

CORELATION BETWEEN MEASURED & CALCULATED VALUES OF SNM ANGLE & MMA

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ABSTRACT

Introduction: Assessment of vertical jaw relationship is pivotal in orthodontic diagnosis and treatment planning. This study was aimed at finding whether significant difference exist between measured value of \angle SNM & calculated values of \angle SNM (\angle SNMc1 & \angle SNMc2) and measured value of MMA & calculated value of MMA and the difference if any has any impact on overall diagnosis or not. **Materials and Methods:** Lateral Cephalograms of 60 subjects (30 females & 30 males) with mean age 18.43 ± 4.21 were taken and analyzed by measuring \angle SNM, \angle SNP, \angle SNO, MMA, \angle UOcc & \angle LOcc Calculated \angle SNM I.e. \angle SNMc1= \angle SNP+MMA, \angle SNMc2 = \angle SNOcc+ \angle LOcc and calculated MMA= \angle UOcc+ \angle LOcc were then determined. Descriptive statistics for each variable was calculated and co-efficient of correlation (r) was calculated among the variables used. **Results:** 1. Statistically significant and highly correlated relationship was found between the \angle SNM (measured) and \angle SNMc1 & \angle SNMc2, 2. Statistically significant and highly correlated relationship was found between the MMA (measured) and MMAc & 3 Statistically significant and highly correlated relationship was found between the MMA and \angle UOcc & \angle LOcc **Conclusion:** No difference exists between the measured & calculated values of \angle SNM & MMA and thus statistically insignificant difference have no impact on quality of diagnosis.

Keywords: Vertical Skeletal Dysplasia, Mandibular Plane Angle, Maxillo-mandibular Plane Angle

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INTRODUCTION

Assessment of vertical jaw relationship is pivotal in orthodontic treatment planning as macro-aesthetics, extraction vs non-extraction decision, Anchorage requirements & Surgical vs Non-surgical decision all are dependent on the vertical pattern of the patient. Moreover Therapeutic control of the vertical dimension is usually, more difficult than the control of sagittal dimensions¹

Different Cephalometric & non-cephalometric methods have been reported in the literature to assess the vertical pattern of the patient. Though each method has limitations, but statistically & clinically significant co-relations exists between the different parameters used to assess the Vertical growth pattern of the patient.^{2,3} \angle SNM (SN-Mandibular Plane Angle) has been widely used in the literature to assess the vertical pattern of growth cephalometrically. Its normal value is $32^{\circ} \pm 4$. Value greater than the range is indicative of Skeletal Open Bite and value lesser than the range is indicative of Skeletal Deep Bite^{4,5}

\angle SNP is angle between SN Plane & Palatal Plane. Its normal value is $6^{\circ} \pm 4$ while MMA⁸ is an angle between Palatal Plane (Maxillary Plane) & Mandibular Plane. Its normal value is $24^{\circ} \pm 4$. Literature has reported significant correlation between the \angle SNM, \angle SNP & MMA confirming dependence of overall vertical growth pattern on growth pattern of Maxillary plane & Mandibular Plane.³ MMA is intern dependent on Upper Occlusal angle which is an angle between palatal plane & Occlusal plane with normal value of $11^{\circ} \pm 4$ and on Lower Occlusal angle which is an angle between occlusal plane & Mandibular plane with a normal value of $14^{\circ} \pm 4$, thus confirming dependence of Maxillo-mandibular growth pattern on inclination of Occlusal Plane & thus the vertical position of Maxillary & Mandibular Posterior teeth⁶⁻⁹.

\angle SNM is also dependent on Occlusal plane inclination & thus \angle SNM= \angle SNOcc+ \angle LOcc. Normal value of \angle SNOcc is $17^{\circ} \pm 4$ while that of \angle LOcc is

14°±4. Literature has reported significant correlation between the <SNM, <SNOcc & <LOcc confirming dependence of overall vertical growth pattern on inclination of Occlusal Plane & thus the vertical position of Maxillary & Mandibular Posterior teeth. Thus by knowing different above discussed parameters morphology of skeletal dysplasia can be screened and thus aimed for treatment. It is however important to find whether the measured value of <SNM is the same as the calculated value of <SNM i.e. <SNMc1=<SNP+MMA. & <SNMc2= <SNO+<LOcc. and measured value of MMA is same as the calculated value of MMAc=<UOcc+LOcc. This study was thus aimed to find whether significant difference exist on measured value of <SNM & calculated values of <SNM (<SNMc1 & <SNMc2) and the difference if any has any impact on overall diagnosis and to find whether significant difference exist on measured value of MMA & calculated value of MMA and the difference if any has any impact on overall diagnosis

OBJECTIVES

The objectives of this study are to:

1. Find whether the measured value of <SNM is the same as the calculated value of <SNM i.e. <SNMc1=<SNP+MMA.
2. Find whether the measured value of <SNM is the same as the calculated value of <SNM i.e. <SNMc2=<SNO+<LOcc .
3. Find whether the measured value of MMA is the same as the calculated value of MMA i.e. <MMAc=<UOcc+<LOcc.
4. Establish correlation between MMA, <UOcc & <LOcc

HYPOTHESIS

H₀ No difference exist between the measured & calculated values of <SNM & MMA and thus have no diagnostic impact

H₁ Difference exist between the measured & calculated values of <SNM & MMA and thus have a diagnostic impact

MATERIALS AND METHODS

The study was conducted on 60 subjects (30 females, 30 males) with age range of 12-30 years who reported at de`Montmorency College of Dentistry and Faculty of Dentistry, The University of Lahore. Subjects having supernumerary or congenitally missing teeth, already undergoing with orthodontic treatment and Syndromes, were excluded from the study. Sample

was collected using the non-probability convenience sampling technique.

