

Comparative Assessment of Sagittal Skeletal Discrepancy in Patients with Bilateral Cleft Lip and Palate - A Cephalometric Study

Arihant Golchha, Pragati Jain, Shashi Ahirwar, Rishabh Golchha, Shivani Deshmukh

Abstract: *Context: In orthodontic diagnosis, it is important to recognize the sagittal difference between the maxillary and mandibular apical bases as treatment planning aims at normalization of the maxillo-mandibular relationship. In contrast to normal individual, the development of the craniofacial complex in cleft lip/palate cases is altered and this difference may affect the growth and positioning of other facial structures. Aims: The present study is aimed at comparison of Beta angle, ANB angle, Wits appraisal, YEN angle and W angle for assessment of sagittal skeletal discrepancy in the patients with cleft lip / palate and to find out which is the most reliable amongst them. Methods and Material: 50 lateral cephalograms of patients with bilateral cleft lip and palate and Normal individuals were traced using Auto-cad software. After marking the points, reference lines were marked and evaluated for ANB angle, Wits Appraisal, Beta angle, YEN angle and W angle. These angles were compared for reliability using statistical analysis. Results: t-test analysis was performed and highly significant differences were found in ANB angle, Beta angle, W-angle and Wits appraisal in all the 50 patients. Coefficient of variability was calculated for intra-group comparisons. Conclusions: It is concluded from the study that ANB angle, Beta angle, W-angle and Wits appraisal are highly significant measurements to assess the sagittal jaw relationship between maxilla and mandible. Wits appraisal was found to be least variable parameter and Yen angle was found to be the most variable parameter.*

Keywords: Sagittal skeletal discrepancy, Bilateral cleft lip and palate, ANB angle, Wits Appraisal, W-angle, YEN angle, β - angle

1. Introduction

The antero-posterior relationship between the maxillary and mandibular dental bases is defined as the dental base relationship. It is also called the skeletal pattern, jaw relationship, or the sagittal apical base relationship. In orthodontic diagnosis, it is important to recognize the sagittal difference between the maxillary and mandibular apical bases as treatment planning aims at normalization of the maxillo-mandibular relationship. To aid in diagnosing antero-posterior discrepancies, cephalometric analyses have incorporated various angular and linear measurements. Studies have been conducted to assess the reliability and accuracy of these measurements and a need has been found to establish parameters which are accurate, reproducible and independent of cranial base and dental structures¹.

Historically, orthodontists have related both the maxilla and the mandible to reference points in the cranial base of the skull. The first step in evaluating antero-posterior apical base relationship cephalometrically was by Down's (1948) description of points A and B².

Reidel (1952) measured the SNA and SNB angle and used their difference or ANB angle as an expression of dental apical base relationship³. Steiner proposed the appraisal of various parts of the skull separately, namely the skeletal, dental and soft tissues.

The 'Wits' appraisal was suggested by Jacobson (1975), relates points A and B to the occlusal plane O⁴.

Beta angle was introduced by Baik and Ververidou (2004), as the angle between the last perpendicular line from point A to the C-B line, and the A-B line. This angle does not depend on any cranial landmarks or dental occlusion⁵.

Most recently introduced sagittal dysplasia indicator is YEN angle introduced by Neela et al (2009). Since it measures an angle between line SM and MG, rotation of jaw because of growth or orthodontic treatment can mask true basal dysplasia, similar to ANB angle⁶.

To overcome these problems, Bhad et al (2011) developed W-angle⁷. It does not depend on any unstable landmarks or dental occlusion and would be especially valuable to assess true sagittal changes because of growth and orthodontic treatment.

In contrast to normal individual, the development of the craniofacial complex in cleft lip and palate cases is altered and in an attempt to establish the mechanisms and determinant factors of facial development in such individuals, a number of studies have stated that the base of the skull is intrinsically different in shape and size in patients with cleft lip and palate and this difference may affect the growth and positioning of other facial structures. The antero-posterior deformities often found in such individuals may actually result from surgical trauma, adaptive changes or a combination of both.

The present study is aimed at comparison of Beta angle, ANB angle, Wits appraisal, YEN angle and W angle for assessment of sagittal skeletal discrepancy in the patients with cleft lip / palate and to find out which is the most reliable amongst them. Literature is replete with attempts to accurately assess antero-posterior discrepancy using different cephalometric analyses with varying degrees of success. Rotational effects of jaws, varying positions of points A and B, nasion, variations in cranial base length, tooth eruption, etc. seem to have influenced sagittal assessment leading to the use of extracranial reference planes as well. Due to the large variability in human population, a single cephalometric analysis may not provide an accurate diagnosis. Hence, it is imperative that a clinician

be aware of a range of cephalometric analyses to be used appropriately as the need arises.

Aim and Objective

The study was aimed to compare different parameters i. e. ANB angle, Wits appraisal, Beta angle, YEN angle and W angle for assessment of sagittal skeletal discrepancy in patients with bilateral cleft lip and palate with normal Class I malocclusion individuals.

2. Subjects and Methods

A retrospective study was performed. This study was approved by the Institutional Research Ethics Committee. Informed consent was signed by all subjects of parents. The study was carried out on 25 surgically treated bilateral CLP (BCLP) patients within age group of 14-25 years irrespective of gender who were selected from the archival patient data of Department of Orthodontics and Dentofacial Orthopedics of our institution. The exclusion criteria included unilateral cleft lip and palate, clefting associated with diagnosed syndromes and prior adenoidectomy and/or tonsillectomy and prior orthodontic treatment.

