The position of mandibular incisors in a sample of Iraqi adults with Class I malocclusion

Samher Ali Al-Shaham B.D.S., M.Sc. [1]

ABSTRACT

Background: The attempt to make good diagnosis enforce the orthodontists to examine the relationship of the mandibular incisors position in patients with malocclusion to provide the practitioners with more diagnostic norms and correlation equation. This study aimed to determine the position of the mandibular incisors in a sample of adults (aged 18-25 years) with Class I malocclusion, to determine the existence of gender differences in mandibular incisors position, and to determine the correlation between the mandibular incisors position with some measurements.

Materials and method: Lateral cephalometric radiographs were taken for 60 adults subjects (30 males and 30 females). The cephalometric radiographs were traced and verified using AutoCAD 2008 program.

Results and Conclusions: The results show non-significant gender difference in the position of the mandibular incisors, and very high significant direct correlation between GoGn-NB angle and the $\bar{1}$-NB. The GoGn-NB angle can be classified as most important of the guiding angular variables in determining the lower incisors position ($\bar{1}$ -NB).

Keywords: Mandibular incisors position, Class I malocclusion. (J Bagh Coll Dentistry 2010;22(4):107-110).

INTRODUCTION

Achieving good facial esthetics and balance is important in orthodontic treatment [1]. The mandibular incisors are believed to play a dominant role in the development of well-balanced face. Hence, the location of the mandibular incisors with respect to the remaining craniofacial complex gives us much of the diagnostic information upon which we build treatment plans [2].

Unfortunately, no exact amount of retention will make an inherently unstable tooth position become stable [3]. The position of the mandibular incisors is generally acknowledged to be the key to successful orthodontic treatment and has been the focus of attention for many years in diagnosis and treatment planning [4]. The main purpose of orthodontics can usually be defined as the creation of the best balance between occlusal and dental relationships with facial aesthetics. Stability of the result as well as the long-term maintenance of the dentition is also critical [5]. The lower incisors have a central role to all these goals, therefore, used as a basis for discussion of dento-basal and dento-alveolar objectives [6]. Much attention has been focused on anteroposterior position of the lower incisors, from the point of view of its effects on the profile of the lower face, and the stability of treatment result.

These considerations determine the desired incisor position from which extraction, anchorage requirements are evaluated, and the remaining tooth movements planned [7]. Several linear and angular measurements have been introduced as basis for their positioning [7-9].

However, in previous studies [8-10], the range of normality of various parameters were somewhat wide enough that did not permit the clinician to utilize these values to make precise diagnosis could be achieved. It is accepted that the lower incisors lie in a zone of balance between the tongue and the lips. During orthodontic treatment in a majority of patients, the significant changes in the position of the lower incisors are followed by relapse. In spite of that, there are exceptions to the above rule [11].

Steiner [8, 12] considered the ANB angle as a guiding variable to describe the incisor position and in this way brought into practice floating norms for incisors. Later, Tweed believes that the diagnostic triangle concept was most important contribution to clinical orthodontics [12], and the strong guiding value of this angle has also been demonstrated in other investigations [13,14]. Further, Steiner introduced the configuration of the bony chin, expressed by Holdaway's ratio, into his analysis and the chin was characterized by the distance from Pogonion to the NB line (Pg-NB) [14,15]. As additional guiding variable, Norderval [16] had introduced the N angle, which proved to describe the bony chin configuration more accurately. This study aimed to determine the position of the mandibular incisors in a sample of adults with Class I malocclusion, to determine the existence of gender differences in

(1) Assistant lecturer / Department of Orthodontics, College of Dentistry, University of Baghdad

mandibular incisors position, and to determine the correlation between the mandibular incisors position with some measurements.

MATERIALS AND METHODS

Sample

The sample consisted of 60 adults (30 females and 30 males) aged 18-25 years old, selected from the patients attending the Orthodontic department at the College of Dentistry, University of Baghdad.

