Journal of Oral Health & Community Dentistry

ORIGINAL ARTICLE

Comparative Assessment of Sagittal Maxillo-mandibular Jaw Relationship - A Cephalometric Study

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ABSTRACT

History is evident that correct assessment of Sagittal Jaw Relationship has always remained the perennial problem in orthodontics. The present study is undertaken to use Sagittal methods for assessing individuals and classifying for Skeletal Class I, Class II and Class III based on Jaw Relationship and to evaluate the reliability of sagittal methods. 200 subjects in the age group of 12 to 18 yrs were selected and were subjected to cephalometric radiography and traced. The sample was divided into skeletal Class I, Class II and Class III on the basis of AXD angle, FABA angle and MM Bisector. Subsequently following angles and linear measurements were measured; Beta angle; AB plane angle; JYD angle; ANB angle; AXB angle; AF – BF and App – Bpp. Result - Consistency could be demonstrated by all the methods assessed by Antero-Posterior jaw relationship. Insignificant difference on influence of growth, age and sex was noted. Angular methods used for assessing jaw relationship such as FABA, AXD, Beta and linear measurements such as App-Bpp, MM Bisector could demonstrate superiority for assessing Antero-Posterior jaw relationship over other methods such as AXB, AB plane, ANB and AF-BF which showed more variability.

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J Oral Health Comm Dent 2012;**6**(1)14-17

INTRODUCTION

Cephalometric radiograph is a valuable tool in orthodontic diagnosis and treatment planning. In orthodontics, discrepancies are commonly described in three planes namely, transverse, sagittal and vertical. Of these the sagittal discrepancies are more commonly encountered in day to day practice. Angular and linear measurements have also been incorporated into various cephalometric analyses to help the clinician for diagnosing these antero-posterior discrepancies. To determine the sagittal denture base relationship, A-B plane angle was introduced (1). A few years later SNA, SNB, and ANB angles were used (2,3). More recently, it has been claimed that the ANB angle is affected by several environmental factors and thus a diagnosis based on this angle may give false results (4). To eliminate the influence of anatomic variations in nasion on the sagittal relationship of the jaws, Wits appraisal was presented (5). AXB angle was also introduced by drawing perpendicular from point A to FH plane (6). A number of angular measurements have been developed to determine the actual sagittal skeletal discrepancy such as AXD, JYD, MM^0 bisector, FABA and Beta angles (7 - 11). Also linear measurements such as AF-BF and App-Bpp were introduced to overcome the shortcomings of angular measurements (12,13).

All the above mentioned analyses used reference planes in the cranial references or dental occlusion. Each one of the reference planes had their own limitations. A measurement independent of cranial reference planes or dental occlusion could be a desirable adjunct in determining apical base relationship.

In view of the above, the present study is undertaken to evaluate sagittal methods for assessing Skeletal Class I, Class II and Class III for Jaw Relationship and to evaluate the reliability of sagittal methods utilizing FABA, AXD, MM Bisector, Beta angle, JYD angle, AB plane angle, ANB angle, AXB angle, AF – BF and App – Bpp from randomly selected subjects at Moradabad.

MATERIAL AND METHODS

200 subjects were selected from out patients Department of Orthodontics and Dentofacial Orthopedics of Kothiwal Dental College and Research Center Moradabad and from schools in Moradabad city by using a simple random sampling technique. Sample so selected for the present study ranged in the age group of 12 to 18 yrs.

Selected individuals were subjected to cephalometric radiography and tracing of the lateral cephalogram was done. Patient's facial profile, AXD, FABA and MM^0 Bisector were used as criteria for dividing the patients as Class I, Class II and Class III. On dividing, total number of sample in Class I was 59, Class II 114 and Class III 27. Out of 59 Class I sample, 17 were males and 42 were females, out of 114 Class II sample, 48 were males and 66 were females and from 27 Class III sample, 12 were males and 15 were females. The following angular and linear measurements were made on tracing of the radiographs to analyze maxillo-mandibular relationship: FABA, AXD, MM^0 Bisector, Beta angle, JYD angle, AB plane angle, ANB angle,AXB angle, AF – BF,App – Bpp.

