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Cephalometric Study Examined The Correlation Of W Angle And Wits Appraisal Cephalometric Factors To Determine The Sagittal Relationship Between The Maxilla And Mandible In Eastern And Western U.P. Population.

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Abstract
The current study's goal is to determine how the W Angle and Wits apprasial interacts with each other for sagittal divergence in order to find more stable and consistent parameter for anterior-posterior cephalometric analysis. 500 participants (250 from the eastern and 250 from the western UP population) had lateral cephalograms taken, which were then traced for W Angle and Wits sagittal discrepancy criteria. This study showed that the more evenly distributed metric for determining anterior-posterior sagittal divergence is W angle. Both the measurements included in the study have statistically significant correlations with one another, it is advisable to investigate and correlate more metrics with clinical data rather than relying solely on one**.**

Keywords: Sagittal Discrepancy¸ Anterioposterior relation, W angle, Witz Apprasial

Cephalometry has made it feasible to accurately identify changes in the living head that could be brought on by orthodontic treatment or developmental growth. At many succeeding ages, the changes in the same person can also be observed and measured. The cranial base is the area that shows no change between specific ages, according to later cephalometric investigations. Therefore, these regions provide a more solid foundation for linking the tracings and provide a highly precise way to measure changes in teeth, jaws, and faces. 1
Different angular and linear metrics were developed in cephalometry to evaluate the sagittal mismatch between the maxilla and mandible.

In 1975, Jacobson2 introduced the WITS assessment. This technique involves tracing perpendicular lines from points A and B on the maxilla and mandible, respectively, onto the occlusal plane on a lateral cephalometric head film to determine the degree or extent of the jaw disharmony. It is

currently an essential component of cephalometric analysis. However, accurate positioning or depiction of the occlusal plane is crucial for the WITS appraisal's assessment of anteroposterior apical base discrepancy. Correct Introduction [3] of Occlusal plane identification can be challenging at times, particularly with mixed dentition. Additionally, WITS assessment during orthodontic therapy may also show modifications in the functional occlusal plane as opposed to just sagittal adjustments to the jaws. Bhad et al.4 created the other measurement known as W angle in 2013. The three skeletal markers point M, G, and S are also used as reference points in this angle. By using this measurement, several of the limitations of earlier measurements overcame since it is independent of functional occlusal planes and unstable landmarks. In skeletal patterns where the jaws rotate either clockwise or anticlockwise as well as during periods of transition when vertical face growth is occurring, the W angle is a valuable sagittal metric. W angle is not covering up the actual skeletal classes I, II, and III patterns because it is independent of cranial base length. However, accurate pre-maxilla tracing and pinpointing its centre will be challenging, necessitating the use of superior cephalometric X-rays.5

To measure and compare various sagittal and other hard tissue metrics, numerous research have been conducted. However, there were conflicting findings and no obvious rationale for therapeutic application. In light of this, the study anticipates evaluating the relationships between sagittal discrepancy indicators W angle and WITS assessment.

Material and Method

The Department of Oral Medicine and Radiology at Saraswati Dental College in Lucknow took pre-treatment digital lateral cephalograms on 500 (250 eastern U.P. and 250 Western U.P.) individuals between the ages of 18 and 30 who had never had orthodontic treatment before. The radiographs were taken with the head in its natural position and the teeth in occlusion. The population of North India that was willing to receive orthodontic treatment at the Saraswati Dental College's Department of Orthodontics and Dentofacial Orthopaedics served as the study's sample. Each of them gave their informed consent. None of the individuals involved in the study had ever received orthodontic treatment before, suffered any facial damage, or had a congenital facial defect. They were all born and raised in Uttar Pradesh. Their ages ranged from 18 to 30. The study excluded participants with a history of orthodontic treatment, any type of cranial or facial abnormality, a history of craniofacial trauma, or congenital anomalies.

Each cephalogram was captured using the same exposure parameters (KVP - 80, mA-10 exposure period 0.5 sec), 100% magnification, and the same device (Kodak 8000C Digital and Panoramic System Cephalometer Rochester). While taking a lateral cephalogram, the teeth were aligned concentrically and the Frankfort Horizontal plane was parallel to the ground. The x-rays were printed using Fujifilm Medical Dry Imaging film (8x10 inches in size) and the Fujifilm Dry pix plus printer.

