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CORRELATION OF ANB, WITS APPRAISAL AND MCNAMARA ANALYSIS WITH MANDIBULAR CORPUS LENGTH IN CLASS I, II AND III ADULT PATIENTS VISITING TERTIARY CARE HOSPITAL

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ABSTRACT

This study was aimed to find out the correlation of mandibular corpus length with ANB, Wits appraisal, and McNamara analysis. Lateral cephalograms of 116 patients were selected as per inclusion/exclusion criteria. The sample included both males and females with age range of 16 – 30 years. Each cephalogram was traced manually on acetate paper and the parameters were recorded. Statistical analysis was done using SPSS version 26 and Pearson correlation coefficient test was used to determine correlation among the various variables. The Pearson's correlation coefficient showed that mandibular corpus length has a negative weak but significant correlation with Wits (r = -0.350, P = 0.000), positive weak but significant correlation with Nasion perpendicular to pogonion (r = 0.394, p=0.000), negative weak and insignificant correlation with ANB (r = -0.010, p=0.912) and positive weak but significant correlation with nasion perpendicular to point A (r = 0.184, p=0.048).With increase of mandibular corpus length the nasion perpendicular to pogonion and point A also increase significantly. The mandibular corpus length increases significantly with decrease in Wits.

KEYWORDS: *Cephalometry, Dental Occlusion, Malocclusion, Mandible, Maxilla, Radiography.*

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INTRODUCTION

Radiography was proclaimed by Price as a diagnostic tool in Orthodontics in the year 1900.[1] Lateral Cephalometric radiographs are used as a standard diagnostic tool for comprehensive orthodontic treatment and were introduced in 1931 by Broadbent in United States.[2] It has an important role in orthodontic growth analysis, diagnosis, treatment planning, therapy monitoring, and evaluation of treatment outcomes.[3] Lateral cephalograms are indispensable for orthodontic diagnosis because it provides insight into skeletal harmony, dental relationship, and soft tissue profile.[4]

Various analyses have been proposed to assess the anteroposterior jaw relationship. The sagittal relationship between the upper and lower jaw can be identified by ANB angle and Wits appraisal. ANB angle is found to be most valid for all sagittal groups and Wits appraisal is the most reliable indicator for class III malocclusion.[5] ANB angle evaluates anteroposterior jaw relationship. Normal values of ANB are from 0 to 4 degrees. The value less than "0" indicates a prognathic mandible and a value greater than 4 indicates a prognathic maxilla. The disadvantage of ANB is that being affected by jaw rotation with the patient's skeletal growth.[6]

Wits appraisal is a measure that tells anteroposterior harmony of the upper and lower jaws and has a normal value of 0mm in females and -1mm in males.[1] It is drawn by drawing two perpendicular lines to the occlusal plane named AO and BO from points A and B and the distance between them is measured in mm. It is not affected by the patient's growth but the problem arises when drawing the occlusal plane is influenced by teeth decay or other abnormalities.[7]

McNamara's analysis describes the relationship of the maxilla and mandible to the cranial base. It can be constructed by drawing a line from the nasion perpendicular to Frankfort's horizontal plane and evaluates the positional relationship of both jaws with the cranial base. The normal value of nasion perpendicular to point A in adults is 0mm and a normal value of nasion perpendicular to pogonion of 0 to -4mm in females and -2mm to +5mm in males is indicated.[1]The problem with its construction is the difficulty in locating the Orbitale and Porion which forms the Frankfort plane.

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The Mandibular length is an essential indicator of therapeutic prognosis and it could be measured by way of cephalometry. Human mandible modifications that arise throughout growth were first studied by Bjork and Enlow. The maxillofacial complex steepness is increased during the first four years of life, and then during the adolescent growth spurt.[8] Mandibular length is measured from point Gonion to Menton along the mandibular tangent according to Schwarz analysis and is compared with SN length[9]. The average "ought to be length of the mandibular body is the same as the distance from Nasion to Sella (anterior cranial base) plus 5mm for children up to CVM3 and 7mm for adults.[1]

This study aims to determine the cephalometric correlation of mandibular length with ANB angle, Wits appraisal and McNamara analysis. This study will help us find out which analysis is closely correlated with mandibular corpus length to facilitate a more accurate diagnosis of skeletal disharmony among jaws. The overall goal was to improve the assessment and treatment of skeletal malocclusions involving the mandible.

