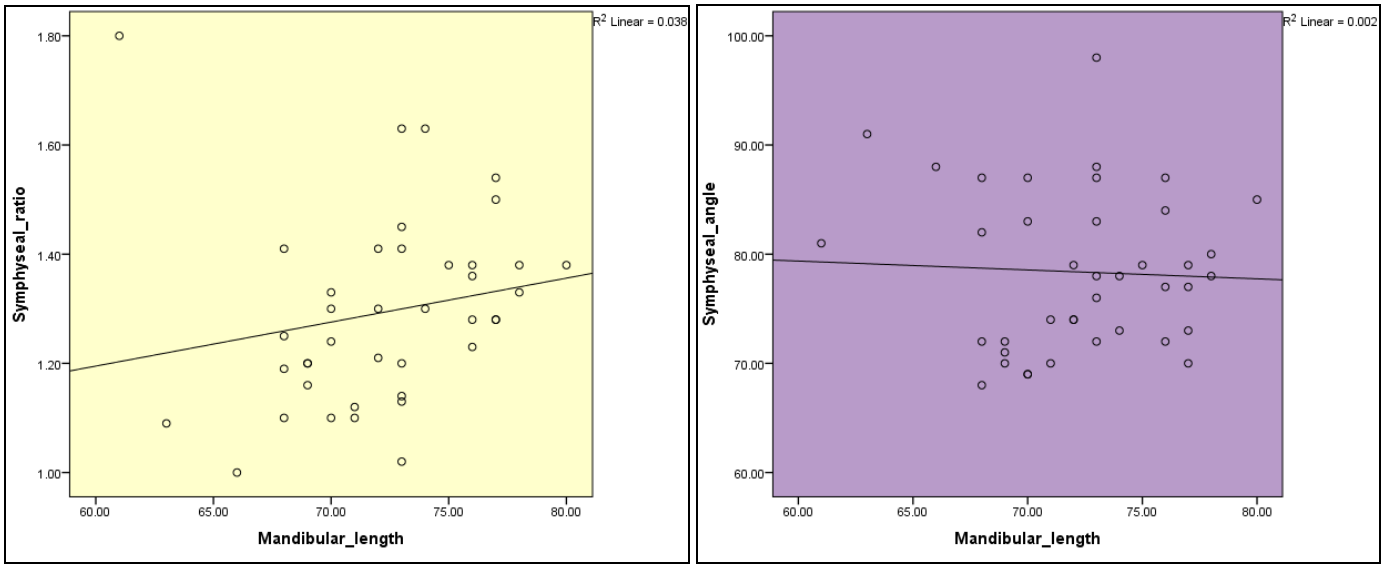
symphyseal angle, and mandibular length were assessed by both observers on the same day. Cronbach's Alpha value was measured for all the parameters.

