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Effect of Cranial Base Flexure on Anteroposterior Jaw Relationship in Kashmir population. A Cephalometric Insight.

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Abstract:
Background: *The cranial base has long been an area of interest to Orthodontists. The cranial base has been considered to have a pivotal role in development of craniofacial structures. It has been described as a template of growth over which facial structures develop. The purpose of this study was to assess the relation of Cranial flexure(saddle angle) to the position of the mandible and the anteroposterior jaw relation. An understanding of the morphological features of cranial base could be of great importance in early diagnosis and prediction of developing facial pattern and management of malocclusion.* ***Methods:*** *The sample consisted of lateral cephalograms of 90 subjects(Class I=30, Class II=30 and Class III=30). Cephalometric tracings were done and various measurements taken. The Sample was differentiated into 3 classes using ANB angle, Wits appraisal and Beta angle. The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 for analysis.* ***Results:*** *On comparison of cranial base angle(Saddle angle) in three sagittal skeletal patterns we found that the mean value of cranial base angle was not significantly different. This suggests that the flattening of cranial base angle might not be the cause of posterior mandibular position and closure of the cranial base angle may not result in anterior mandibular position.* ***Conclusion:*** *Cranial base has no determinant role in anterioposterior jaw relation. Cranial base angle cannot be considered as the sole etiological factor responsible for sagittal skeletal malocclusion.*
Key words: *Cranial flexure, sagittal skeletal malocclusion, anterioposterior jaw relation.*

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I. Introduction:

The cranial base has long been an area of interest to Orthodontists. The cranial base has been considered for over 50 years to have a pivotal role in development of craniofacial structures. It has been described as a template of growth over which facial structures develop. Structurally it forms the floor of the cranial vault and extends from foramen caecum to occipital bone. Cephalometrically, Sella Turcica divides the cranial base into two parts, anterior cranial base, marked from Sella to Nasion and posterior cranial base, marked from Sella to Basion or Sella to Articulare. The two parts form an angle at the center of Sella turcica called saddle angle[1]. It is approximately 142º at birth, but decreases to 130º at 5 years of age and becomes relatively stable by 5 to 15 years of age.[2] The Nasomaxillary complex has been related to the anterior cranial base and the mandible to posterior cranial base. It has been stated that a flattening or open angle of the cranial base will produce a posterior and superior implantation of the glenoid fossa, and therefore of the Temporomandibular Joint (TMJ) as well, thus placing the mandible in a retrusive position and gives a final result of convex profile and skeletal class II. On the contrary a pronounced inclination or closed angle, will produce an anterior and inferior implantation of the glenoid fossa, of the TMJ, and will displace the mandible to a forward position, the final result then being a concave profile and a skeletal class III.

II. Material and Methods

The sample consisted of lateral cephalograms of 90 subjects(Class I=30, Class II=30 and Class III=30). Cephalometric tracings were done and various measurements taken. The Sample was differentiated into 3 classes using ANB angle, Wits appraisal and Beta angle as described in Table no. 1.

Parameter	Class I	Class II	Class III
1.ANB	2-4degrees	>4degrees	<2degrees
2.Wits Male Female	 -1mm 0mm	 >-1mm >0mm	 <-1mm < 0mm
3.Beta angle	27-35degrees	<27 degrees	>27degrees

Usually all the three parameters should be used to help arrive at a more accurate diagnosis of anteroposterior skeletal relationship. The cases where inferences from all these parameters did not match, were not included in the study.The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 for analysis

III. Results

Table 2 and bar diagram 1 show the age distributrion of the 3 malocclusionm groups.

Table 2: Age distribution of malocculusion groups

Class	N	Mean	SD	Range	P-value
Class I	30	17.6	2.30	15-25	0.556
Class II	30	17.1	3.76	16-27	
Class III	30	18.0	3.38	17-28	