RESULT

The Mean, SD, SEM and Confidence Interval values of AXD, FABA, MM Bisector, Beta angle, JYD angle, AB plane angle, ANB angle, AXB angle, AF – BF, App – Bpp, are presented in the tabular form

The coefficient of variability was found to be least for FABA followed by Beta, AXD and MM Bisector. The maximum variability was found for ANB and AB plane angle.

DISCUSSION

Great importance has been attached in evaluating the sagittal apical base relationship during orthodontic diagnosis and treatment planning. Ever since the introduction of the angle ANB, it has become one of the most popular means for evaluating the antero-posterior relationship of the apical bases (2). In spite of its well known established shortcomings, it is still used by many, as an absolute determination for assessment of sagittal skeletal disharmony, and the effects of variations in the vertical and sagittal jaw dimensions relative to the cranial base.

In early 1955 the functional occlusal plane was selected as a reference base for the measurement of sagittal jaw disharmony (5). It was reasoned that all phases of dentistry traditionally use this plane as a primary

Table 1: Shows mean, SD, SEM and confidence interval of AXD angle (in degrees) in males and females in skeletal class I, II and III.

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	11.38	10.60	14.75	14.64	4.63	4.80
SD	1.47	1.32	1.26	1.48	2.69	2.85
SEM	0.36	0.20	0.18	0.18	0.75	0.74
Confidence Interval	9 to 13.5	9 to 13	13 to 17	13 to 19	-3 to 7	-3 to 7.5

Table 2: Shows Mean, SD, SEM and confidence interval of MM^0 bisector linear (in mm) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	-3.59	-2.94	3.35	3.05	-10.67	-9.87
SD	1.05	1.14	2.08	1.58	1.56	2.98
SEM	0.25	0.18	0.30	0.19	0.43	0.77
Confidence Interval	-2 to -5	-1 to -5	0 to 9	0 to 7	-8 to -14	-6.5 to -15.5

Table 3: Shows Mean, SD, SEM and confidence interval of FABA angle (in degrees) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	79.97	80.17	73.10	72.77	93.42	92.80
SD	1.61	1.68	3.48	4.03	4.55	4.38
SEM	0.39	0.26	0.50	0.50	1.26	1.13
Confidence Interval	77 to 82	77 to 83	65 to 77	60 to 77	86 to 101	86 to 101

Table 4: Shows mean, SD, SEM and confidence interval of AXB angle (in degrees) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	5.26	4.99	9.04	9.67	-2.04	-0.80
SD	1.14	1.02	0.78	0.67	0.98	1.90
SEM	0.58	0.52	0.40	0.34	0.50	0.97
Confidence Interval	4.1 to 6.4	3.9 to 6.1	8.3 to 9.8	9 to 10.4	-1.1 to -3.1	-2.7 to 1.1

Table 5: Shows mean, SD, SEM and confidence interval of JYD angle (in degrees) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	8.62	8.93	11.04	11.80	3.96	4.83
SD	1.16	0.69	0.78	0.55	1.92	1.35
SEM	0.59	0.35	0.40	0.28	0.98	0.69
Confidence Interval	7.5 to 9.8	8.3 to 9.6	10.3 to 11.8	11.3 to 12.3	2.1 to 5.4	3.5 to 6.2

plane of orientation, since all masticatory forces are focused on this plane and intimately related to it (5). Points A and B were projected on to the occlusal plane and termed the resulting measurement of A-B difference. However, the effect of inclination of the occlusal plane on the A-B reading was recognized, which in extreme cases could change so much that the projection of point B could fall behind point A. ANB angle is not always an accurate method of establishing the actual amount of apical base divergence (7). As a result AXD angle was devised, as an alternative to the ANB angle for measuring apical base discrepancy, where point X is formed by projecting point A on to a perpendicular to the S-N line, and point D is located in the center of the bony symphysis.. Other authors have suggested angles or linear measurements based on the palatal plane (13). Although the palatal plane is highly stable with age, its inclination is highly variable, making it difficult to establish mean values for the norm. A measurement such as the Beta angle which is independent of cranial reference planes or dental occlusion would be a desirable adjunct in determining the apical base relationship (11).

