ORIGINAL ARTICLE

ASSESSMENT OF CORRELATION BETWEEN CRANIAL BASE ANGLE AND SKELETAL DYSPLASIAS

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ABSTRACT

Cranial base growth effects the growth and rotation of entire viscreocranium. The cranial base through its articulation with maxilla and mandible is thought to have an impact on anteroposterior jaw positions.Although Scientific literature indicates a relation between deflection of cranial base and skeletal discrepancies, various studies done on effect of cranial base growth on facial complex seems to show conflicting results depicting both positive and negative correlation between the the two entities.

The aim and purpose of this study, therefore, was to evaluate and assess the relationship and correlation (if there is any) between various skeletal malocclusion and angle of cranial base.Cranial base angles (N-S-Ar)(N-S-Ba) were traced measured on lateral cephalograms of 100 patients with different horizontal skeletal dysplasias.

In this study no differences were recorded between cranial base deflection angles (NSAr and NSBa) and three malocclusions groups I.e. Class I ,II and III. This study did not find / record any correlationship between cranial base angle and various skeletal dysplasias.

Keywords: *Cranial base, malocclusions.*

INTRODUCTION

The cranial base area of craniofacial complex has long been of interest to orthodontists as it has crucial integrative and functional roles in the skull,a lot of which are reflective of its phylognetic history as being the ancient component of vertebrate skull.[6,8]

It also influences growth of various adjacent areas of skull e.g. brain components and areas of nasal and oral cavities[1].The skull not only protects and supports brain but also articulates the cranium with both the jaws and to vertebral column. Skull base also plays a role in adaptations of neurocranium and viscreocranium.[2,3] It has a pivotal role in influencing normal growth and development of several facial functions like chewing, swallowing.[21] It also plays a major role in defining various skeletal malocclusions.[19] Cranial base morphology has a positive influence on positions of both maxilla and mandible and pattern of malocclusion is related positivley with cranial base structures as proposed by Bjork[2] and others. Although cranial base develops majorly from chondrocranium , it shows both neural growth, from sella upto foramen caecum, and somatic pattern of growth type. From 7-8 years growth in the anterior segment is majorly due to enlargement of frontal sinus and remodeling at nasion point. Whereas, posteriorly growth is due to interstitial growth at spheno-occipital synchondrosis.Cranial base center, sella turcica , forms anterior limb (from sella to nasion) and posterior limb (from sella to basion) of cranial base; forming an angle of 130^{o} - 135^{o} at sella. Growth in anterior part of cranial base influences maxilla while mandible due to its attachment is effected by posterior cranial base growth. Given that it would be wise to assume that the skeletal pattern of a individual might be influenced by cranial base morphology, and studies support this.[14,15,16,17,8] In his studies conducted on the same topic Bjork[2] discussed the influence of alterations in cranial base upon occlusion. While Moss[5] showed a smaller cranial base angle in subjects of class III malocclusion and that of Hopkins et al[10] and other studies showed greater angle in Class II subjects[8], there are studies reporting little or no such correlation.

Evidence stating regional differences in cranial base components also exists.[20] In the view of above facts a study was conducted on lateral cephalometrics films of orthodontic patients visiting our hospital settings. The aim and purpose of this present cross sectional study was to look into for any possible relationship ,if there is any, between cranial base angle and various skeletal dysplasias in our population sample.

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MATERIALS AND METHODS

Pretreatment lateral cephalometric radiographs of 100 patients seeking orthodontic treatment in Department of Orthodontics Nishtar Institute Of Dentistry Multan, from June 2018 to December 2108, were collected. Sample included 35 males and 65 females. Average age of patients was 15.9 ±4.1 years.All the lateral cephalograms were taken in natural head position by single operator. Inclusion sample consisted of patients having no previous history of orthodontic treatment, known deformity , and age above 8 years, as cranial base stabilizes after 7 years[7]. Informed consent was taken from patients.