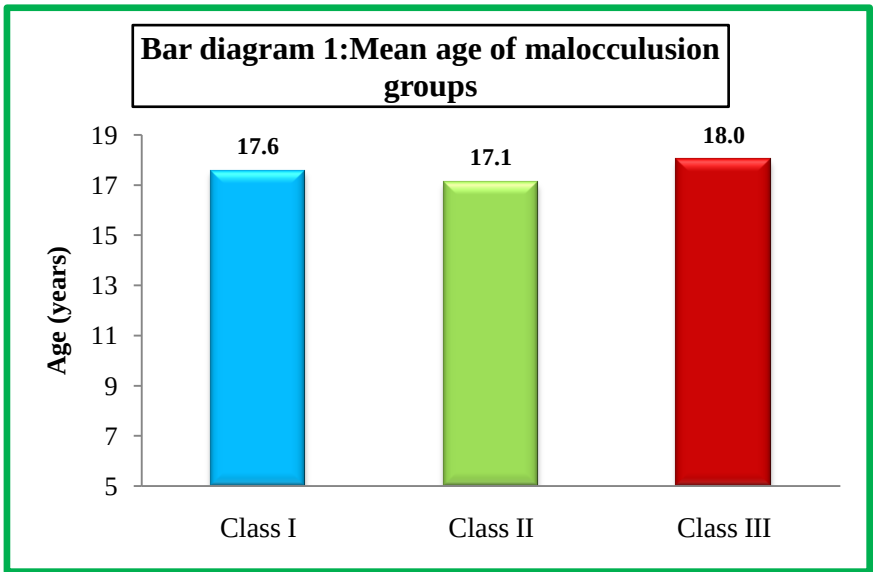


Table 2 and bar diagram 1 show that the age group used in Class I, Class II and Class III were 15-25, 16-27 and 17-28 years respectively with mean age of 17.6, 17.1 and 18years respectively. The difference between three classes on the basis of age was statistically non-significant(P-value=0.556) indicating that there was no effect of age on different parameters.

Gender distribution in the three classes given in the table and bar diagram below:

Table3: Gender distribution of malocculusion groups

Gender	Class I		Class II		Class III	
	No.	%age	No.	%age	No.	%age
Male	10	33.3	14	46.7	16	53.3
Female	20	66.7	16	53.3	14	46.7
Total	30	100	30	100	30	100
Chi-square=2.52; P-value=0.284						

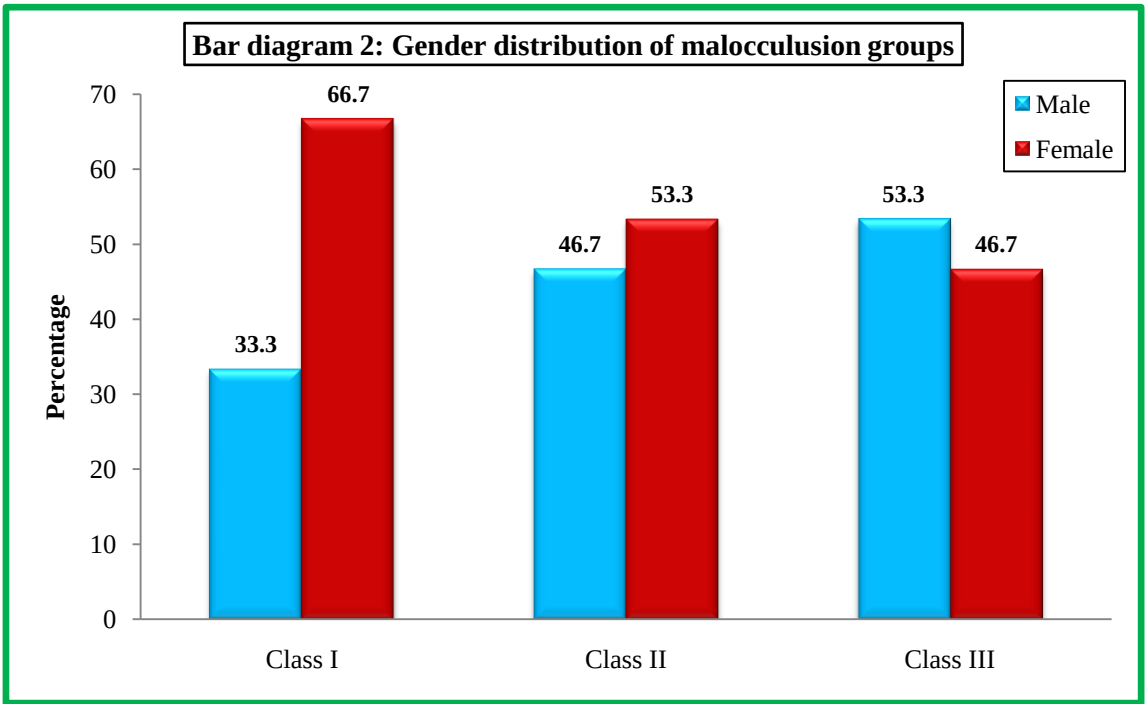
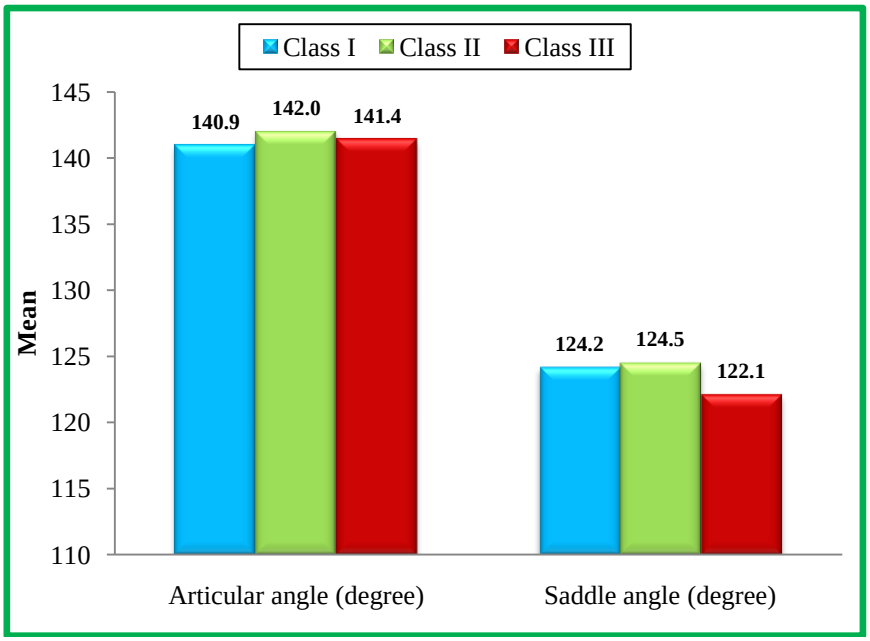