Lateral Cephalogram was taken in natural head position for each subject. Lateral Cephalogram was then traced and analyzed for each patient. SN Plane to Mandibular Plane Angle (<SNM 32°±4), SN Plane to Palatal Plane Angle (<SNP 6°±4), SN Plane to Occlusal Plane Angle (<SNO 17°±4), Angle between Maxillary plane & Mandibular plane (MMA 25°±4), Angle between Palatal plane & Occlusal plane (<UOcc 11°±4) and Angle between Occlusal plane & Mandibular plane (<LOcc11°±4) were measured manually on Cephalogram. <SNM & MMA were also calculated by using the following formulas and correlations established <SNMc1= <SNP+MMA, <SNMc2= <SNOcc + < LOcc and MMA= <UOcc+<LOcc.

STATISTICAL METHOD

SPSS 16.0 was used for statistical evaluation.

1. Mean, Standard Deviation, Variance, Minimum & Maximum value and Range were calculated for each parameter for each subject.
2. Correlation coefficients between <SNM, <SNMc1 & <SNMc2 were calculated using Pearson's correlation.
3. Correlation coefficients between MMA & MMAc was calculated using Pearson's correlation
4. Correlation coefficients between MMA ,<UOcc & <LOcc was calculated using Pearson's correlation

RESULTS

The study was conducted on 60 subjects (30 females & 30 males) with mean age 18.43±4.21. Descriptive Statistics were calculated for each variable for each subject as shown in table 1.

Statistically significant and highly correlated relationship was found between the <SNM (measured) and <SNMc1=<SNP+MMA & <SNMc2 =<SNOcc+<LOcc as shown in table 2.

Statistically significant and highly correlated relationship was found between the MMA (measured) and MMAc= <UOcc+<LOcc as shown in table 3.

Statistically significant and highly correlated relationship was found between the MMA and <UOcc & <LOcc as shown in table 3 thus confirming that change in Palatal plane , Occlusal plane &

Mandibular plane has an impact on Maxillo-mandibular relationship.

Table 1
N=60

Descriptive Statistics				
	Minimum	Maximum	Mean	Std. Deviation
AGE	12.00	30.00	18.4333	4.20801
<SNM	19.00	50.00	33.2917	7.12318
<SNMc1	17.00	49.00	33.1583	7.24656
<SNMc2	18.00	50.00	32.4750	7.13871
MMA	10.00	41.00	24.5417	7.01167
MMAc	10.00	41.00	24.7000	6.96188
<SNP	1.00	17.00	8.6333	3.21525
<SNOcc	4.00	31.00	17.0750	5.72522
<UOcc	.00	22.00	9.1000	4.89448
<LOcc	4.00	31.00	15.6333	5.67769

Table2 Correlation between various <SNM (measured) & <SNMc1 , <SNMc2 (calculated)

Correlations		
	<SNMc1	<SNMc2
<SNM	.990**	.944**
<SNMc1		.952**

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

Table 3 Correlation between various MMA (measured) & MMAc (Calculated), <UOcc & <LOcc

Correlations			
	MMAc	<UOcc	<LOcc
MMA	.976**	.572**	.706**
MMAc		.592**	.717**
<UOcc			-.137

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

DISCUSSION

SN-Mandibular plane angle (<SNM) has been used to assess the Vertical Growth pattern of the patient and is primarily dependent upon change in Maxillary & Mandibular Growth direction. Maxillary growth direction can be assessed in vertical plane by <SNP (angle between SN plane & Maxillary plane) while Mandibular growth direction can be assessed by MMA (angle between Maxillary and Mandibular planes) though other reliable methods to assess growth direction do exist e.g. C-axis^{10,11} & NCFA¹ for

maxillary growth direction and G-axis¹², Gonial angle³, facial & JaraBack ratios³, Facial axis angle³ & Mandibular Arc³ for Mandibular growth directions. This study was aimed to find whether significant difference exist on measured value of <SNM & calculated value of <SNM (SNMc1) and the difference if any has any impact on overall diagnosis. Statistically significant and highly correlated relationship was found between the <SNM (measured) and <SNMc1=<SNP+MMA (r)=0.99 as shown in table 2. Moreover mean value of <SNM (measured) was $33.29^0 \pm 7.12$ while for <SNMc1 was 33.16 ± 7.24 (p-value<0.5) as shown in table 1 thus suggesting that statistically insignificant difference exist between the measured and calculated values and thus have no diagnostic impact.