Table 2: Interexaminer reliability between groups

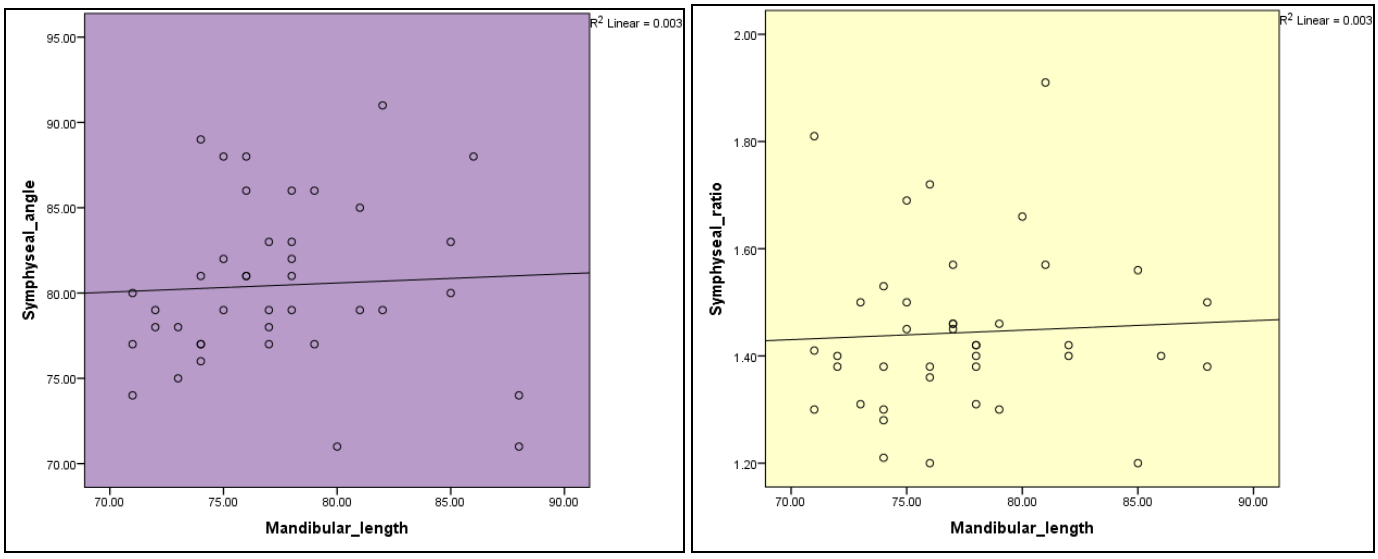
Parameter	Males	Females
Symphyseal ratio	0.899	0.897
Symphyseal angle	0.894	0.889
Mandibular length	0.779	0.789

The inter examiner reliability show excellent agreement for symphyseal ratio and symphyseal angle while as it shows only good agreement for mandibular length. The difference is statistically insignificant.

The Pearson correlation coefficient shows no statistically significant association between symphyseal mandibular morphology and the mandibular length. (p= 0.038 (ratio), 0.002 (angle) for females and p=0.003 for males).



Graph 1: Association between symphyseal mandibular morphology and the mandibular length. (Females)



Graph 2: Association between symphyseal mandibular morphology and the mandibular length (Males)

5. Discussion

A correct diagnosis should take into account both the soft and hard tissues that surround the dentition, given that the value of any cephalometric evaluation or measurement depends ultimately on the occlusal and esthetic criteria of the orthodontist [11]. There is a definite relationship between facial biotype and symphyseal morphology. Studies suggested that symphysis morphology may be used to predict the direction of mandibular growth. On a qualitative basis, there is an association of a thick symphysis with an anterior growth direction. Mandibular symphysis morphology is affected by several factors which include genetic and racial factors. In addition to these inherent factors MS is affected by vertical jaw relationships, inclination of lower incisors and anteroposterior jaw discrepancies [12]. The symphysis may be affected by anteroposterior skeletal classification. Class I skeletal pattern has normal relationship of the maxilla (SNA) to the mandible position (SNB) measured by ANB angle. Class II skeletal pattern has backward position of mandible (large ANB value) and Class III has advanced position of the

mandible (less ANB value). Previous literature found that Class III skeletal pattern is associated with smaller angle of the anterior concavity of the symphysis compared to Class I and II. Also, the alveolus of the mandibular incisor is closer to the mandibular plane. Class III subjects also have larger symphysial area than Class I or II [13]. In another study [14] it was found that although sex differences were not significant; but, on the whole, all dimensions were smaller in females. In the present study it was checked whether there is any correlation between mandibular length and symphyseal morphology. The result showed no correlation between the two. There is paucity of literature supporting or opposing the same. In the present study the correlation of variables between females was weak when compared to males.

6. Limitations

The limitations of present study is the 2-dimensional radiological method used. The lateral cephalogram cannot accurately display the size, morphology, and the relationships of the symphysis due to divergence of the X-rays, although it can depict the symphyseal layout. The lateral cephalograms underestimate the actual amount of bone. In future studies CBCT can provide considerably accurate information. Another limitation is that the sample consisted of only class I malocclusion.

7. Conclusion

The conclusion of the study is that there is no correlation between mandibular length and symphyseal morphology (ratio/angle). Sexual dimorphism occurs in symphysis morphology with MS being more prominent in males compared to females. All the results were applicable to skeletal Class I malocclusions.

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