The lateral cephalograms was traced using Auto-cad software. After marking the points i. e. Point S, Point N, Point A, Point B, Point C, Point M and Point G; reference lines were marked and were evaluated for ANB angle, Wits Appraisal, Beta angle, YEN angle and W angle. These angles were compared for reliability using statistical analysis.

3. Results

The variables under study were evaluated for statistical significance across two groups using one-way ANOVA. The paired comparison between groups were performed and tested for significance using Tukey's post-hoc test. Also, the comparison of variables between right and left sides were carried out using paired t-test. All the analyses were performed in SPSS 18.0 version (SPCC Inc.) and the statistical significance were tested at 5% level. t-test analysis was performed and highly significant differences were found in ANB angle, Beta angle, W-angle and Wits appraisal in all the 50 patients. Coefficient of variability was calculated for intra-group comparisons.

Skeletal Parameters	Normal Value	Group 1		Group 2		p- value
		Mean	SD	Mean	SD	
ANB angle	2	1.72	1.02	6.40	2.47	0.001**
BETA angle	27-33	31.12	1.51	24.32	3.79	0.001**
W angle		45.48	4.36	35.20	3.77	0.001**
YEN angle		104.36	5.31	99.88	5.13	0.004**
WITS appraisal	-1(M) 0(F)	-0.48	1.19	4.08	1.75	0.001**

*Significant at 0.05 level;

** Significant at 0.001 level, thus highly significant

Table 2: Coefficient of Variability in Group 1

Skeletal Parameters	Minimum	Maximum	Mean	Std. Deviation	Coefficient of Variance
ANB angle	.00	3.00	1.72	1.02	1.04
BETA angle	29.00	34.00	31.12	1.51	2.28
W angle	40.00	54.00	45.48	4.36	19.01
YEN angle	95.00	120.00	104.36	5.13	28.24**
WITS appraisal	-2.00	3.00	-0.48	1.19	1.43*

**Least homogenous distribution

*Most homogenous distribution

Table 3: Coefficient of Variability in Group 2

Skeletal Parameters	Minimum	Maximum	Mean	Std. Deviation	Coefficient of Variance
ANB angle	2.00	9.00	6.40	2.47	6.08
BETA angle	13.00	28.00	24.32	3.79	14.39
W angle	29.00	41.00	35.20	3.77	14.25
YEN angle	90.00	109.00	99.88	5.13	26.36**
WITS appraisal	1.00	7.00	4.08	1.75	3.08*

**Least homogenous distribution

*Most homogenous distribution

4. Discussion

Evaluation of sagittal jaw discrepancy is an indispensable step in every orthodontic diagnosis. Many angular and linear measurements have been devised till date, which uses different reference points and planes for this measurement. Different analyses may at times give different values for the same jaw relationship due to change in the reference planes. ANB angle, Wits appraisal, and Beta angle are the commonly used sagittal jaw indicators in regular orthodontic diagnosis. Yen angle and W angle have recently been introduced by Neela et al⁶ and Bhad et al⁷ respectively. In this study, an attempt was made to check these parameters for their correlation, so as to assess their clinical use and predictability as sagittal jaw indicators in patients with bilateral cleft lip and palate cases.

Findings in the literature suggest that the study done by Aparna Palla et al⁹ in year 2015 compared Beta angle, ANB angle and Wits appraisal for evaluating the sagittal apical base relationship using lateral cephalograms. They found that Beta angle can be more reliably used to assess sagittal jaw discrepancies than ANB angle and Wits appraisal.

Similar study was done by Ruchi Sharma et al¹⁰ in 2015 comparing W angle with Beta angle, ANB angle and Wits appraisal in Class I and Class II patients. They found highly significant result with W angle. Priya K. Gupta et al¹¹ in 2016 did a study to evaluate the reliability of Beta and YEN angle in diagnosis of Skeletal Class II malocclusion. They found that Beta and YEN angle showed significant result to assess the sagittal jaw relationship. Romina Kapadia et al¹² in 2017 evaluated the predictability of YEN angle, W angle, Beta angle, ANB angle and Wits appraisal for sagittal jaw dysplasia and found that Yen angle and W angle can be used to assess in addition to the established angles. In Table 1, the correlation among all the five parameters is calculated, wherein it can be seen that they all show a significant

correlation (< 0.001) with each other, suggesting that all the five parameters can be successfully used in assessing the sagittal jaw discrepancy. This finding correlates with that of Mittal et al,¹³ Doshi et al,¹⁴ Trivedi et al,¹⁵ and Alam et al.¹⁶

By this study it was found that Wits appraisal is the best method to evaluate sagittal skeletal discrepancy in patients with bilateral cleft lip and palate. It was also found that Yen Angle is least reliable method to measure skeletal sagittal discrepancy in both bilateral cleft lip and palate cases and normal individuals.

It is concluded from the study that ANB angle, Beta angle, W-angle and Wits appraisal are highly significant measurements to assess the sagittal jaw relationship between maxilla and mandible. Wits appraisal was found to be least variable parameter and Yen angle was found to be the most variable parameter.

However, instead of relying on one single parameter, others also should be checked and should be correlated.

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