Lateral cephalometric radiographs were traced and angles were measured on acetate paper sheet by the author and counter checked by another resident in order to eliminate intra- observer bias.

Patients were separated into 3 groups on basis of ANB angle were :

Group I: Skeletal Class I patients having ANB 1^o -4^o

Group II: Skeletal Class II patients having ANB>4

Group III: Skeletal Class III patients having ANB <0

The landmarks used were;

POINT A traced as the deepest innermost point on the contour of the premaxilla

POINT B traced as the innermost point on th contour of the mandible

SNA: Angle formed between NA and SN plane . Norm is 80^o-82^o

SNB: Angle formed between NB line and SN plane . Norm is 78^o-82^o

ANB ANGLE: Angle formed by the intersection of lines from points Aand B to nasion. (SNA angle minus SNB angle)

ARTICULARE (Ar) (the point at the junction of inferior border of posterior cranial base (occipital bone) and posterior border of ramus)

BASION (Ba) (lower most point on the anterior rim of foramen magnum)

NASION (N): The anterior point of the intersection between the frontal and nasion bones.

SELLA(S) (geometric centre of pitutary fossa)

SN PLANE: Horizontal plane joining points Sella and Nasion

Angles measured were SNA SNB and ANB for skeletal horizontal dysplasias. And for cranial base angulations measured were, **NSBa** and **NSAr**

All the data of the sample were subjected to computerized statistical analysis using SPSS (Statistical Packages for Social Sciences) version 21. Quantitative variables were written as Mean ± standard deviation;S.D. One way analysis (ANOVA) was used for comparison of quantitative parameters among groups.

RESULTS

One hundred lateral cephalograms of patients seeking orthodontic treatment were analyzed. Out of these 65 were females and 35 were males. Average age of patients was 15.9 ± 4.1. Distribution according to malocclusion were 48% Class II subjects , 46% class I subjects and 6%class III subjects. Mean cranial base angle with basion point was found to be 129.1^o ± 5.4^o

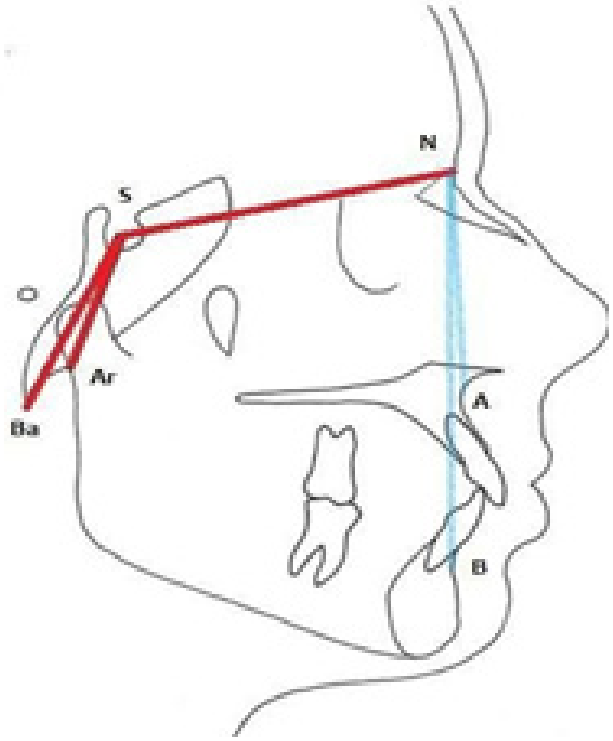

Fig 1: Measurements taken in the study

TABLE I: DESCRIPTIVE STATISTICS ACCORDING TO THREE GROUPS.

