



THE RELATIONSHIP BETWEEN THE LOWER INCISORS CROWDING AND THE SAGITTAL POSITION OF THE CHIN IN ADOLESCENTS IN THE SYRIAN COAST

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ABSTRACT

Aim the purpose of this study was to investigate the relationship between the lower incisors crowding and the sagittal position of the chin in adolescents in the Syrian coast. Materials and methods sample's study contained mandibular dental study casts, and lateral cephalometric graphs of a pretreatment patients who were undergoing orthodontic evaluation at the Department of Orthodontics and Dentofacial Orthopedics at Tishreen University (18 males and 63 females of Syrian coast origin with mean age of 17.7 years). Patient's lower cast and Lateral cephalogram were scanned, digitized, analyzed. Little's Irregularity Index, S-Na-Pog and S-Na-B angles were obtained. Levene's Test for Equality of Variances, t-test and Pearson's Correlation Coefficient were calculated. Results A statistical significance, negative correlation was found between values of Little I irregularity index and both of S-Na-Pog and S-Na-B angles values within all sample's subjects (except of Severe Irregularity Group subjects). Conclusions sagittal lower incisors crowding amongst adolescents in the Syrian coast population have a correlation with the sagittal position of the chin.

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INTRODUCTION

It is recognized that the human dentition is in a dynamic state, continually changing throughout life. Particularly noticeable in this respect is the change in alignment of the lower arch which may be crowded in the early mixed dentition, less so in the years between 8 and 12, and become more crowded after eruption of the second permanent molars (Little *et al*, 1990; Little *et al*, 1990).

Although no direct relationship has been found between changes in soft tissue forces and increased lower arch crowding, it is likely that such changes may adversely affect arrangement of the teeth. Late mandibular growth changes may bring the lower incisors into a different soft tissue environment (Fränkel and Löffler, 1990; Woodside *et al*, 1991; Woodside *et al*, 1991; Siatkowski, 1974). Subtelny and Sakuda claimed that as the mandible increases in size, the lips exert greater pressure than the tongue, creating a lingually directed force that, counteracted by mesial forces, causes incisor crowding (Subtelny and Sakuda, 1966). Sakuda claimed that late lower arch crowding was caused by a specific pattern of growth and a type of skeletal pattern that is susceptible to crowding at the beginning of adolescence (Sakuda *et al*, 1976). However, the growth of the chin can act individual apart from the general process of the dentoalveolar compensation; the area of the chin receives thick deposits of periosteal bone,

although much variation exists in the growth pattern of this particular region. The alveolar area just above the mental protuberance, however, is usually resorptive, and a degree of recession in a posterior direction occurs in this region. This could lead to labiolingual inclination of lower incisor, and well ahead to their crowding, the significance of chin remodeling circumstance is not fully understood yet. Enlow later speculated that the resorptive nature of the mandibular incisor region might represent an adjustment to the growth process and function to stabilize the occlusion (Enlow and Harris, 1964; Enlow, 1966; Sarnat, 1986).

As the increase in growth at the chin point is negligible, a change in the alveolar profile angle during development will supply an expression of the shifting of the dentition in a retrognathous or prognathous direction in relation to the mandibular base (Björk, 1955; Björk, 1956). Nevertheless, circumpubertal changes in anteroposterior chin position follow a simple linear pattern, showing no evidence of an adolescent growth spurt (Milliner, 2011).

The purpose of current study is to investigate the relationship between the lower incisors crowding and the sagittal position of the chin in adolescents in the Syrian coast. The obtained evidence from current study may be used to evaluate the role of morphology in causes, and orthodontic treatment planning of lower incisors crowding amongst adolescents to assess the

state of dental health for planning future dental care programs in the Syrian coast society.

MATERIAL AND METHODS

Sample's Subjects

The sample's subjects were selected from pretreatment patients undergoing orthodontic evaluation at the Department of Orthodontics and Dentofacial Orthopedics at Al Andalus university. Subjects meet the following conditions:

- No story of teeth losing and / or caries during temporary or mixed occlusion.
- Each patient must have full permanent teeth (up till the second permanent molar.)
- No permanent teeth missing nor excessive nor confined.
- No dental restoration however it was allowed a small fillings and / or medium-sized not accompanied by any lost material in the restored tooth crowns.
- No history of dento-facial structures traumas.
- No history of abnormal habits
- Subjects could exhibit varying degrees of skeletal and/or dentoalveolar malocclusions
- Exclusion criteria were subjects with lower incisors spacing, congenital anomalies/ syndromes and marked asymmetric
- No previous orthodontic treatment.
- All patient were examined by the same otolaryngologist to exclude subjects with upper respiratory tract infections, mouth breathing, and snoring.
- All the patients were of Syrian coast origin.

