EVALUATION OF CRANIAL BASE MEASUREMENTS IN DIFFERENT SKELETALPATTERNS USING BJORK-JARABAK ANALYSIS

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Abstract

Aim: To evaluate cranial base measurements in different skeletal patterns using Bjork-Jarabakanalysis.

Objective: To evaluate the linear measurements of the Bjork polygon in different skeletal relationships. To evaluate the angular measurements go the Bjork polygon in different skeletal patterns.

Material and Method: 90 pre-treatment lateral cephalograms will be traced using 0.3mm mechanical pencil and lead acetate papers. The age range of the patients was 18-30 years. Patients with a history of previous orthodontic treatment, orthognathic treatment, craniofacial anomalies, facial trauma, or detected asymmetries were excluded. The average mandibular place angle was 27+/- 5 degrees.

Cephalometric Analysis: Lateral cephalograms will traced using 0.3mm mechanical pencil on lead acetate sheets. Measurements derived from Bjork-Jarabak analysis included linear and angular measurements.

Statistical Analysis: Descriptive statistics (means and standard deviations) will be calculated for all of the measured variables. To assess the differences among groups, analysis of variance was used. Gender differences will be detected using the independent- sample t-test. Statistical significance was predeter- mined as P </=0.05.

Result: Linear measurements such as SN length, S-Ar, Ar-Go, and Go-Gn showed significant differences in various skeletal groups. Angular measurements such as saddle angle and gonial angle differed significantly in various skeletal pattern groups.

Conclusion: There were significant differences in the cranial base measurements using the Bjork-Jarabak analysis between different skeletal patterns and between males and females.

Key words: Bjork-Jarabak analysis, Skeletal patterns, Cephalometric analysis

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Introduction: Orthodontics now is not only concerned with the correct occlusion but with changing paradigms the soft tissue profile and dentofacial skeletal as a whole has gained immense importance. Cranial base growth is linked to the overall growth of facial bones, especially the maxilla and mandible, either directly or indirectly [1]. Huxley, performing his studies on dried skulls, concluded that the cranial base can affect how the maxilla and the mandible are inter-related to each other[2].

Therefore, any change in the amount and/or direction of growth of the cranial base can have director indirect effects on the developing maxilla and mandible [1]. With changing paradigms in orthodontic treatment, more importance is being given to soft tissue profile and growth patterns. Therefore, knowing the growth pattern paves a path for a better treatment planning and better results in return. The cranial base is a crucial component of the craniofacial complex, and its development plays a significant role in the development of malocclusions. Therefore, the evaluation of cranial base measurements is an essential aspect of orthodontic treatment planning and management.

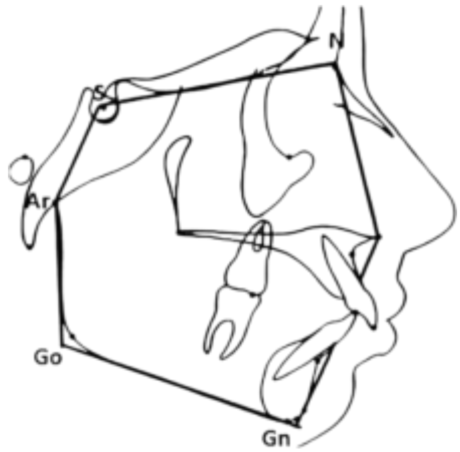
Bjork-Jarabak analysis is a cephalometric analysis that was developed in the 1960s to evaluate the growth and development of the craniofacial complex. The analysis is based on the Bjork polygon, which is a six-point polygon that represents the cranial base. The polygon is formed by connecting the sella, nasion, and anterior and posterior points of the maxilla and mandible. The analysis involves measuring the linear and angular dimensions of the Bjork polygon to assess the size, shape, and position of the craniofacial complex[3].

The present study aims to evaluate the linear and angular measurements of the Bjork polygon in different skeletal patterns using Bjork-Jarabak analysis. The study will include subjects with Class I, Class II, and Class III skeletal patterns, which are commonly encountered malocclusions. The findings of the study will provide valuable information about the growth and development of the craniofacial complex in different skeletal patterns, which can aid in orthodontic treatment planning and management.

Material and method: The study was approved by the local ethics committee. 90 lateral cephalograms of patients in the age range of 18-30 years were taken at rest position. Patients with a history of previous orthodontic treatment and patient who had facial trauma, craniofacial anomalies or facial asymmetries were excluded from the study. The radiographs were traced using 0.3mm mechanical pencil on lead acetate sheets.

