

# THE POSITION OF THE INCISORS IN CORRELATION TO ANB ANGLE, PROCUMBENCY AND INCLINATION IN KOREAN NORMAL OCCLUSION

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## 韓國人 正常咬合에 있어서 前齒의 位置와 ANB角, 突出度, 傾斜度와의 相關關係에 관한 頭部 放射線 計測學의 研究

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張 相 憲

.....> 圖文抄錄 <.....

著者は 韓國人 正常咬合에 있어서 上下顎 前齒의 位置가 ANB角과 어떠한 相關關係가 있는지 그리고 前齒의 位置가 突出度와 傾斜度와 相關關係가 있는 지를 調査 研究하기 爲하여 20~24歲 年齡의 男子 54名, 女子 56名 合計 110名의 韓國人 正常咬合의 側貌頭部 X-線寫眞을 使用 分析했다.

이의 統計分析은 Computer 過程을 거쳤으며 다음과 같은 結果를 얻었다.

1. 上下顎 前齒 傾斜는 ANB角과 密接한 相關關係가 있고, 上顎前齒의 位置는 ANB角에 (-) 相關關係 下顎前齒의 位置는 ANB角에 (+) 相關關係가 있으며 이는 Steiner 分析法의 acceptable compromise 에서 보여준 것과 類似한 傾向을 나타냈다.
2. 上顎前齒 傾斜는 上顎突出度와 (-) 相關關係가 있다.
3. 1-NA角은 上顎傾斜度와 相互獨立의이다.
4. 1-NA角은 下顎突出度와 下顎傾斜度와 意義있는 相關關係를 나타냈다.
5. 1-NA거리와 上顎傾斜度와의 相關關係는 女性群에서만 意義있는 것으로 나타났다.
6. 下顎前齒齒軸傾斜는 下顎突出度와 下顎傾斜度와는 男性群에서만 相關關係가 있고 女性群에서는 意義가 없는 것으로 나타났다.

### INTRODUCTION

The greatest value of cephalometrics is in the field of comparative studies; such comparisons divulge and demonstrate changes that have occurred and indicate the responses to the treatment therapy that has been employed.

\* 本 論文의 要旨은 1971年 11月 15日 第4回 大韓齒科矯正學會 學術大會에서 發表 되었음.

Anyone working with cephalometrics soon learns that hundreds of measurements and combinations of measurements can be made from cephalometric films. Many of these have value.

In Steiner's cephalometric analysis, the axial inclination of the maxillary incisors is measured relation to NA line ( $\perp$ -NA in degrees) and that of the lower incisors is measured in relation to the NB line ( $\perp$ -NB in degrees)<sup>9)9)10)</sup>. In addition to these, the position of the incisors is further defined by measuring the distance between the incisal edge and the reference line,  $\perp$ -NA, in millimeters,  $\perp$ -NB, in millimeters. And then, upper incisor long axis angle with one of the four basal planes, Na-Sella line ( $\perp$ -NS in degrees)<sup>13)</sup>.

It has been demonstrated that the lower incisor inclination shows a positive correlation with the sagittal basal discrepancy (ANB angle) and that the values in the acceptable compromise vary accordingly. The degree to which this may be true for the upper incisor inclination and its value is uncertain<sup>9)9)8)</sup>.

According to studies by Hasund and Remmes<sup>4)</sup>, it is also necessary to take into account the degree of prognathism when evaluating the norms in the cephalometric analysis. The lines NA and NB vary with the degree of prognathism.

Hasund and Sivertsen<sup>5)</sup> have shown that a correlation between lower incisor inclination and the degree of prognathism of the mandible must be related to the close connection which exists between degree of prognathism and mandibular inclination.

Hasund and Ulstein<sup>11)</sup> demonstrated that there was no significant connection between the upper incisor inclination and prognathism nor with inclination.

Bearing these findings in mind, we must consider whether the correlation between incisor axial inclination and basal sagittal discrepancy, prognathism, inclination should be evaluated before the norm is transferred from the model to the individual case.