this study sample contained mandibular dental study casts, and lateral cephalometric graphs of 81 Caucasian patients of Syrian coast origin (18 males and 63 females) from 15 to 18 years of age (mean age of 17.7 years)

The average age of the females was 15.3 years; the average age of the males was 16.2 years. Lower alginate impressions with maximum displacement of soft tissues, created by maximum extension of the impression were taken and poured with dental stone to prepare the study model.

Furthermore, lateral cephalometric radiographs were obtained in centric occlusion with the head in the natural head position and lips in the rest position. Each patient's lower cast and Lateral cephalogram has been scanned into JPEG digital format at 300 dpi and an 8-bit greyscale using scanner with 1600 dpi imaging 40 800 pixels per line and 48-bit color depth, and displayed on 15-inch LCD screen Notebook with resolution of 1366 X 768, high-pixel resolution with pixel pitch of 0.297 mm, a contrast ratio of 450:1, and a brightness of 250 cd/m², with 32-bit color.

Digital tracing of the lateral cephalogram and patient's lower casts were digitized using Dolphin Imaging Software Version 11 (Dolphin Imaging). The same author performed all digital measurements. Linear measurements accurate to the nearest 0.01 mm. whereas angular measurements were accurate to the nearest 0.01 degrees.

Lower incisors crowding analysis

Little irregularity index was digitally calculated, sizes were to the nearest 0.01 mm as was advised by Little (Little,1975).

Patients were classified into five groups according to degree of the lower incisors crowding, according to Little index (Tab.1).Little's Irregularity Index technique takes in measuring the linear distance (in millimeters) from anatomic contact point to adjacent anatomic contact point of mandibular anterior teeth, the sum of the five measurements represent the irregularity index.

Table 1 Sample's subjects grouping according to the Degree of Crowding of Little index

Degree of Crowding	Little's Index
0 mm	Perfect alignment
1-3 mm	Minimal irregularity
4-6 mm	Moderate irregularity
7-9 mm	Severe irregularity
10 mm	Very severe irregularity

Lateral cephalometric analysis

Pog point were used to estimate the sagittal position of the chin (Milliner,2011); for this purpose, the S-Na-Pog angle was utilized on the digital tracing of the lateral cephalogram,The S-Na-Pog angle was formed with the vertex at point (N) and two sides respectively extending to (S)-point as well as (Pog)-point. Since Mandible tend to grow forward and downward (Björk,1956), hence, bony chin development during adolescence occur, in part, from deferential jaw growth and compensatory dentoalveolar movement. The chin could become more developed because the lower incisor and point (B) moved relatively lingually with growth.(Marshall et al, 2011), where periosteal remodeling compensation can take place (Björk,1955;Björk,1956).Consequently, (B) point was used in this research to evaluate the sagittal position of the Mandible to find out if it effects on the chin's sagittal position in regards of the relationship with lower incisors crowding. For this purpose, the S-Na-Pog angle was calculated. Angular cephalometric measurements were accurate to the nearest 0.01 degrees.

Error of method

All measurements (cephalograms and lower casts)were repeated digitally twice with a three month interval, by the same calibrated examiner, the initial and the repeated measurements were compared by using a paired t-test (at = 0.05) to check any systematic error. No statistical significance. difference were found between the initial and the repeated measurements.

Statistical method

The relationship between gender and the degree of the crowding severity was analyzed using Levene's Test for Equality of Variances, and t-test for Equality of Means, using SPSS statistics program (version19)

Using Microsoft Excel of Microsoft office 2013, Pearson's Correlation Coefficient was calculated to investigate:

1. The strength of a linear association (dependence) of Little index and of S-Na-Pog angle values within all sample's subjects regardless of crowding severity grouping.
2. The strength of a linear association (dependence) of Little index and values of S-Na-Pog angle within all sample's subjects (both genders), female, and male subjects of this study sample in every single crowding severity group.

- The strength of a linear association (dependence) of Little index and values of S-Na-B angle within all sample's subjects (both genders), female, and male subjects of this study sample in every single crowding severity group.