In order to correct the magnification errors of lateral cephalographs, a fixed metallic cross with a length of 2 inches was added to the radiographs. The study omitted cephalographs that displayed magnification in the metallic cross measurement.

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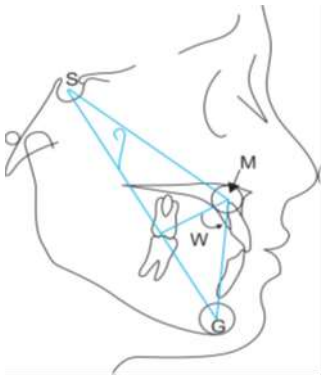
These cephalograms were hand-drawn using a 4H pencil and an X-ray viewer on acetate tracing paper. Every important structure and landmark was identified. Scale was used to measure linear lengths to the nearest 0.5 mm, and angles were measured to the nearest 0.5 degrees. Numerous

reference points, planes, and angles were made and recorded for examination of W angle and Wits Apprasial.

The data were verified and statistically analysed to identify the relationship between both sagittal dysplasia indicators used in this study.

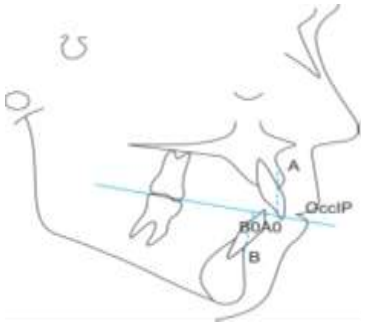
MEASURABLES USED IN THE STUDY

(Bhad et al. 2013, W angle)4 - The locations of points S, M, and G were used to create the W angle. Three lines were drawn to connect the points S and M, M and G, and S and G. After drawing a second line perpendicular to the S-G line at point M, the angle W between the M-G line at point M and the perpendicular line to the S-G line was calculated.



W Angle

Evaluation using WITS (Jacobson, 1975)5 - The linear distance between sites A and B projected perpendicularly on the functional occlusal plane is known as the AO-BO distance or WITS evaluation



WITS APPRASIAL

Based on the results of the pre-treatment, the lateral cephalograms of the 500 samples (250 eastern U.P. and 250 Western U.P.) utilised in the study were divided into three groups: Groups are made up of Class I, Class II, and Class III skeletal pattern groups. An individual patient could only be assigned to a group if both parameters—the W angle, and WITS—were favourable to that group.

The following inclusion criteria were taken for class I skeletal pattern group
- Wits appraisal between 0 and -3mm
- W angle between 51° - 56°
- Pleasant profile.

Inclusion criteria for class II skeletal pattern group:
 Wits appraisal with AO ahead of BO in females or AO coinciding with or ahead of BO in males.
 W-angle less 51°
 Profile had a Class II appearance.
Inclusion criteria for class III skeletal pattern group
 Wits BO ahead of AO in females or BO ahead of AO by more than 1 mm in males
 W angle more than 56°
 Profile had a Class III appearance

STATSTICAL ANALYSIS

The following statistical techniques were used in the current study:
1. 50 randomly chosen cephalograms were measured again one month later for reliability study. The representative measurement was determined as the average of two readings. Using Dahlberg's error analysis, the representative measurements at the two intervals were compared.
2. Maximum and lowest values, as well as the mean and standard deviation, were computed.
3. An independent t test was used to determine whether there were any measurements that differed significantly between the male and female samples.
4. The variability coefficient was determined.
5. The Pearson's correlation coefficient was used to calculate the correlation coefficients between different parameters.

RESULTS

Dahlberg's error analysis, a statistical procedure to examine the error between repeated measurements, revealed that the error was considerably below the threshold of 0.5mm for all parameters.

