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Comparison of linear cephalometric measurements for assessing sagittal jaw relationship

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Abstract

In orthodontic diagnosis and treatment planning, great importance has been attached to evaluate the sagittal apical base relationship. A total of 100 lateral cephalograms were used for the study out of which 59 cephalograms belonged to male patients and 41 cephalograms belonged to female patients. All cephalograms were taken with patients in standing position with teeth in centric occlusion and lips relaxed. The results showed that there was statistically significant and highly correlated relationship between parameters used in the study for assessment of sagittal jaw relationship. In linear measurements, most homogenously distributed was APP-BPP distance (CV=101.9) and measurements with least homogenous distribution was the Wits Appraisal (CV=-1142.9). No single measurement is perfect in all the cases. A combination of different measurements should be used to have a true assessment of sagittal jaw relationship.

Keywords: Veneers, aesthetics, fluorosis

Introduction

Sagittal relationship between the upper and lower jaw represent the basic characteristic of human profile. In orthodontic diagnosis and treatment planning, great importance has been attached to evaluate the sagittal apical base relationship. Sagittal discrepancies are most commonly encountered in day to day practice. Angle in 1907 provided one of the first assessments of jaw relationship based on the permanent molar relationship; however, this is representative of the anteroposterior relationship of dentition only [1]. There are obvious shortcomings for both angular and linear measurements [2]. Extracranial measurements independent of the cranial reference planes or dental occlusion reflecting the true sagittal relationship have also been used [3]. With Broadbent's introduction of the cephalometer in 1931 [4], a new era of cephalometrics began in orthodontics with numerous cephalometric measurements been devised. Cephalometrics has been adapted as an important clinical tool for assessment of jaw relationship in all the three planes-anteroposterior, transverse and vertical being an integral part of orthodontic treatment plan [5].

Methodology

The study was carried out on the patients visiting the out-patient section of the Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College & Hospital Shreen Bagh, Srinagar. A total of 100 lateral cephalograms were used for the study out of which 59 cephalograms belonged to male patients and 41 cephalograms belonged to female patients. All cephalograms were taken with patients in standing position with teeth in centric occlusion and lips relaxed. All the cephalograms were taken using the same x-ray machine and a standard technique. The machine used was Newtom Giana NNT. All the films were exposed with 64 KVp, 8 mA and an exposure time of 9 seconds. All the cephalograms were traced on a standard acetate paper of 8"x10" size and 0.003" thickness by a standard technique. The linear measurements were recorded with a measuring scale up to 0.5mm correction.

Table 1: Mean age and number of patients in the three groups used in the study

Groups	No of patients (n)	Mean Age (Years)	S.D
Class I	35	19.57	4.00
Class II	35	20.48	3.58
Class III	30	20.11	4.49

Statistical Analysis

The data of the study was subjected to descriptive tests, mean, standard deviation, range, maximum and minimum values and correlation coefficient for each measurement. The student's t-test was applied to determine whether there were any differences between the measurements of male and female subjects. Correlation in different sagittal jaw parameters was studied to see for their interchangeability.

Table 2: Showing linear parameters used in study

S.no.	Parameter	Average value
1.	WIT'S Appraisal	Females (AO & BO COINCIDE) Males (BO is 1mm ahead of AO)
2.	AF-BF Distance	3.87 ± 2.93 mm (males) 3.87 ± 2.63 mm (females)
3.	APP-BPP Distance	4.8 ± 3.6 mm (males) 5.2 ± 2.9 mm (females)

Results

The data was collected, tabulated and statistically analyzed using the SPSS 20.0 software. Statistical methods employed in the present investigations were:

1. Minimum and maximum value, range, mean and standard deviation were calculated for each subject (Table 4).
2. Differences in distribution of cases in each skeletal class as shown in table 3.
3. To find out the significant differences for the measurements between male and female sample, Independent 't' test was applied.
4. Coefficients of Variability of all parameters were calculated (Table 4).
5. Correlation coefficients between the various parameters were calculated using Pearson's correlation to determine which combination would produce a higher value (Table 5).
6. The results showed that there was statistically significant and highly correlated relationship between parameters used in the study for assessment of sagittal jaw relationship as shown in table 5.

In linear measurements, most homogenously distributed was APP-BPP distance (CV=101.9) and measurements with least homogenous distribution was the Wits Appraisal (CV=-1142.9). Wits showed the greatest percentage in Class III.

Table 3: Comparison of Assessments of Sagittal Jaw Relationship by Linear Measurements of Analysis

Method of Analysis	No. of cases in each skeletal category		
	Class I	Class II	Class III
WIT'S Appraisal	17	35	48
AF-BF Distance	35	40	25
APP-BPP Distance	39	40	21

Table 4: Descriptive Statistics of Pooled Group

	Minimum	Maximum	Mean	SD	CV (%)
WIT'S Appraisal	-11	12	-0.42	4.80	-1142.9
AF-BF Distance	-6	19	4.74	5.32	112.2
APP-BPP Distance	-6	21	5.75	5.86	101.9

Table 5: Correlation Matrix for Wits, AFBF, APP-BPP, (r- correlation coefficient; p- value).