Where:

: Positive **weak** strength of correlation, :
 : Negative **weak** strength of correlation, : Negative
moderate strength of correlation, : Negative **strong**
 strength of correlation

Within subjects of **minimal irregularity** groups, Pearson's Correlation test showed a statistical significance, negative correlation between values of Little index and values of S-Na-Pog angle. Should be noted that no male subjects were found with minimal irregularity in the sample of this study.

RESULTS

Consuming to Little index scaling, this sample's study have no subjects with perfect alignment, furthermore, no male subjects were found with minimal irregularity. Descriptive statistics of crowding severity groups (both genders) according to Little index scaling. Are presented in (tab 2).

Table 2 Descriptive statistics of crowding severity groups (both genders) according to Little index scaling

Little Index &	Minimal irregularity	Moderate irregularity	Severe irregularity	Very severe irregularity
Mean	7.36	6.52	5.85	6.17
Standard Error	1.44	0.45	0.57	0.71
Standard Deviation	3.54	3.03	2.42	2.48
Sample Variance	12.51	9.21	5.88	6.13
Range	8.34	10.26	9.14	8.94
Minimum	3.20	3.48	3.30	1.95
Maximum	11.55	13.74	12.45	10.89
Count	6.00	45.00	18.00	12.00
Confidence Level (95.0%)	3.71	0.91	1.21	1.57

Descriptive statistics for S-Na-Pog angle within all subjects (both genders) of the groups of crowding severity according to Little index scaling are presented in (tab 3).

Within subjects of **moderate irregularity** groups, Pearson's Correlation test showed a statistical significance moderate, negative correlation between values of Little index and values

Table 3 Descriptive statistics for S-Na-Pog angle within all subjects (both genders) of the groups of crowding severity according to Little index scaling

S-Na-Pog &	Minimal irregularity	Moderate irregularity	Severe irregularity	Very severe irregularity
Mean	75.90	76.42	77.00	75.58
Standard Error	1.49	0.58	0.69	1.20
Standard Deviation	3.64	3.89	2.92	4.17
Sample Variance	13.24	15.16	8.51	17.41
Range	9.04	15.37	9.11	13.27
Minimum	71.17	67.17	73.17	67.36
Maximum	80.21	82.54	82.28	80.63
Count	6.00	45.00	18.00	12.00
Confidence Level(95.0%)	3.82	1.17	1.45	2.65

Pearson's Correlation test showed a statistical significance, negative correlation between values of Little index and of S-Na-Pog angle values within all sample's subjects regardless of crowding severity grouping (tab4).

of S-Na-Pog angle. However, this correlation was stronger within female comparing with male sample's subjects.

Table 4 Pearson's Correlation test between values of Little index and of S-Na-Pog angle values within all sample's subjects regardless of crowding severity grouping.

	S-Na-Pog
Pearson Correlation	-.378-**
Sig. (2-tailed)	.001
N	81

Within all subjects of **severe irregularity** groups, Pearson's Correlation test showed a statistical significance positive (but weak) correlation between values of Little index and values of S-Na-Pog angle.

Pearson's Correlation test was performed to test the relationship between values of Little index and values of S-Na-Pog angle within all sample's subjects (both genders), female, and male subjects of this study sample in every single crowding severity group. (tab5).

Within subjects of **very severe irregularity** groups, Pearson's Correlation test showed a statistical significance, negative correlation between values of Little index and values of S-Na-Pog angle. However, this correlation was very strong within male comparing with female sample's subjects

Pearson's Correlation test was performed to test the relationship between values of Little index and values of S-Na-B angle within all sample's subjects (both genders), female, and male subjects of this study sample (tab6).

Table 5 Pearson's Correlation test between values of Little index and values of S-Na-Pog angle within all sample's subjects (both genders), female, and male subjects of this study sample in every single crowding severity group.

Little index and S-Na-Pog Correlation in:	&		
Minimal irregularity group	-0.66	-0.66	No male subjects with Minimal irregularity
Moderate irregularity group	-0.48	-0.67	-0.01
Severe irregularity group	0.22	0.26	0.30
Very severe irregularity group	-0.38	-0.48	-1

Table 6 Pearson's Correlation test between values of Little index and values of S-Na-B angle within all sample's subjects (both genders), female, and male subjects of this study sample in every single crowding severity group.