	N	Mean	Std. Deviation
S-N-Ba	100	129.1	5.4
CLASS I	46	129.04	5.1
CLASS II	48	129.3	5.7
CLASS III	6	128.5	5.8
S-N-Ar	100	125.2	5.9
CLASS I	46	125.4	5.1
CLASS II	48	124.7	6.6
CLASS III	6	123.8	6.4

while with articulare was found to be $125.2^{o}\pm5.9^{o}$. Mean N-S-Ba for class I was $129.04^{o} \pm 5.1^{0}$ with maximum of 141^{o} and minimum of 115^{o}. As for class II average N-S- Ba was found to be $129.3^{o} +5.7^{o}$ with maximum of 140^{o} and minimum of 116^{o}. For class III average N-S-Ba was $128.5^{o} \pm 5.8^{o}$ with maximum of 138^{o} and minimum of 120^{o}.As for N-S-Ar, it was calculated to be average of $125.4^{o} \pm 5.1^{o}$, $124.7^{o} \pm 6.6^{o}$ and $123.8^{o} \pm 6.4^{o}$for class I , II and III respectively. (Table 1 & 2)

One way analysis ANOVA was applied to the three groups of malocclusion in the study sample to compare their means .The p value was 0.7 for N-S-Ar and was 0.9 for N-S Ba which is statistically insignificant. (Table 3)

TABLE 2: DESCRIPTIVE STATISTIC FOR VARIABLES INVOLVED IN STUDY

	N	Mean	Std. Deviation
Age	100	15.1	4.1
NSAr	100	125.2^{o}	5.9^{o}
NSBa	100	129.1^{o}	5.4^{o}

and Bjork[2]. Jarvinen[20] reported a larger SNAr angle in class II subjects. The angle N-S-Ba is 142^{o} at birth, but decreases to about 130^{o} at the age of 5 years and then remains relatively stable from age of 5 upto 15 years[4]. The mean NSBa in our study was found to be $129.1^{o} \pm 5.4^{o}$ whereas mean NSAr was recorded to be of $125.2^{o} \pm 4.1$.

Despite above all, many studies showed little or no correlation between two entities[1,19] Hildwein et all[11] found no significant differences in NSBa angle between individuals of two classes (I and II). Kasai et al[21] reported no differences in maxillofacial structural morphology and skull base in class I & II in Japenese population. Likewise, Wilhelm et al[13] also reported similar cranial base growth patterns for both classes I.e. I and II and no did not support more larger or obtuse angle of cranial base for class II subjects. Similar findings were put forward in other study on Pakistani population, our study ,however, recorded smaller values for both the angles indicating regional differences among various population groups[12].

TABLE 3: ANOVA APPLIED FOR MEASUREMENTS.

	Sum of Squares	df	Mean Square	F	Sig
NSBa					
Between Groups	3.884	2	1.94	0.065	0.93
Within Groups	2890.2	97	29.76		
Total	2894.1	99			
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig**
NSAr					
Between Groups	19.01	2	9.50	0.26	0.77
Within Groups	3514.9	97	36.2		
Total	3534.00	99			

DISCUSSION

The area of cranial base while articulating with maxilla and mandible may have an impact on facial morphology and sagittal jaw positions thereby effecting the classification of malocclusion.[10] Horizontal skeletal dysplasis are the result of various morphological features including positioning of jaws. Among various factors effecting skeletal malocclusions are morphology of basicranium , head neck posture, soft tissue stretching and breathing pattern. Along with these possible indicators cranial base flexion has been stated as an entity effecting sagittal jaw relationship. Enlow showed that growth of maxilla is effected by skull base. Ricketts[9] reported the possible correlation between skull base on facial prognathism, also stating that class II tends to worsen with age. Similar positive correlations were documented by other authors including Hopkins et al[10]

The aim and purpose of this cross-sectional study was to determine whether or not a correlationship exists between cranial base flexion and skeletal dysplasias. Present study , however, did not find/record any such correlation between cranial base angles and horizontal skeletal dysplasias. The results of the current study are consistent with other studies.[1,13]

CONCLUSIONS

In the present study no differences were found/ recorded between cranial base angles (NSAr and NSBa) and three malocclusions groups i.e. Class I ,II and III.

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