Table 3 and bar diagram 2 shows the gender distribution of various malocclusion groups. The gender distribution was comparable in three classes (P-value=0.284), indicating that the gender distribution has no statistically significant effect on various malocclusions.

On comparison of Saddle angle(NSAr) in three Classes of Skeletal malocclusion there was no statistically significant difference in the mean values of Saddle angle. Also the mean value of articular angle(SArGo) were not significantly different in the three groups.



IV. Discussion:

Cranial base has long been related to the anterioposterior jaw relation. It was considered as the main etiological factor responsible for various skeletal anterioposterior malocclusions. But there has always been the conflict of interest in various authors. Some believe that cranial flexure opening or closing results in various malocclusions whereas some have other opinions regarding this.

There have been contradicting opinions regarding the cranial flexure. Bjork(1958)[1] and Hopkin and Houston (1968)[3] in their research found a linear relationship between the cranial base angle and sagittal skeletal malocclusion. In their study they found that cranial base angle systematically reduced from Class II, via Class I, to Class III individuals. Björk[1] states that any change in the shape of the cranial base will have the result of displacing the glenoid fossa and, in consequence of a mandibular protrusion. According to Enlow(1990)[4] a forward tilted middle cranial fossa exerts protrusive mandibular action. In cases where it is tilted backwards it has a retrusive mandibular effect.

Nevertheless, some recent studies have contradictory opinions about cranial base flexure in the establishment of the type of malocclusion. Andria et al[5] found that the angle of the saddle or cranial base does not have a statistically significant relationship with the position of the chin in the profile, and, consequently, in the skeletal class or type of malocclusion. Dhopatkar et al,[6] in their study, determined that the angle of the cranial base, by itself, does not have a fundamental role in the establishment of malocclusion.

In 2002, Nanda et al[7] found that cranial base flexure is associated with a specific facial pattern, but exerts only limited effect in the development of mandibular sagittal discrepancies. They likewise determined that relationship between cranial base flexure and skeletal pattern of the jaws is established before the fifth year of life.

Wilhelm et al(2001) [8]did not find statistically significant differences in cranial base angle among subjects with skeletal class I and II. His findings did not corroborate what Jarabak establishes in his cephalometric analysis. In it, he uses the value for the saddle angle (S) or N-S-AR along with other measurements to determine the existence of a prognathic or retrognathic skeletal pattern. They reached the conclusion that individuals with class II skeletal patterns did not present a cranial base angle significantly more obtuse.

The results of our study are different from the authors like Bjork[1], Hopkin and Houston[3] and Enlow[4]. We found that the cranial flexure angle(Saddle angle, NSAr) as well as as the articular angle(SArGo) were not significantly different in three malocclusions.

However our findings where supported by Andria et al., Dhopatkar et al., Nanda et al. and Wilhelm et al.

Similarly on comparison of Articular angle in three Classes there was no significant difference in the three Classes.

The fact to consider is that the saddle angle(NSAr) can vary due to changes in the height of the anterior cranial base. This is due to the fact that this angle depends on the location of three points: Nasion, Sella and Articulare. If one of these points changes position, the value of the resulting angle will be equally modified. This means that, if nasion is placed in a more superior position, the anterior cranial base, or S-N plane will tilt upwards, and this will open the angle of the cranial base. The opposite result takes place when nasion is located in lower position.

Another variation which has to be taken into account is the length of the posterior cranial base which can compensate any cranial flexure. For example, the effect of a closed cranial base angle which will locate the glenoid fossa and lower jaw in an anterior position, could be countered by an increased length of the posterior cranial base, which would displace the articular point and consequently the mandible, to a posterior position.

V. Conclusions:

1. There is no relationship of cranial base flexure and articular angle with sagittal skeletal jaw relationship.
2. Cranial base flexure is not the cause and cannot be considered as single etiological factor. Individual variations must be considered as well as differential growth in the growth pattern of the different craniofacial complex structures in every person.
3. It is necessary to conduct more extensive and deeper studies in search for evidence which confirm the findings of this research, and thus determine the standards that apply to our population.

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