Cephalometric analysis: All points and lines were marked on the tracings and measurements were all done by the same investigator to reduce inter- examiner bias. Measurements derived from Bjork- Jarabak analysis included linear and angular measurements.

Fig. 1 Bjork polygon linear and angular measurements[1].



Linear measurements	
Sella- nasion	Distance between point nation and point sella. This represents the anterior cranial base length
Sella- Articulare	Distance between point sella and point articulare. This represent posterior cranial base length.
Articulare-Gonion	Distance between point articulare and point gonion. This represents Kamal height.
Gonion-Gnathion	Distance between point gonion and point gnathion. This represents the length of body of mandible.
Angluar measurements	
Saddle angle	Angle formed between nasion-sella-articulare
Articular angle	Angle formed between sella-articulare-gonion
Gonial angle	Angle formed between articulare-gonion- gnathion
Sum of Bjork polygon	Sum of saddle, articular and genial angles

Table 1- Cranial Base (Bjork Polygon) Linear and Angular Measurements Used in This Study

In addition to this angle ANB was also measured to classify the patients between class I class II inclass III cases.

Skeletal relationship	**ANB angle**
CLass I	2°-4°
Class II	>4°
Class III	<2°

Table 2- Classification of samples according to antero-posterior skeletal relationship

Statistical Analysis: One way analysis of variance and Tukey's post hoc test was used to determine intergroup differences. Independent sample t-test was used to determine gender variations. Statistical significance was predetermined as P </=0.05.

Groups	Gender	N	Mean	SD	p-value
S-N	male	45	67.6222	3.41314	0.001 (s)
	female	45	64.1444	2.65138	
S-Ar	male	45	38.6556	3.01855	0.001 (s)
	female	45	35.8000	4.66783	
Go-Gn	male	45	72.2889	6.90067	0.002 (s)
	female	45	59.1667	11.93353	
Ar-Go	male	45	50.7333	6.12892	0.738 (n.s)
	female	45	51.3222	10.02902	
Saddle angle	male	45	129.16	5.22214	0.001 (s)
	female	45	125.33	6.51223	
Articulare angle	male	45	139.83	5.84847	0.817 (n.s)
	female	45	140.16	7.23613	
Gonial angle	male	45	127.56	6.52811	0.369 (n.s)
	female	45	129.08	9.24536	
	male	45	396.54	8.59031	0.331 (n.s)

Bjork sum angles	female	45	394.57	10.50844	

Results: There was a significant difference between the SN length between different skeletal patterns. S-Ar and Ar-Go differs significantly between class I to class III and class II to class III. Go-Gn had a significant difference in various skeletal groups. Saddle angle was significantly smaller in class II. Gonial angle also differed significantly in various skeletal pattern groups.

Table 3- Means and Standard Deviations (SDs) of Cranial Base (Bjork Polygon) Measurements in Different P Skeletal Relationships

There was a significant difference between the sella-nasion linear measurement amongst males and females. Sella-articulare and gonion-gnathion linear measurements differed significantly amongst males and females.Saddle angle was the one angle that was found to differ significantly amongst males and females.

Groups	Gender	N	Mean	SD	p-value
S-N	male	45	67.6222	3.41314	0.001 (s)
	female	45	64.1444	2.65138	
S-Ar	male	45	38.6556	3.01855	0.001 (s)
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	female	45	129.08	9.24536	
Bjork sum angles	male	45	396.54	8.59031	0.331 (n.s)
	female	45	394.57	10.50844	

Table 4- Means and Standard Deviations (SDs) of Cranial Base (Bjork Polygon) Measurements in men and women and differences between them

Discussion: The significant differences found in the study between different skeletal patterns and genders highlight the importance of understanding individual variations in cranial base morphology. The study found that the SN length, S-Ar, and Ar-Go measurements differed significantly between class I, class II, and class III skeletal patterns. This finding is consistent with previous studies that have reported significant differences in cranial base measurements among different skeletal patterns [4,5]. Moreover, the study found significant differences in Go-Gn and gonial angle measurements between different skeletal pattern groups, which is in line with previous research that has reported differences in these measurements among different skeletal patterns [6,7].

The significant differences in saddle angle measurements observed in the study between males and females also suggest the importance of gender-specific cranial base measurements in orthodontic treatment planning [8].