Table 7: Shows mean, SD, SEM and confidence interval of beta angle (in degrees) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	31.29	30.08	22.61	22.74	39.17	39.23
SD	1.69	0.78	1.35	1.02	1.80	1.80
SEM	0.86	0.40	0.69	0.52	0.92	0.92
Confidence Interval	29.6 to 32.9	29.3 to 30.8	21.3 to 23.9	21.7 to 23.7	37.4 to 40.9	37.4 to 41.1

Table 6: Shows mean, SD, SEM and confidence interval of ANB angle (in degrees) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	3.00	4.32	6.13	6.86	-2.08	-1.70
SD	0.78	0.71	0.74	0.51	1.82	1.37
SEM	0.40	0.36	0.38	0.26	0.93	0.70
Confidence Interval	2.22 to 3.78	3.61 to 5.03	5.39 to 6.87	6.35 to 7.37	-3.9 to -0.26	-3.07 to -0.33

Table 8: Shows mean, SD, SEM and confidence interval of AB plane angle (in degrees) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	-3.15	-5.40	-10.39	-9.29	3.00	2.03
SD	1.14	1.31	1.20	1.51	1.90	2.08
SEM	0.58	0.67	0.61	0.77	0.97	1.06
Confidence Interval	-2.1 to -4.3	-4.1 to -6.7	-9.2 to -11.6	-7.8 to -10.8	-4.9 to 1.1	-0.1 to 24.1

Table 9: Shows mean, SD, SEM and confidence interval of AF-BF linear (in mm) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	6.16	6.30	10.54	11.04	-2.00	-2.33
SD	1.638	0.6435	0.975	0.9555	2.3985	1.5795
SEM	0.84	0.33	0.50	0.49	1.23	0.81
Confidence Interval	4.4 to 7.8	5.6 to 6.9	9.6 to 11.5	10.1 to 12.0	0.04 to -4.4	-0.7 to 3.9

Table 10: Shows mean, SD, SEM and confidence interval of app-bpp linear (in mm) in males and females in skeletal Class I, II and III

	Class I		Class II		Class III	
	Males	Females	Males	Females	Males	Females
MEAN	5.29	6.82	10.83	11.39	-3.21	-3.07
SD	2.1756	0.882	1.0584	0.9016	2.744	2.1952
SEM	1.11	0.45	0.54	0.46	1.40	1.12
Confidence Interval	3.1 to 7.5	5.9 to 7.7	9.7 to 11.9	10.4 to 12.3	-0.5 to -5.9	-0.9 to -5.3

In the present study FABA was found to be least variable indicating that it was the most homogeneously distributed parameter. FABA is more accurate in assessing sagittal jaw relationship when compared with other angular and linear measurements. Next least variable parameter was AXD angle. According to previous study AXD more critically evaluates sagittal jaw relationship eliminating changing variable of Nasion with age (7). MM Bisector was found to be less variable which is in accordance with previous study (7). It is more accurate than other linear measurements as it eliminates the construction of occlusal plane as seen in Wits and eliminates canting of cranial base as seen in AF-BF. On checking the rest of the parameters Beta angle was found to be least variable followed by App-Bpp, AXB, JYD, AF-BF. The most variable was found to be AB plane angle

Table 11: Shows coefficient of cariation in sample

Variables	CV (in %)
FABA	1.36
BETA	3.58
AXD	4.30
MM	-4.56
APP-BPP	4.86
AXB	4.97
JYD	9.79
AF – BF	10.02
ANB	11.05
AB PL	-13.46

and ANB. This related to the previous findings that change in the relative position of nasion (14).

CONCLUSION

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

- Consistency could be demonstrated by all the methods assessed by Antero-Posterior jaw relationship.
- Insignificant difference on influence of growth, age and sex was noted for all the methods used for assessing Antero-Posterior jaw relationship.
- Angular methods used for assessing jaw relationship such as FABA, AXD, Beta and linear measurements such as App-Bpp, MM Bisector could demonstrate superiority for assessing Antero-Posterior jaw relationship over other methods such as AXB, AB plane, ANB and AF-BF which showed more variability.

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