The aims of this study were as follows;

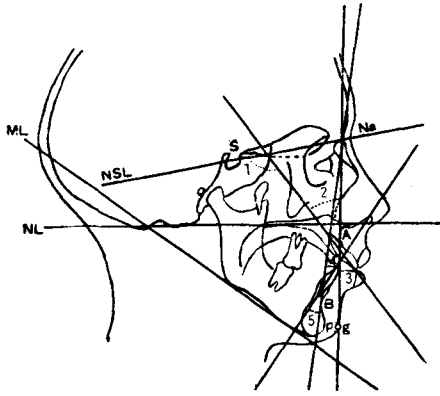
1. To investigate whether both the upper and lower incisor positions are correlated to the sagittal basal discrepancy in Korean normal occlusion.
2. To investigate whether the axial inclination of the incisors are correlated to the prognathism and inclination in Korean normal occlusion.

## MATERIAL AND METHOD

The material used in this study was profile roentgenocephalometric films, taken by Infirmary, College of Dentistry, Seoul National University. The material consists of 110 Korean adults (54 men and 56 women). The age of men and women ranged from 20 to 24 years. The material consists of person with generally normal occlusion, but was not represented with ideal occlusion only.

This investigation was made on cephalometric radiograms.

The following chief measurements were made;



**Fig. 1 :**Reference points and lines used in this study. 1 is the angle  $\bar{1}$ -NSL, 2 is the angle  $\bar{1}$ -NA, 3 is the distance  $\bar{1}$ -NA, 4 is the distance  $\bar{1}$ -NB, 5 is the angle  $\bar{1}$ -NB.

- $\bar{1}$ -NSL(degrees) : The angle between the long axis of the upper incisors and the NS line.
- $\bar{1}$ -NA(degrees) : The angle between the long axis of the upper incisors and the NA line.
- $\bar{1}$ -NA (mm) : The distance from the incisal edge of the upper central incisor to the NA line.
- $\bar{1}$ -NB(degrees) : The angle between the long axis of the lower incisors and the NB line.
- $\bar{1}$ -NB (mm) : The distance from the incisal edge of the lower central incisor to the NB line.

### Statistical Procedures;

The author employed the coefficients of correlation between the incisor axial inclination and variables expressing sagittal basal discrepancy, prognathism and inclination.

The data were punched and usual statistical parameters calculated by IBM 360, Model 40 in Economic Planning Board Computer Center.

The significance test on the coefficients of correlation based on 5% level of significance.

## RESULTS

**Table 1.** The linear correlation between angle  $\bar{1}$ -NSL and  $\bar{1}$ -NA(angle) and variables expressing prognathism, basal discrepancy and mandibular and maxillary inclination.

Variable	$\bar{1}$ -NSL(angle)		$\bar{1}$ -NA(angle)	
	Male	Female	Male	Female
SNA	0.22	0.63	-0.22	-0.98
SNB	0.36	0.68	-0.35	0.98
SN-Pog	0.22	0.59	-0.79	0.13
ANB	-0.30	-0.47	-0.39	-0.41
NL-NSL	-0.70	-0.43	0.17	-0.15
ML-NSL	-0.15	-0.33	0.56	-0.28

For male, n=54 (p=0.05 for r=0.27)