MATERIALS AND METHODS

This cross-sectional study was conducted in the department of Orthodontics at tertiary care hospital. Ethical approval was obtained from the ethical committee of the institute (Prime/IRB/2022-412). Data included 116 pretreatment lateral Cephalometric radiographs of orthodontic patients selected as per inclusion criteria by convenience sampling method from the departmental records. The sample consisted of 39 males and 77 females divided into 3 groups i.e. group1 (class I malocclusion), group 2 (class II malocclusion), and group 3(class III malocclusion). Age of the patients ranged from 16 to 30 years. Patients with normal SNA and clear radiographs from the same machine were taken. Exclusion criteria were post-treatment radiographs, and patients with syndromes and cleft lip and palate.

Tracing was done in the standard manner by a single investigator with 8×10 inch translucent acetate tracing paper over a standard illuminated view box with a lead pencil. The various measurements were recorded as shown in figure 1. Patients were classified into three malocclusion classes based on Cephalometric measurements and dental relations. The written consent of the patients for use of their records for research was taken at the time of pretreatment records. Data collected was analyzed by SPSS 26 (IBM Corp., Armonk, N.Y., USA) software for windows. Descriptive statistics were used to calculate the mean, standard deviation, and percentage of data. Pearson correlation test was used for the correlation of ANB, Wits appraisal, and McNamara analysis with mandibular corpus length. A p-value equal to or less than 0.05 was considered statistically significant.

RESULTS

The sample contained 66.4% of females and 33.6% of males. Locations of the patients were that 73.3% were from Peshawar city, 1.7% were from swat, 18.1% were from other areas of KPK and 6.9% were from other provinces of the country and most of the patients were from Peshawar city as shown in table 1.

The correlational analysis of mandibular corpus length with ANB, Wits appraisal, and McNamara analysis are presented in table 2. The Pearson's correlation coefficient showed that mandibular corpus length has a negative weak but significant correlation with Wits (r = -0.350, P = 0.000), positive weak but significant correlation with Nasion perpendicular to pogonion (r = 0.394, p=0.000), negative weak and insignificant correlation with ANB (r = -0.010, p=0.912) and positive weak but significant correlation with nasion perpendicular to point A (r = 0.184, p=0.048).

DISCUSSION

Lateral Cephalometric radiographs gives information essential for different cephalometric analysis which helps in diagnosis and treatment planning.[1] This study aimed to determine the Cephalometric correlation of mandibular corpus length with ANB angle, Wits appraisal, and McNamara analysis to find out which analysis is closely correlated with the corpus mandibular length to facilitate a more accurate diagnosis of skeletal disharmony among jaws.

ANB is the angle that gives information about jaws relative to cranial base. This angle is affected by two factors which are the vertical height of the face and the anteroposterior position of the nasion.[10] Wits appraisal is the projection of point A and B on the occlusal plane and the linear measurement of these two points give the degree and severity of jaw disharmony. McNamara

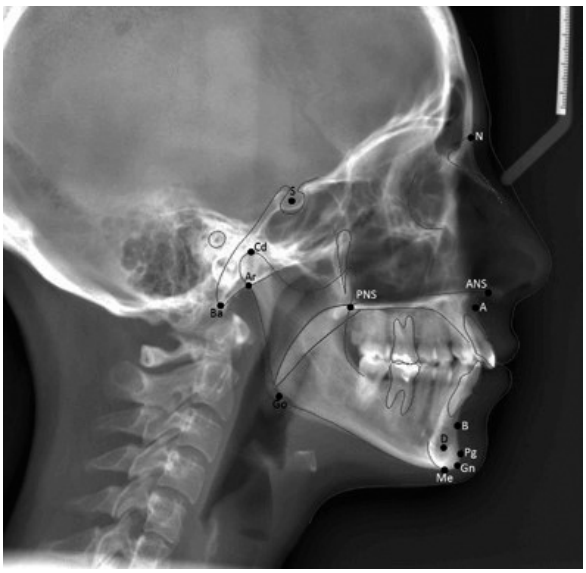

Fig 1[19]. Definition of the landmarks A point A, ANS anterior nasal spine, Ar articulare, B point B, Ba basion, Cd condylion, D center of symphysis, Gn gnathion, Go gonion, Me menton, N nasion, Pg pogonion, PNS posterior nasal spine, and S sella