SN-Mandibular plane angle (<SNM) is also dependent on the vertical position of molars, as e.g. extruded molars change the occlusal plane inclination and thus redirect the Mandibular growth in downward & backward direction and vice versa¹³⁻¹⁵. This study was also aimed to find whether significant difference exist on measured value of <SNM & calculated value of <SNM (SNMc2) and the difference if any has any impact on overall diagnosis. Statistically significant and highly correlated relationship was found between the <SNM (measured) and <SNMc2= <SN)cc+<LOcc (r)=0.945 as shown in table 2. Moreover mean value of <SNM (measured) was $33.29^0 \pm 7.12$ while for <SNMc2 was 32.47 ± 7.14 (p-value<0.5) as shown in table 1 thus suggesting that statistically insignificant difference exist between the measured and calculated values and thus have no diagnostic impact.

Maxillo-mandibular plane angle (MMA) is dependent on the change in inclination of palatal plane, occlusal plane & Mandibular plane and any change in any of the above mentioned attributes will change the overall growth direction in vertical plane. This study was also aimed to find whether significant difference exist on measured value of MMA & calculated value of MMA (MMAc) and the difference if any has any impact on overall diagnosis. Statistically significant and highly correlated relationship was found between the MMA (measured) and MMAc=<UOcc+<LOcc (r)=0.976 as shown in table 3. Moreover mean value of MMA (measured) was $24.54^0 \pm 7.01$ while for MMAc was 24.7 ± 6.96 (p-value<0.5) as shown in table I thus suggesting that statistically insignificant difference exist between the measured and calculated values and thus have no diagnostic impact. Moreover statistically significant correlation occurs between MMA and upper & lower occlusal angles.

The measure values for SNM and MMA are correlated well with the calculated values by the formula and the difference between the measured and calculated values is statistically negligible confirming that this difference has no impact on overall quality of diagnosis.

CONCLUSION

Following conclusions can be drawn from this study:

1. Statistically significant and highly correlated relationship was found between the <SNM (measured) and <SNMc1=<SNP+MMA & <SNMc2 =<SNOcc+<LOcc
2. Statistically significant and highly correlated relationship was found between the MMA (measured) and MMAc= <UOcc+<LOcc
3. Null Hypothesis i.e. No difference exist between the measured & calculated values of <SNM & MMA and thus have no diagnostic impact was found correct
4. Statistically significant and highly correlated relationship was found between the MMA and <UOcc & <LOcc thus confirming that change in Palatal plane , Occlusal plane & Mandibular plane has an impact on Maxilo-mandibular relationship

REFERENCE

1. Gregoret J, Tuber E, Escobar P, da Fonseca AM. Orthodontics and Orthognathic Surgery diagnosis and planning;2003 .p.135-173
2. Asad S, Naeem S. Co-relation between various vertical dysplasia assessment parameters. POJ. 2006 June;1(1):28-33
3. Gregoret J, Tuber E, Escobar P, da Fonseca AM. Orthodontics and Orthognathic Surgery diagnosis and planning;2003 .p.175-198
4. Sarver DM, Proffit WR. Diagnosis: Gathering and Organizing the Appropriate Information. In: Proffit WR,
5. White RP Jr, Sarver DM, editors. Contemporary treatment of dentofacial deformity.4th ed. Elsevier: Mosby; 2008. p. 127-17
6. Bock JJ, Fuhrmann RA. Evaluation of vertical parameters in cephalometry. J Orofac Orthop. 2007 May;68(3):210-22
7. Kharbanda OP, Sidhu SS, Sundrum KR. Vertical proportions of face: a cephalometric study. Int J Orthod. 1991 Fall-Winter;29 (3-4):6-8.
8. Ioi H, Nakata S, Nakasima A, Counts AL. Comparison of cephalometric norms between Japanese and Caucasian adults in antero-posterior & vertical dimensions
9. Steiner CC. The use of cephalometrics as an aid to planning and assessing orthodontic treatment. Am J Orthod 1960;46:721-35.
10. Al-Jasser NM. Cephaometric evaluation for Saudi population using Downs & Steiner analysis. J Contemp Dent Pract. 2005; 15;6(2):52-63
11. Kuitert R, Beckmann S, van Loenen M, Tuinzing B, Zentner A. Dentoalveolar compensation in subjects with vertical skeletal dysplasia. Am J Orthod Dentofacial Orthop. 2006 May;129(5) :649-57
12. Anwar N, Fida M. Compensation for vertical dysplasia and its clinical application. Eu.J.O 2009 Oct 31(5): 516-522
13. Braun S, Diers NR, Engel G,Wojtkiewicz P, Ewing SK. The effect of Frankel II and modified twin block appliances on the 'C'-axis: the growth vector of the dentomaxillary complex. AngleOrthod. 2004 Dec;74(6): 749-53
14. Braun S, Bottrel JA. Pilot study evaluating the effects of a cervical headgear on the C-axis: the growth axis of the dentomaxillary complex.Am J Orthod Dentofacial Orthop. 2004 Dec;126(6):694-8
15. Braun S, Kittleson R, Kim K. The G-Axis: a growth vector for the mandible. Angle Orthod. 2004 Jun; 74 (3):328-31.