The sample was selected according to the following criteria:-

1. All the patients were clinically classified as Angle's Class I with mild crowding of less than (2) mm.
2. All having full complement of permanent teeth regardless the third molars.
3. No previous history of orthodontic treatment and /or orthognathic surgery.
4. No obvious loss of tooth material as a result of caries, fracture, inter-proximal wear and congenital defects.
5. Normal transverse relationships and optimal inter-cuspidation.
6. A harmonious soft tissue profile was evident with the lips are in slight contact at rest.

Method

All of the individuals were subjected to clinical examination and lateral cephalometric radiographs using Planmeca machine, with the patient in rest position (minimal lip activity) and the radiographs were taken with Frankfort plane horizontal and the teeth held tightly together in centric occlusion.

Cephalometric analysis

The lateral cephalometric radiographs were traced and verified using AutoCAD program 2008 on the computer.

Cephalometric Landmarks, Planes, and Measurements

Cephalometric Landmarks [17]

1. **Point Nasion (N):** The most anterior point of nasofrontal suture in the median plane.
2. **Point subspinale (A):** The deepest midline point in the curved bony outline from the base to the alveolar process of the maxilla.
3. **Point superamentale (B):** It is the most posterior point in the outer contour of the mandibular alveolar process, in the median plane.
4. **Point anterior nasal spine (ANS):** it is the tip of the bony anterior nasal spine, in the median plane.
5. **Point posterior nasal spine (PNS)**. This is a constructed radiological point, the intersection of a continuation of the anterior wall of the pterygo-palatine fossa and the floor of the nose. It marks the dorsal limit of the maxilla.
6. **Point Gonion (Go):** A constructed point, the intersection of the lines tangent to the posterior margin of the ascending ramus and the mandibular base.
7. **Point Gnathion (Gn):** it is the most anterior and the most inferior point of the bony chin.
8. **Point Ii (Incisor inferius):** The tip of the crown of the most anterior mandibular central incisor.

Cephalometric Planes [17]

1. **N-A plane:** Formed by a line joining points A and N
2. **N-B plane:** Formed by a line joining points B and N
3. **Palatal plane:** Formed by a line joining points ANS and PNS.
4. **Mandibular plane:** Formed by a line joining points Go and Gn

Cephalometric measurements

A. ***Angular measurements*****:** [14,17,18]

1) **Maxillary-mandibular plane (MM) angle:** The angle of inclination of the mandible, it is formed between the mandibular and palatal planes.
2) **Mandibular plane-N-B (GoGn-N-B) angle:** The angle formed between the mandibular plane and NB line.
3) **ANB angle:** The angle formed N-A and N-B lines and defined the mutual relationship, in sagittal plane, of the maxillary & mandibular bases.

B. ***Linear measurements*****:** [15,18,19]

The $\bar{1}$ - NB was used which represents the horizontal distance between the lower incisors and the N-B line.

Statistical analysis

The data were subjected to computerized statistical analysis by mean of SPSS software program version 17.0 to get descriptive analysis (mean, standard deviation, minimum, and maximum), and to compare measurements between the males and females using independent samples t-test. Pearson's correlation coefficient was used to show the correlation between the position of the mandibular incisors with the other variables. Furthermore, the multiple linear regression models was applied on Steiner's equation to investigate the relation between one or more of the angular variables (ANB, MM, GoGn-NB) and linear variable ($\bar{1}$ - BN). In the statistical evaluation, the following levels of significance are used:

Non-significant NS $P > 0.05$

Significant	*	$0.05 \geq P > 0.01$
Highly significant	**	$0.01 \geq P > 0.001$
Very highly significant	***	$P \leq 0.001$

RESULTS AND DISCUSSION

Descriptive statistics and gender difference for all the cephalometric measurements are shown in table 1.

The MM angle showed a great variation ranging from 12 to 37 degrees, with a mean value of 23.47 degrees for the total sample. The mean value of this angle is higher in females in comparison with males with a non significant gender difference.

The GoGn-NB angle demonstrated a well marked bony chin with a mean value of 59.85 degrees for the total sample, and revealed a wide range from 44 to 78 degrees. The mean value of this angle is higher in males with a non significant gender difference.