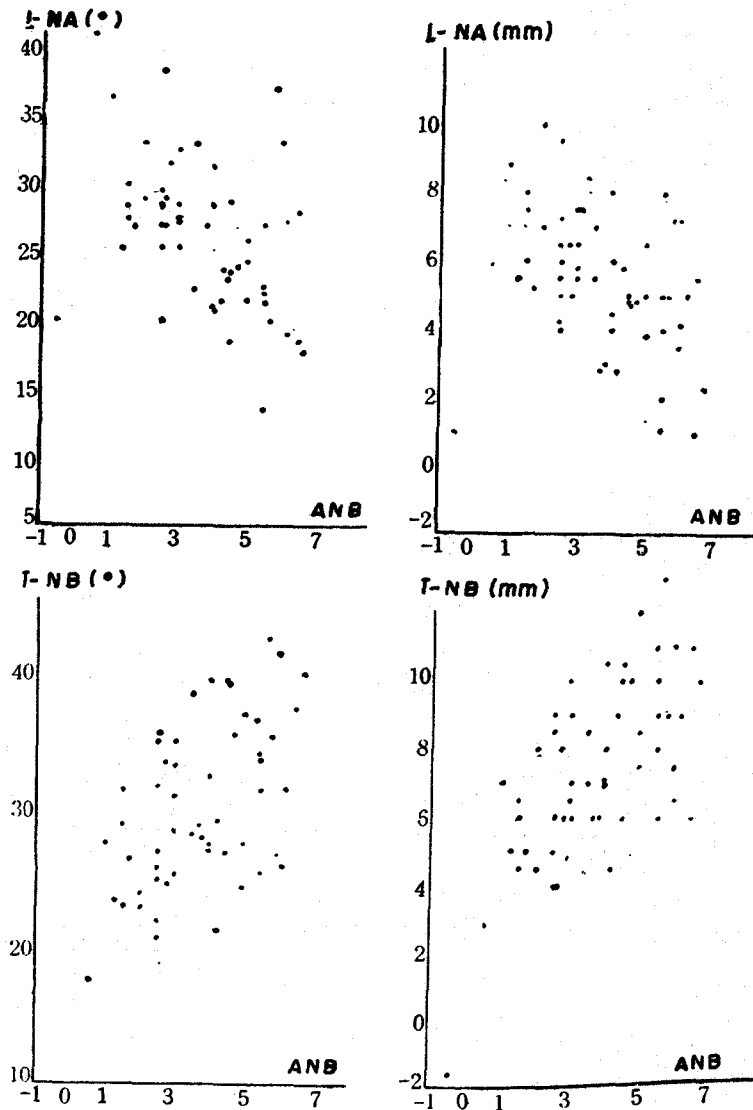
For female, n=56 (p=0.05 for r=0.26)

**Table I.** The linear correlation between distance I-NA(mm) and variables expressing maxillary prognathism, angle ANB, maxillary inclination.

Variable	I-NA	
	Male	Female
ANB	-0.45	-0.34
ML-NSL	0.19	-0.60
SNA	-0.32	-0.67

For male, n=54 (p=0.05 for r=0.27)

For female, n=56 (p=0.05 for r=0.26)



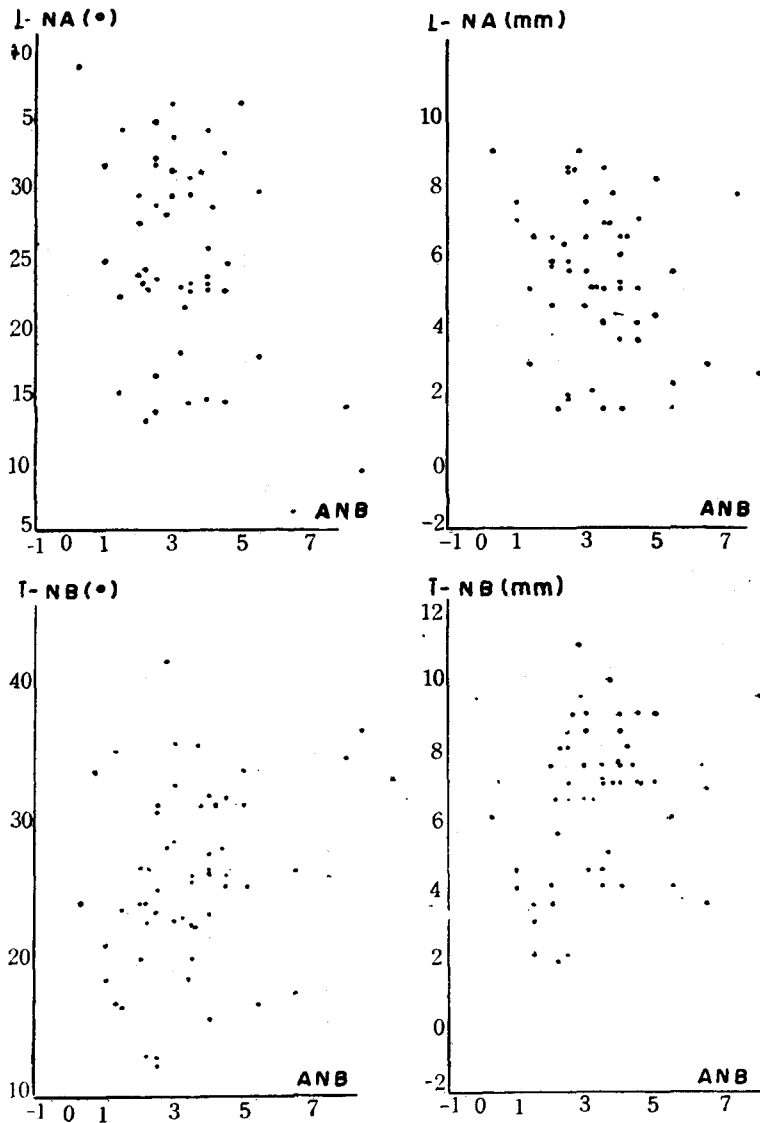
**Fig. I** Incisal inclination in relation to angle ANB in male.