TABLE 1: AGE, GENDER, ADDRESS, AND MALOCCLUSION OF THE PATIENTS

Characteristics		Frequency	Percent	Mean
AGE	5-20	84	72.4	1.29
	21-30	30	25.9	
	30 & above	2	1.7	
GENDER	Female	77	66.4	1.34
	Male	39	33.6	
	Total	116	100.0	
ADDRESS OF THE PATIENTS	Peshawar city	85	73.3	1.59
	Swat	2	1.7	
	Other areas of KPK	21	18.1	
	Other provinces	8	6.9	
MALOCCLUSION OF THE PATIENTS	Class I	27	23.3	1.97
	Class II div 1	69	59.5	
	Class II div 2	16	13.8	
	Class III	4	3.4	
	Total	116	100.0	

TABLE 2: CORRELATIONS OF MANDIBULAR CORPUS LENGTH WITH ANB, WITS APPRAISAL, AND MCNAMARA ANALYSIS

		Mandibular corpus length	Point-A-nasion-point B(ANB)	Nasion perpendicular to Pogonion	Point A/ point Bto occlusal plane (AO-BO)	Nasion perpendicular to point A
Mandibular corpus length	Pearson Correlation	1	-.010	.394**	-.350**	.184*
	Sig. (2-tailed)		.912	.000	.000	.048
	N	116	116	116	116	116

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

analysis determines the anteroposterior orientation of jaws relative to the cranial base.[1]The mandibular corpus is the linear entity. Mandibular growth goes at a constant rate of 2-3mm per year before puberty. Its growth in width ends before the adolescent growth spurt while height and length are continuous through the period of puberty.[1]

As Wits appraisal and nasion perpendicular to point B is associated with the mandible so a strong correlation was expected. The results of this study gave a weak but significant correlation of mandibular corpus length with Wits appraisal and Nasion perpendicular to pogonion. The relation of mandibular corpus length is negative with the Wits but positive with the Nasion perpendicular to Pogonion(NaP-Po) which means that decrease in Wits and increase in NaP-Po will result from increase in mandibular corpus length. Although, the change in the mandibular corpus length significantly influences the Wits and NaP-Po values, the relationship is weak and therefore, they cannot predict strongly the length changes of mandibular corpus.

A study revealed that ANB angle can vary due the factors other than the actual apical base difference, which are the rotation of the S-N plane, the relative length of the S-N plane, and the rotation of the jaws.[11] Another study stated that the ANB angle does not measure the anteroposterior changes in the mandibular growth as it is affected by the anterior and inferior movement of point B. While the Wits analysis gives the accurate changes as it is measured from the occlusal plane and is not dependent on the vertical changes. In the present study similar results have been shown as the relationship between the angle ANB and mandibular corpus length is weak. Other study revealed that remodeling pattern (obtuse gonial angle and bone deposition at the lower posterior aspect of the mandible)

is the primary determinant of mandibular prognathism in class III subjects.[12-13]

A study advocated that the retrusive mandible tends to increase ANB angle more than the protrusive maxilla in class II malocclusion subjects.[14] In our study the weak but statistically significant relationship of the mandibular length and ANB also suggest that it is a good predictor of the mandibular corpus length in class II cases. The mandibular length was considered the most important predictor of facial rotation pattern in a Croatian study.[15] Another study suggested that there is an increase in anterior facial height in association with an increase in mandibular corpus length[16]. Therefore, when interpreting the ANB for the mandibular deficiency the vertical facial height must also be taken in to consideration.

A study reported that mandibular corpus length is more in the negative overjet group compared to the positive overjet group and there is a relation of wits and NaP-PO to mandibular length.[17] Another study suggested that the Shape and relative position of the mandible contributed to malocclusion but vary within the different malocclusion[18].In the present study a weak relationship shows that corpus length should be analyzed with great care and multiple analysis should be considered for proper diagnosis.

CONCLUSION

1. There is a weak correlation between Wits analysis and Nasion perpendicular to Pog with mandibular corpus length and are highly significant.
2. The correlation of Nasion perpendicular to Point A is weak and slightly significant.
3. There is a weak correlation of ANB with mandibular corpus length and is statistically insignificant.

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3 Zafar ul Islam:	Data analysis, interpretation, results, discussion.
4 Hassan Ali Raza:	Abstract, introduction, conclusion
5 Sadaf Ilham:	Data collection, introduction, discussion.
6 Naila Sunmbal:	Data collection, abstract results