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Original Article

Evaluation of Mandibular Dental Height Using Stable Structure of Bjork – A Comparative Cephalometric study

Vasanthan P[1], Jayashree Mohan[2], Sabarinathan J[3], Sabitha S[4], Sathiya Jeeva J[5]

[1]Research scholar, [3]Professor, Department of Orthodontics, [2]Professor and Head, Department of Prosthodontics, [4]Research scholar, Department of Oral Maxillofacial Surgery, Vinayaka Mission's Sankarachariyar Dental College, Vinayaka Mission's Research Foundation (Deemed to be university), Salem-636 308, Tamil Nadu, India, [5]Associate Professor, Department of Dentistry, Annapoorana Medical College and Hospital, The Tamil Nadu Dr.MGR Medical University, Salem-636 308, Tamil Nadu- India.

ABSTRACT

Aim: The objective of the study is to evaluate the anterior and posterior mandibular dental height in class I and class II malocclusions using two stable structure of Bjork (inner contour of the cortical plate of the mandibular symphysis and contour of the mandibular canal). Furthermore, it is intended to compare with the mandibular plane. **Methods**: Fourty five cases of Angle's Class I, Class II division 1 and Class II division 2 malocclusions with age group of 13 to 17 years were selected and equally divided into three groups. The data of pre and post-treatment lateral cephalograms were obtained for the comparison of anterior and posterior mandibular dental height using mandibular plane (Go-Me) and a plane from most postero-inferior point on contour of the mandibular canal (C) to inferior most point on the inner contour of the cortical plate of the mandibular symphysis (Sm).P re and post treatment mandibular dental height changes were evaluated and compared using paired t test. **Result**: Pre and post treatment mandibular dental height measured from mandibular plane showed significant changes at posterior region, whereas anterior mandibular dental height (ADH) changes were not significant. Similarly, pre and post treatment mandibular dental height measured from CSm plane showed significant changes for posterior mandibular dental height (PDH), but ADH changes were not significant. Comparison of mandibular dental height measured from mandibular plane and CSm plane showed significant differences in both anterior and posterior region for all malocclusion groups except ADH in Class II division 2 malocclusion. **Conclusion:** Mandibular dental height measured from mandibular plane and CSm plane showed significant changes which suggest bone remodelling changes might have occurred at the lower border of the mandible.

Key words: Bjork's stable structure, Dental height, Malocclussion, Mandibular Plane.

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Corresponding author: Dr. Vasanthan P, *MDS.,* 19-3D; ARRS apartment, Greenways road, Fairlands, Salem – 636016

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INTRODUCTION

Orthodontic diagnosis and treatment planning requires comprehensive data derived from diagnostic aids such as a general observation, clinical examination, study models and related radiographs. Among all these, cephalometrics has been considered to be part of the 'gold' standard for diagnosis at the start of orthodontic treatment.[1-3]

Cephalometrics can be employed for descriptions of morphology, quantitative analysis of growth, and for outlining objectives of treatment planning.[4-7] In cephalometrics, mandibular plane is used widely for analysis of facial patterns in orthodontics. Based on the type of analysis, several mandibular planes are constructed.[8] The most commonly used ones are Tweed's, Steiners and Down's mandibular plane.[8]

Out of three different types of mandibular planes used Down's mandibular plane (connecting Go-Me plane) was used to measure mandibular dental height by Veli et al[9] and Arfan Ul Haq[10] et al to relate the depth of the curve of Spee in various malocclusions. Mandibular dental height is one of the factor considered for the assessment of the depth of the curve of Spee.[9,10] The mandibular plane is commonly used to assess the mandibular dental height, although the lower border of the mandible being subject to change by bone remodelling in growing patients.[9-10]

Bjork's method of superimposition provides 'stable stuctures' in the mandible[11]. So, In this study we used two anatomical landmark from Bjork' s 'stable structures' of mandible to construct a plane (CSm). By using mandibular plane and CSm plane, mandibular dental height was measured at anterior (mandibular central incisor) and posterior (mandibular first molar) regions to evaluate and compare the changes in mandibular dental height during growing phase of orthodontic treatment.

MATERIAL AND METHOD:

This retrospective study was carried out in Vinayaka Mission's Sankarachariyar Dental College, Salem. The samples retrieved from the Department of Orthodontics with comprehensive clinical data, pre and post-treatment conventional lateral cephalogram from the year 2000 to 2016. The sample of 45 cases (46.7% Male, 53.3% Females) was divided equally into three groups according to Angle's categorization of dental malocclusions: Class I (60% Male and 40% Females), Class II division 1(33.3% Male and 66.7% Female) and Class II division 2 (46.7% Male and 53.3% Female) malocclusions. All patients fulfilled the following criteria were taken into consideration.