The findings of this study are consistent with previous studies that have investigated the relationships between skeletal patterns and cranial base measurements using the Bjork-Jarabak analysis. For instance, a study by Pirttiniemi and Kantomaa (1999) investigated craniofacial and craniocervical morphology in Finnish children with different skeletal relationships and reported significant differences in cranial base measurements between different skeletal groups using the Bjork-Jarabak analysis[9]. Similarly, a study by Ravanmehr et al. (2015) compared craniofacial morphology in skeletal class II and class III patients using the Bjork-Jarabak analysis and found significant differences in cranial base measurements between the two groups[10].

The differences in cranial base measurements between males and females observed in this study are also consistent with previous research. For example, a study by Janiszewska-Olszowska et al. (2010) investigated gender differences in cephalometric measurements in adults with Class II division 1 malocclusion and found significant differences in cranial base measurements between males and females[11]. Similarly, a study by Huang et al. (2005) investigated gender differences in cephalometric analysis and reported significant differences in several cranial base measurements between males and females[12].

It is important to note that the results of this study may have implications for orthodontic treatment planning and management. For instance, the differences in cranial base measurements between different skeletal patterns may impact treatment outcomes and may require different treatment approaches[13]. Moreover, the gender-specific differences in cranial base measurements may also have implications for orthodontic treatment planning, as it may be necessary to consider gender- specific norms when evaluating cranial base morphology [14].

Conclusion: There were significant differences in the cranial base measurements using the Bjork-Jarabakanalysis between different skeletal patterns.

- Linear measurements such as SN length, S-Ar, Ar-Go, and Go-Gn showed significant differencesin various skeletal groups.
- Angular measurements such as saddle angle and gonial angle differed significantly in variousskeletal pattern groups.
- There were significant differences in cranial base measurements between males and females, with sella-nasion, sella-articulare, and gonion-gnathion measurements showing significant differences.
- These findings suggest the importance of considering individual variations in cranial basemorphology in orthodontic treatment planning and management.

References

1. Al Maaitah EF, Alomari S, Al-Khateeb SN, Abu Alhaija ES. Cranial base measurements in different anteroposterior skeletal relationships using Bjork- Jarabak analysis. Angle Orthod. 2022 Jun 20;92(5):613–8. doi;10.2319/111321-838.1. Epub ahead of print. PMID: 35723655; PMCID: PMC9374356.
2. Huxley TH. Evidence as to man’s place in nature. London: Williams and Norgate; 1863. p. 119–59
3. Bjork A, Jarabak JR. Orthodontic aspects of the cranial base. Am J Orthod. 1952;38(5):358-378.
4. Chung CH, Font B, Skeletal Maturation in Early Orthodontic Treatment. Clin Orthod Res 1999; 2: 142–149.
5. Grewe JM, Huang GJ, Pendleton VR, et al. Craniofacial skeletal and dental variations in Down

syndrome. Angle Orthod 2010; 80: 905-914.

6. Pirttiniemi P, Kantomaa T. Variability in craniofacial and craniocervical morphology of Finnish children with different skeletal relationships. Eur J Orthod 1999; 21: 491-506.
7. Ravanmehr H, Pousti M, Karami E, et al. A comparative study of craniofacial morphology in skeletal class II and class III patients. J Dent Res Dent Clin Dent Prospects 2015; 9: 1-5.
8. Janiszewska-Olszowska J, Szatkiewicz T, Tomaszewska IM, et al. Gender differences in cephalometric measurements in adults with Class II division 1 malocclusion. Angle Orthod 2010; 80: 417-423.\
9. Pirttiniemi P, Kantomaa T. Variability in craniofacial and craniocervical morphology of Finnish children with different skeletal relationships. Eur J Orthod 1999; 21: 491-506.
10. Ravanmehr H, Pousti M, Karami E, et al. A comparative study of craniofacial morphology in skeletal class II and class III patients. J Dent Res Dent Clin Dent Prospects 2015; 9: 1-5.
11. Janiszewska-Olszowska J, Szatkiewicz T, Tomaszewska IM, et al. Gender differences in cephalometric measurements in adults with Class II division 1 malocclusion. Angle Orthod 2010; 80: 417-423.
12. Huang GJ, Cooperstein J, Rinchuse DJ, et al. Gender differences in cephalometric analysis. Angle Orthod 2005; 75: 254-260.
13. Kapila S, Conley RS, Harrell WE, et al. The relationship between craniofacial morphology and mandibular growth orientation in children. Eur J Orthod 1998; 20: 169-180.
14. Huang GJ, Cooperstein J, Rinchuse DJ, et al. Gender differences in cephalometric analysis. Angle Orthod 2005; 75: 254-260.