The ANB angle exhibited a mean value of 3.25 degrees for total sample; however, it varied from one to four degrees in both genders, and showed non-significant gender difference.

The lower incisors edges were on the average positioned 5.18 mm in front of the NB line [$\bar{1}$ - NB] in the total sample, as shown in table 1. The mean value in both sexes is nearly similar with a non-significant gender difference. This is in agreement with other study [14], while Ricketts's observed approximately the same range using A-Pg line as a reference line [19].

All the three prospective angular guiding variables of the present study corresponded well with results observed in other studies [14,16]. The application of the three guiding angular variables in relation to the linear variable ($\bar{1}$ -NB) can be demonstrated in a multiple regression equation.

$\hat{Y}_{(\bar{1}\text{-NB})} = \alpha + b$ (mm angle) $+b$ (GoGn-NB angle) $+ b$ (ANB angle)$+\ldots$.

$\hat{Y}_{(\bar{1}\text{-NB})} = -2.268 + 7.957$ E-02 (mm angle) $+$ 8.357E-02 (GoGn-NB angle) $+$ 0.183 (ANB angle).

T = -1.326	2.486	3.757	0.817
p = 0.190	0.016	0.00	0.418
f = 6.557	p= 0.001		R^2= 0.260

The multiple correlation coefficient R square was equal to 0.260, and p-value was equal to 0.001 as shown above explained a highly significant correlation between the three guiding variables and $\bar{1}$ - NB line, when this equation is applied in the treatment planning, the anticipated values for the three guiding angular variables (MM, GoGn-NB and ANB angles), as they appear at the end of treatment, and hence to be used as a bases for the calculation. The guidance; therefore, is depend upon the ability to formulate a good growth prognosis.

Consequently, in table 2, the Pearson's correlation coefficient was very highly significant between the $\bar{1}$-NB line and the GoGn-NB angle for total sample, hence from this result, we conclude that the GoGn-NB angle can be classified as most important of the prospective angular guiding variables in the present study in determining $\bar{1}$-NB position.

The basal configuration demonstrated the most influential effect on lower incisors position. The same variety of basal configuration can also be demonstrated in individuals with malocclusion [9]. The fact behind that is nature, which enables to achieve an ideal occlusion even in cases exhibiting a basal configuration quite different from what is expected to be ideal, and it seem as if nature in these cases is using the variation in incisors position to compensate for different basal, sagittal, and vertical relationships. The basal parts of the face may also be influenced by orthodontic means; however, a total normalization can only be expected in a minority of people. Consequently, a wide range in lower incisors position must be expected in treated people when the mentioned equation is used to individualize the position of lower incisors, it therefore should be utilized with caution. The general and individual character of the malocclusion treatment must always be considered, in addition to the guiding angular variables. On other hand, the use of the equation seems to be more reliable than trying to individualize the standard Steiner's analysis. The present study was conducted on a sample of adults only; it would be of interest to test the mode using a group of younger persons to further examine its validity.

REFERENCES

1) Kambara T, et al. J Osaka Dent Univ 2006; 40(2):153-8.
2) Metzdorf DW. A cephalometric study of cranial, mandibular, and lower incisor morphology in the adult face. Angle Orthod 1977; 47: 288-92.
3) Mitchell L. An introduction of orthodontics 2007; 109.
4) Hong KI young. Cephalometric investigation of mandibular incisors inclination and apex position in untreated dentitions; Sydney 1992.
5) Proffit WR, Fields HW. Contemporary orthodontics. 3rd edition. St. Louis: Mosby; 2000.
6) Hasund A, Janson, I. The jaw-orthopedic treatment. Carl Hanser Verlag, Munchen-Wien; 1978.