Inclusion criteria:

- Complete clinical data with standardized pre and post-treatment lateral cephalogram
- Age group of 13 to 17 years.
- Completely erupted permanent dentition.

Exclusion criteria:

- Partially erupted and mixed dentition.
- Extraction cases.
- Class III malocclusion.
- Previous history of trauma and facial asymmetry

To measure mandibular dental height from mandibular plane

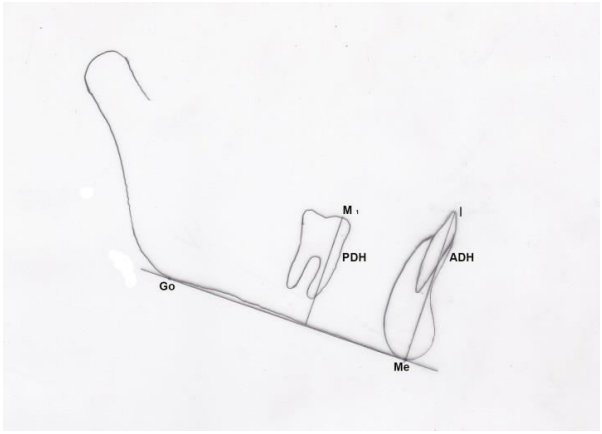
All cephalograms were traced manually and the anatomical landmarks taken to measure the dental height were: the tip of the mandibular central incisor (I) and the mesiobuccal cusp tip of the mandibular first molar (M_1) and the mandibular plane (MP).

The ADH was measured perpendicularly from incisal edge of the mandibular central incisor to mandibular plane (I-MP), and PDH was measured from mesiobuccal cusp tip of the mandibular first molar perpendicular to mandibular plane (M_1-MP) (Figure: 1).

To measure mandibular dental height from CSm plane

CSm plane constructed from most postero-inferior point on contour of the mandibular canal (C) to inferior most point on inner contour of the cortical plate of the mandibular symphysis (Sm). ADH (I-CSm) and PDH ((M_1- CSm) were measured perpendicularly from the incisal edge of mandibular central incisor (I) and mesiobuccal cusp tip of the mandibular first molar (M_1) respectively (Figure 2). Superimposition of MP and CSm plane were presented in Figure 3.

Figure 1: Mandibular dental height measured from mandibular plane



Statistical analysis

Paired t- test was used to compare pre and post treatment mandibular dental height and the difference of mandibular dental height measured from the mandibular plane and CSm plane.

RESULTS:

Descriptive analysis of ADH and PDH from MP

In class I malocclusion, ADH and PDH showed a mean value of 42mm and 32.03 mm in pre treatment respectively. But, post treatment values were 42.06 mm and 33.53mm. For class II division 1 malocclusion, ADH and PDH were 44.66 mm and 34.53 mm in pre treatment and 45mm and 36.86mm in post treatment respectively. In class II Division 2malocclusion, of ADH and PDH observed mean value of 46.63 mm and 35.66mm in pre-treatment respectively. But, post treatment values were 46.46 mm and 37.90 mm.

Descriptive analysis of ADH and PDH from CSm plane

The pre-treatment analysis of ADH and PDH showed a mean value of 36.33mm and 21.43 mm in class I malocclusion, 37.06mm and 22.50 mm in class II division 1 malocclusion and 33.90mm and 20.30mm in class II division 2malocclusion respectively. But, the post treatment result was 35.76 mm and 23.63 mm in class I malocclusion, 36.76 mm and 24.13 mm in class II division 1 malocclusion and 32.56 mm and 21.53 mm in class II division 2 malocclusion respectively.

Comparison of mandibular dental height measured from MP and CSm plane

The pre and post treatment comparison of ADH measured from MP and CSm plane was not significant ($p>0.05$) in all malocclusions but PDH showed a significant changes ($p<0.01$).

ADH comparison between MP and CSm plane was showed a significant differences ($p<0.05$) in class I and class II division1 except class II division 2 (p-0.104) malocclusions. But significant differences were noted in PDH for all three malocclusions ($p<0.01$) (Table 1)

Table 1: Comparison of mandibular dental height measured from mandibular plane and CSm plane

Malocclusion	Dental Height	Mean Difference	Standard Deviation	Standard Error	t-value	p-value
Class I malocclusion	I-MP/I-CSm	0.633	0.693	0.179	3.53	0.003
	M_1 –MP/M_1-CSM	-0.700	0.253	0.065	-10.693	0.000
Class II Division1 malocclusion	I-MP/I-CSm	0.633	0.441	0.114	5.551	0.000
	M_1 –MP/M_1-CSM	0.700	0.368	0.095	7.359	0.000
Class II Division 2 malocclusion	I-MP/I-CSm	1.166	2.602	0.672	1.736	0.104
	M_1 –MP/M_1-CSM	1.000	0.422	0.109	9.165	0.000