**Table II.** The linear correlation between angle I-NB and variables expressing mandibular prognathism, mandibular inclination, and sagittal basal discrepancy.

Variable	I-NB	
	Male	Female
SNB	-0.35	0.10
ML-NSL	0.37	0.12
ANB	0.35	0.56

For male, n=54 (p=0.05 for r=0.27)

For female, n=56 (p=0.05 for r=0.26)



**Fig. II** Incisal inclination in relation to angle ANB in female.

**Table V.** The linear correlation between distance I-NB(mm) and variables expressing mandibular prognathism, angle ANB, and mandibular inclination.

Variable	I -NB	
	Male	Female
ANB	0.42	0.65
ML-NSL	0.42	0.21
SNB	-0.32	0.11

For male, n=54 (p=0.05 for r=0.27)

For female, n=56 (p=0.05 for r=0.26)

## DISCUSSION

### I. The upper incisor inclination related to the nasion-sella line ( $\underline{1}$ -NSL)

The linear correlation between the upper incisor axial angle( $\underline{1}$ -NSL) and the other variables are shown in Table I.

The correlation analysis showed a poor relationship between the upper incisor inclination, angle SNA, SNPg and ML-NSL in male, and indicating more protrusive incisors with an increasing degree of prognathism. This relationship was also demonstrated by a negative correlation between the variables ML-MSL and  $\underline{1}$ -NSL and, by a strongly marked correlation between the upper incisor axial angle and the degree of mandibular prognathism. This findings correspond with the results of an investigation of Hasund<sup>3)</sup>.

The correlation analysis also demonstrated the connection between angle ANB and the axial inclination of the upper incisors, indicating a tendency to more retruded upper incisors in relation to NSL. The axial inclination showed a distinct negative correlation with the basal sagittal discrepancy.

The distribution of the large ANB angles in the normal occlusion may therefore influence. The covariation between axial angle, mandibular prognathism, and maxillary inclination. Related to SNA, the incisors tended to become more protruded with increasing degree of prognathism, but this tendency was not statistically significant especially in male.

In female there were significant values for maxillary prognathism (SNA) as well as for mandibular inclination(ML-NSL). However, this trend was non-significant in the male group.

Sagittal basal discrepancy, mandibular prognathism, and maxillary inclination showed a correlation with the axial inclination of the upper incisors.

### II. The upper incisor inclination in relation to NA in degree( $\underline{1}$ -NA)

Angle  $\underline{1}$ -NA showed a tendency to less correlation with the degree of maxillary inclination than did  $\underline{1}$ -NSL.

Angle  $\underline{1}$ -NA in relation to mandibular inclination gave significant values than  $\underline{1}$ -NSL.

Table I shows a positive linear correlation between SNA and  $\underline{1}$ -NSL and a negative

correlation between SNA and  $\underline{1}$ -NA. Angle ANB showed a strong influence also on angle  $\underline{1}$ -NA. This was in agreement with the acceptable compromises in Steiner's analysis<sup>8)</sup>, where small ANB angles are accompanied by large  $\underline{1}$ -NA angles. This co-variation is so pronounced that the connection between  $\underline{1}$ -NA and the other variables must be considered in relation to angle ANB. Hasund and Ulstein<sup>11)</sup> have shown that angle  $\underline{1}$ -NA is independent of prognathism as well as of inclination, but the author showed that angle  $\underline{1}$ -NA was independent of maxillary inclination only.

### **III. Distance $\underline{1}$ -NA (mm) in relation to degree of prognathism, inclination and ANB angle**

The distance  $\underline{1}$ -NA (mm) showed a significant correlation with the angle ANB. This was consistent with the upper incisor axial inclination in relation to NA and NSL.