7) Ricketts RM. A foundation for cephalometric communication. Am J Orthod 1960; 46: 330-57.
8) Steiner CC. Cephalometrics for you and me. Am J Orthod 1953: 39:729-55.
9) Hasund A, Ulstein C. The position of the incisors in relation to the lines NA and NB in different facial types. Am J Orthod 1970; 57: 1-14.
10) Steiner CC. Cephalometrics in clinical practice. Angle Orthod 1959; 29: 8-29.
11) Bukhary M. T. Reliability and accuracy of the lower incisor mandibular plane angle. Saudi Dent J 2001; 13:143-7.
12) Tweed CH. Frankfort-mandibular incisor angle (FMIA) in orthodontic diagnosis, treatment planning and prognosis. Angle Orthod 1954; 24: 121-69.
13) Ricketts RM, Bench RW, Gugino CF, Hilgers JJ, Schulhof RJ. Bioprogressive Therapy. Rocky Mountain/ Orthodontics; 1979
14) Hasund A, Böe OE. Floating norms as guidance for the position of the lower incisors. Angle Orthod 1980; 50: 165-8.
15) Garcia CJ. Cephalometric evaluation of Mexican Americans using the Downs and Steiner analyses. Am J Orthod 1975; 68: 67-74.
16) Nordeval K, Wisth PJ, Boe OE. Mandibular anterior crowding in relation to tooth size and craniofacial morphology. Scand J Dental Res 1975; 83: 267-73.
17) Rakosi T. An atlas and manual of cephalometric radiography. 2nd ed. London: Wolfe medical publications Ltd.; 1982.
18) Jacobson A. Radiographic cephalometry from basics to videoimaging. 1st ed. Chicago: Quintessence publishing Co.; 1995.
19) Ricketts RM. A foundation for cephalometric communication. Am J Orthod 1960; 46: 330-57.

Table 1: Descriptive statistics and gender differences

Variables	Descriptive statistics												Genders difference (d.f.=58)	
	Total (N=60)				Males (N=30)				Females (N=30)					
	Mean	S.D	Min	Max	Mean	S.D	Min	Max	Mean	S.D	Min	Max	t-test	*p-value*
MM°	23.47	5.65	12	37	22.83	5.57	12	33	24	5.62	12	37	-0.8	0.41 (NS)
GoGn-NB°	59.85	8.2	32	78	60.33	7.73	32	77	59.26	8.55	44	78	0.5	0.61 (NS)
ANB°	3.25	0.84	1	4	3.33	0.75	1	4	3.06	0.83	1	4	1.3	0.20 (NS)
$\bar{1}$- NB (mm)	5.18	1.15	2.16	8.27	5.2	1.19	2.44	8.27	5.15	1.11	2.16	7.86	0.13	0.90 (NS)

Table 2: Correlations between mandibular incisors position with other variables

Variables		MM°	GoGn-NB°	ANB°
$\bar{1}$- NB (mm)	r	0.225	0.414	0.137
	p	0.085 (NS)	0.001 ***	0.295 (NS)
ANB°	r	-0.06	0.137	
	p	0.64 (NS)	0.296 (NS)	
GoGn-NB°	r	-0.13		
	p	0.313 (NS)		

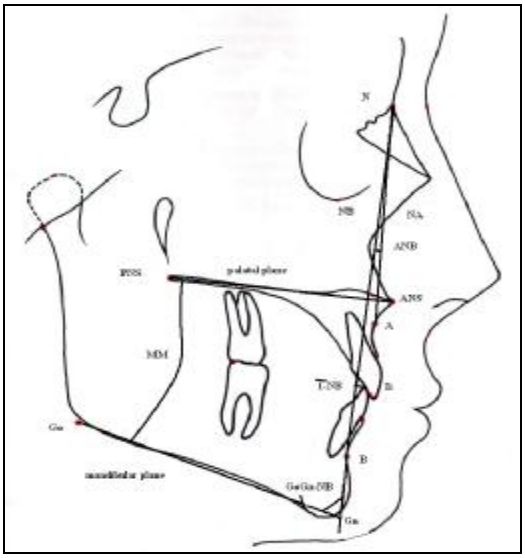

Figure 1: Cephalometric points, planes, and measurements