Significant value P<0.05

Figure 2: Mandibular dental height measured from CSm plane

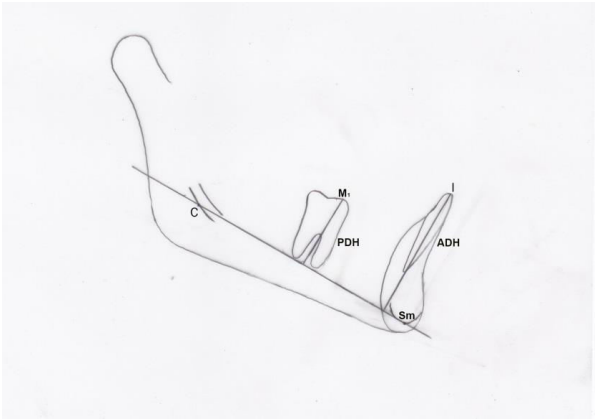
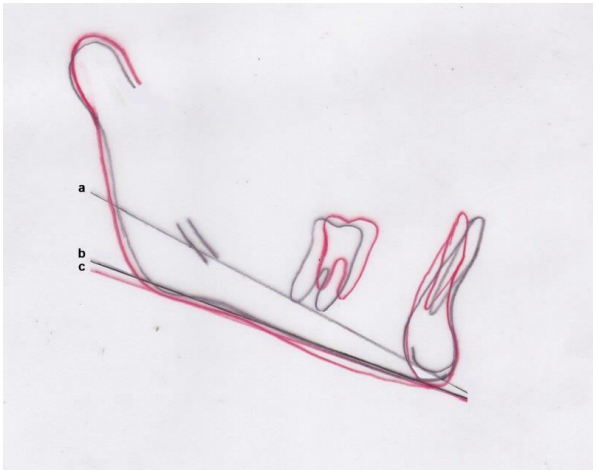


Figure 3: Pre and post treatment mandibular and CSm planes



DISCUSSION

Appropriate orthodontic diagnosis and treatment planning are major factors to be considered to achieve an ideal treatment result. Diagnostic tool like lateral cephalogram is used to assess the dento-skeletal abnormality.[12] Various cephalometric analysis helps to synthesize the treatment planning for better orthodontic treatment. Determining the anterior and posterior dental height relative to the depth of the curve of Spee in various malocclusions helps to plan the space requirement in the dental arch and bracket positioning for tooth movements. The lower border of the mandible is commonly considered to assess dental height, although it being subject to change by remodelling in growing patients.[9,10] So the aim is to evaluate the anterior and posterior mandibular dental height using stable structures of Bjork and compare it with the mandibular plane.

Bjork superimposition study on mandible indicated relatively stable structures: anteriorly, the contour of the chin and inner contour of the cortical plate at the inferior border of the symphysis and any prominent trabecular structure in the lower part of the symphysis; posteriorly, the contours of the mandibular canal and on the lower contour of a mineralized molar germ.[13] Various studies suggested stable structure of Bjork are more reliable to assess the mandibular changes during growth.[14] In our study, we used two stable structures of Bjork: inner contour of the cortical plate of the mandibular symphysis for anterior region and contour of the mandibular canal at the posterior region of the mandible.

In the present study, pre and post ADH measured from MP and CSm plane was not significant. But, PDH was showed a significant vertical tooth movement. The anterior and posterior dental height differences between the MP and CSm plane was significant. This suggests, the bone remodelling changes at lower border of the mandible might have caused the difference in post treatment groups.

Previous studies stated that mandibular lower border remodelling is part of normal development and can be subject to change during growth.[15-17] The remodelling changes described, the inferior mandibular border have been related to rotational changes of the mandible. Generally, anterior rotation is associated with deposition of the inferior aspect; posterior rotation is associated with resorption.

In conclusion, the significant dental height difference measured between two planes suggests that bone remodelling changes might happened at the lower border of the mandible. So, considering MP to evaluate the dental height might not be reliable to assess the vertical tooth movements. But the CSm plane superimposition between pre and post treatment were not altered which provide an actual vertical movement without any effect of bone remodelling in the mandible.

CONCLUSION:

1. CSm plane constructed from two stable landmarks from Bjork were not altered in pre and post treatment groups.
2. Mandibular dental height measured from mandibular plane and CSm plane showed significant changes which suggest remodelling changes might have occurred at the lower border of the mandible.
3. CSm plane as a stable superimposed horizontal plane can be used to assess the real mandibular dental changes than the mandibular plane during growth phase.

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