Small basal sagittal discrepancies from the incisal edge to the NA line than were larger ANB angles. This is in agreement with the acceptable compromises and is taken into account in Steiner's analysis<sup>8)</sup>.

There was significant correlation between the distance  $\underline{1}$ -NA mm., and maxillary prognathism and maxillary inclination except maxillary inclination in male group. Hasund and Ulstein<sup>11)</sup> showed that there was no significant connection between the distance  $\underline{1}$ -NA (mm) and prognathism nor with inclination in this material.

### **IV. The angle between the lower incisor long axis and NB line ( $\bar{1}$ -NB)**

The  $\bar{1}$ -NB angle showed the strongest positive correlation with the ANB angle.

The analysis of linear correlation showed no connection between  $\bar{1}$ -NB on mandibular prognathism in female.

In mandibular inclination,  $\bar{1}$ -NB angle showed the positive correlation with the ML-NSL in male only, with a tendency toward a large angle with an increasing inclination.

### **V. The distance from the incisal edge to the NB line ( $\bar{1}$ -NB) in millimeters**

Generally, the same tendency which became apparent for the angle in  $\bar{1}$ -NB was also found for the linear distance from the incisal edge to the NB line.

The correlation showed the degree of mandibular inclination to be more closely correlated with this dimension than with the mandibular incisor axial angle.

## **CONCLUSION**

1. Both the upper and lower incisor positions are closely correlated to angle ANB. The upper incisor positions are negative correlated, the lower incisor positions are positive correlated to angle ANB. This covariation has a tendency similar to that shown in the acceptable compromise in Steiner's analysis.
2. The upper incisor inclinations show a negative correlation with maxillary prognathism.
3. Angle  $\underline{1}$ -NA is independent of maxillary inclination.
4. Angle  $\underline{1}$ -NA shows a significant correlation with mandibular prognathism and mandibular inclination.

5. Distance  $\perp$ -NA are correlated with maxillary inclination in female only.
6. Lower incisor inclinations show a correlation with mandibular prognathism and mandibular inclination in male group, but there is no significant correlation in female.

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REFERENCES

- 1) Austin, Bradford, Hill: Principles of Medical Statistic, p. 180-200, 8th edition, 1966, Oxford University Press.
- 2) Huldah, Bancroft: Introduction to Biostatistics, p. 149-171, 1957, A Hoeber-Harper International Edition.
- 3) Hasund, A.: Position of the mandibular incisors in relation to orthodontic treatment, Tr. European Orthodont. Soc., p. 199-212, 1967.
- 4) Hasund, A., and Remme, T.: Prognathism and facial harmony related to the degree of spacing/crowding of the dental arches in Norwegian children between 3 and 7 years, Norkse tannlaegeforen. tid. 77: 319-338, 1967.
- 5) Hasund, A., and Sivertsen, R.: An evaluation of the diagnostic triangle in relation to the facial type, the inclination of the facial planes and the degree of facial prognathism, Norske tannlaegeforen. tid. 78:551-570, 1968.
- 6) Snedecor, G.W.: Statistical methods, Ames, Iowa 1961. The Iowa State College Press.
- 7) Solow, B.: The pattern of cranio-facial associations. Acta odont. scandinav., Supp. 46, 1966.
- 8) Steiner, C.C.: The use of cephalometrics as an aid to planning and assessing orthodontic treatment, Am. J. Orthodont. 46: 721-735, 1960.
- 9) Steiner, C.: Cephalometrics for You and Me, Am. J. Orthodont., 39: 729-755, 1953.
- 10) Steiner, C.: Cephalometrics in Clinical Practice, Angle Orthodont., 29:829, 1959.
- 11) Hasund and Ulstein: The position of the incisors in relation to the lines NA and NB indifferent facial types, Am. J. Orthodont. 57: 1-14, 1970.
- 12) Salzmann, J. A.: Practice of orthodontics (pp.527-535), Lippincott, Philadelphia, 1966.
- 13) Graber: Orthodontics principles and practice, 443-445, 2nd edition.
- 14) Joel, M. Servoss.: Deviation of acceptable arrangements in the Steiner analysis, The Angle Orthodont., 41: 146-149, 1971.