		WIT'S	AFBF	APP BPP
WITS	r			
	P-value			
AFBF	r	0.688		
	P-value	***		
APP BPP	r	0.753	0.847	
	P-value	***	***	

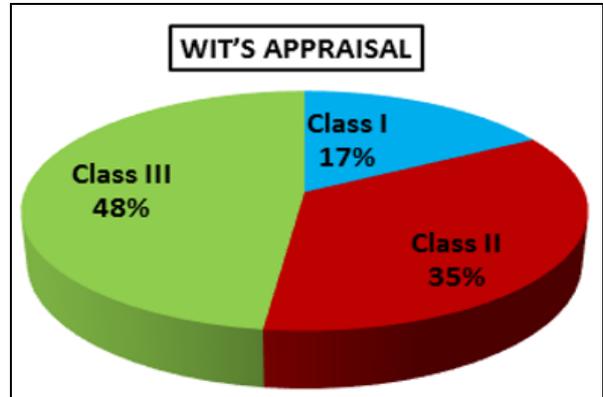


Fig 1: Graph showing percentage in 3 classes (Wit's Appraisal)

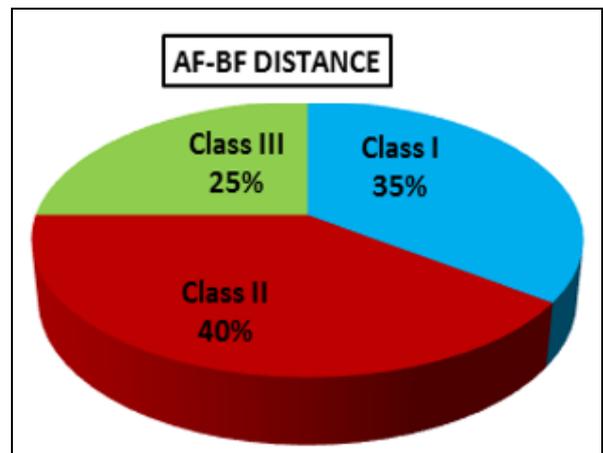


Fig 2: Graph showing percentage of AF-BF distance in 3 classes

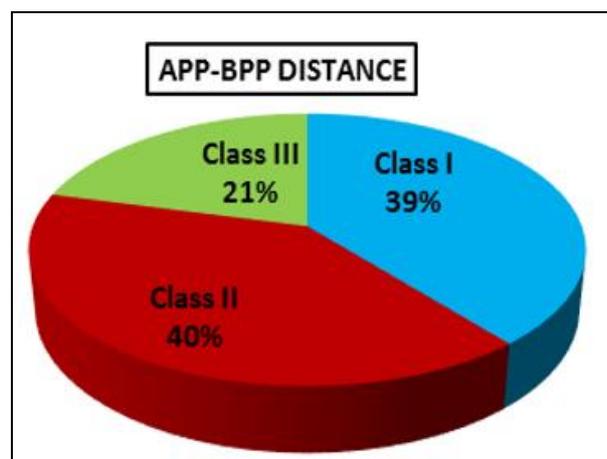


Fig 3: Graph showing App-BPP distance in three classes

Discussion

Pearson's correlation of different sagittal parameters used to assess maxillo-mandibular relationship was studied. All the parameters had highly significant relation to each other in the present study. The high correlation coefficients among three sagittal parameters denote that these parameters are closely related to each other and may be used interchangeably. Linear measurements such as APP-BPP and AF-BF distance could demonstrate superiority for assessing antero-posterior jaw relationship over other methods such as Wits. Almost similar findings have been reported by other studies [6]. Similarly, Bhardwaj P [7] *et al.*, compared and correlated Beta angle with other angular and linear measurements for assessment of sagittal skeletal discrepancy.

Among linear measurements, the parameter with most homogenous distribution was APP-BPP (CV=101.9) and the least homogenous was Wits (CV=-1142.9) in our study. Coefficient of variability is highest for Wits. The greatest coefficient of variability may be attributed, in part to difficulties or inaccuracies in identifying the functional occlusal plane and/or variation in it. Wits appraisal was affected by rotation of jaws and is in agreement with Chang (1987) [8], who opined that the Wits appraisal could be easily affected by changes in the inclination of occlusal plane and the variation in the vertical position of point A, point B or both.

Moore *et al.* [9] and Ishikawa [10] *et al.* who also stated that Wits appraisal although not affected by landmarks or jaw rotations; it still has the problem of correctly identifying the functional occlusal plane, which can sometimes be impossible, especially in mixed dentition. Furthermore, changes of the Wits measurement throughout orthodontic treatment might also reflect changes in the functional occlusal plane rather than pure sagittal changes of the jaws. Wits appraisal was found to be skewed in the class III direction in our study. In those persons determined to be class I and class II by the A to B measurement on palatal plane, the Wits appraisal was found to be biased in favour of class III relationships.

Conclusion

From above analysis and obtained results following conclusion can be drawn:

- The parameter with most homogenous distribution was APP-BPP (CV= 101.9) and the least homogenous was Wits (CV=-1142.9).
- Wits appraisal was found to be skewed in the Class III direction.
- No single measurement is perfect in all the cases. A combination of different measurements should be used to have a true assessment of sagittal jaw relationship.

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