Little index and S-Na-B Correlation in:	&		
Minimal irregularity group	-0.65	-0.65	No male subjects with Minimal irregularity
Moderate irregularity group	-0.54	-0.72	-0.06
Severe irregularity group	0.13	0.13	0.35
Very severe irregularity group	-0.42	-0.52	-1

Where:

: Positive weak strength of correlation.

: Negative weak strength of correlation, : Negative moderate strength of correlation, : Negative strong strength of correlation.

Within subjects of minimal irregularity groups, Pearson's Correlation test showed a statistical significance, negative correlation between values of Little index and values of S-Na-B angle. Should be noted that no male subjects were found with minimal irregularity in the sample of this study.

Within subjects of moderate irregularity groups, Pearson's Correlation test showed a statistical significance, negative correlation between values of Little index and values of S-Na-B angle. However, this correlation was very strong within female comparing with male sample's subjects.

Within all subjects of severe irregularity groups, Pearson's Correlation test showed a statistical significance positive (but weak) correlation between values of Little index and values of S-Na-B angle.

Within subjects of very severe irregularity groups, Pearson's Correlation test showed a statistical significance, negative correlation between values of Little index and values of S-Na-B angle. However, this correlation was stronger within male comparing with female sample's subjects.

DISCUSSION

The principal finding of this study is that the sagittal lower incisors crowding amongst adolescents in the Syrian coast population have a morphologic correlation with the sagittal position of the chin. Using Little's Irregularity Index technique to classify lower incisors crowding degree shows a low incidence of well aligned incisors, in this research sample have no subjects with perfect alignment. Al Hummayani (Al Hummayani, 2004), Togoo (Togoo *et al*; 2012), Al-Emran (Al-Emran *et al*, 1990), Al-Balkhi (Al-Balkhi and Al-Zahrani, 1994), Bryan (Bryan,1987), have also reported a high incidence of incisor crowding among similar Arabic young population (basic Mediterranean race). Hence, further studies in bigger samples are needed to measure the irregularity index to evaluate the prevalence of mandibular incisor crowding that need orthodontic correction among young Syrian population. In the present study, the males showed a higher degree of incisor irregularity than females. However, subject's gender of the current research showed no statistical significance relationship with the degree of the crowding severity (tab5). Although this was in agreement with Richardson (Richardson, 1992), and Goyal (Goyal, 2012), it was in contrary of results of Buschang (Buschang and Shulman, 2003) probably due to the different age range of subjects of both studies.

Present study showed a statistical significance, negative correlation between values of Little index and of S-Na-Pog angle values within all sample's subjects regardless of crowding severity grouping (tab4).

This negative correlation between the values of Little index and of S-Na-Pog was found within subjects (both genders) of all groups of lower incisors crowding severity, except of Severe Irregularity Group, where this correlation was significance but positive (tab5). S-Na-B angle showed almost similar statistical significance, negative correlation with values of Little index within subjects (both genders) of all groups of lower incisors crowding severity, except of Severe Irregularity Group, where this correlation was significance but positive (tab6). Anyhow, S-Na-Pog, and S-Na-B angles in female subjects showed stronger correlation in both of Minimal irregularity and Sever groups, while this angles showed stronger correlation in males of Very severe irregularity group. Should be noted that no male subjects were found with minimal irregularity in the sample of this study.

Since S-Na-Pog, and S-Na-B angles have almost similar statistical significance with values of Little index, this offer theoretical support to propose that the lower incisors crowding possibly affected not only with the sagittal projection of the chin, but also with the horizontal projection of anterior border of Mandible as whole. It is probably that the diversity of the skeletal form of the Mandible's anterior border are susceptible beside the positional sagittal drift of mandible as result of complex growth patterns as was reported by several studies (Björk, 1969; Björkand Skieller,1972; Sakuda *et al*, 1976). However, Lande (Lande, 1952) found that point B changed less than Gnathion in a horizontal direction suggesting that alveolar growth does not keep pace with skeletal growth. Sakuda (Sakuda *et al*, 1976), and Leighton (Leighton and Hunter, 1982) supported that the lower incisors crowding possibly affected by the sagittal liner dimensions of the lower jaw.

CONCLUSION

- The findings of the present study indicate low incidence of well-aligned incisors amongst adolescents (especially male subjects) in the Syrian coast population.
- Subject's gender of the current research showed no statistical significance relationship with the degree of the crowding severity.
- Present study showed a statistical significance, negative correlation between values of Little index and both of S-Na-Pog and S-Na-B angles values within all sample's subjects (except of Severe Irregularity Group subject).

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