Table 1 shows that W angle and WITS was significantly ($p<0.05$) higher among males compared to females. The mean values of the different parameters in this study i.e. W angle and WITS were 53.13±4.21 and 3.07±2.79 respectively. Table 2 shows the mean, standard deviation and p value for each parameter. ANOVA analysis was performed and highly significant differences were found in W-angle and Wits appraisal in all the three groups (Group I, Group II, and Group III).

Table 1- Comparison of various study parameters with age in eastern and western U.P. population

Parameters	Age in years			p-value[1]
	<20	20-25	26-30	
W angle	52.60 ±4.21	53.27 ±4.25	54.94 ±3.36	0.07
WITS	3.09 ±2.88	3.14 ±2.77	2.53 ±2.53	0.47

Table 2- Comparison of various study parameters in Eastern and Western UP population

Parameters	Eastern UP sample	Western UP sample	p-value[1]
W angle	54.04±4.57	52.73±3.99	0.002 *
WITS apprasial	3.54±2.74	2.86±2.79	0.01*

Unpaired t-test, *Significant

Table-3: Mean, Standard Deviation and p- Value for the three groups

Study parameters	Groups	Mean	SD	p-value[1]
W angle	I	53.57	1.56	0.0001*
	II	47.76	3.28	
	III	58.40	1.36	

WITS	I	0.84	1.06	0.0001*
	II	5.20	1.83	
	III	-2.12	0.34	

ANOVA test, *Significant

DISCUSSION

This study is significant because accurate evaluations are necessary for making crucial orthodontic decisions. Cephalometric data is an important source of inspiration for treatment goals and strategies. If the diagnosis is erroneous, the treatment course may be insufficient, take longer, or produce different effects. It will have other effects, such as patient and parent disappointment, which will have an impact on the clinician's practice.

The ANOVA test used to compare the study parameters with age revealed a p-value larger than 0.05, indicating that there was no significant difference in the study parameters across the various age groups. This was related to the Hassan Ahmed et al. (2016)6 study on the Syrian population. There was no statistically significant difference between the sample of Bhad et al. (2013)4 and the mean value of the various sagittal analysis of the sexes within the categories.

In our study the unpaired t-test for comparing various parameters with gender showed that the YEN angle, W angle and WITS were significantly ($p<0.05$) higher among males compared to females.

The mean value of WITS was recorded as 3.74±2.74 in eastern UP population as compared to western UP population which is 2.86±29 in this study. This was not correlating to the WITS values measured by Jarvinen (1988)7 (−0.6 mm ± 2.9), The higher values of WITS in our study correlate with the value derived by Hurmerinta et al. (1997)8 . They analyzed that the value of WITS appraisal do not remain stable throughout the growth period. The readings were not entirely dependent upon the relative sagittal movements of points A and B. They also showed that any change in the angulation of the functional occlusal plane may profoundly influence the positions of points A and B relative to that plane, and therefore to the value of the WITS appraisal. The direction and magnitude of any change in the WITS appraisal depends upon the direction of facial growth and treatment mechanics.

The mean value of W angle was recorded as 54.04±4.57 in eastern UP population as compared to western UP population which is 52.73±3.99 in this study. his was also supported Bhad et al. (2013)4 who stated that this measurement does not depend on unstable landmarks or the functional occlusal plane.

WITS appraisal was also a popular alternative which demonstrated high correlation with skeletal groups in this study. The values of WITS in this study showed significant difference for all the three skeletal pattern groups ($p<0.001$). These findings correlates with that of Mittal et al. (2016)9.

The distribution of class I, II, & III skeletal pattern groups among the samples according to W angle were found to be 240 (53.3%), 114(25.3%), 96(21.4) in each group respectively. This distribution also showed that class I pattern was higher in our samples according to W angle measurements. However similar study done by Alam et al. (2014)10 among Pakistani samples shown more severity of class III according to W angle.

CONCLUSION

- Despite varying strengths of association, statistically significant correlations were found among the five methods for assessing sagittal jaw relationship i.e., all the parameters shown statistically significant different values for skeletal class I, II, III.
- The mean values of W angle, WITS Appraisal shown gender variation as there was significant difference in their mean values in males and females.
- Significant difference present in eastern and western U.P. population and thus shows different sagittal relation between eastern and western U.P. population.

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