MALOCCLUSION IN LEBANESE ORTHODONTIC PATIENTS: AN EPIDEMIOLOGIC AND ANALYTIC STUDY.

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Abstract

Introduction
The recognition of malocclusion as an important problem in the public dental health services implies the need of carrying out epidemiologic studies and analysing the prevalence rates of malocclusion.

Objectives
Determine the prevalence of malocclusion in 410 Lebanese orthodontic patients (258 girls and 152 boys) referred to the Department of Orthodontics Saint-Joseph University Beirut, at DS6 stage, from different geographic locations.

Material and Methods
Assess the distribution of malocclusion types according to Angle classification and sex and record frequencies of sagittal, vertical and transverse occlusal abnormalities with possible correlation between them.

Results
Class II malocclusion was the most frequently seen (49%) whereas Class III, subdivision the least frequently encountered (2.20%). Statistically significant difference was observed in normal Overjet, Overbite, Cross-bite, slight midline deviation, ANB, NL/ML, NSL/ML according to sex and between FMA, NL/ML, NSL/ML in the hypodivergent and hyperdivergent groups, and between ANB –AoBo in the normal and distal groups.

Conclusion
Class II female Lebanese patients have a higher motivation for orthodontic therapy, statistically significant difference was found between vertical and sagittal angles.

Keywords: Malocclusion – Angle classification – Sex – Sagittal sense – Vertical sense – Transversal sense – Correlation

LA MALOCCLUSION CHEZ DES PATIENTS ORTHODONTIQUES LIBANAIS: UNE ÉTUDE ÉPIDÉMIOLOGIQUE ET ANALYTIQUE.

Résumé

Introduction

La reconnaissance de la malocclusion comme important problème dans les services de santé publique dentaire a impliqué le besoin de la réalisation d'études épidémiologiques pour analyser les taux de prévalence de la malocclusion.

Objectifs

Déterminer la prévalence de la malocclusion chez 410 patients libanais (258 filles et 152 garcons) référés pour traitement orthodontique au Département d'Orthodontie de l'Université Saint-Joseph, au stage DS6, de différentes régions du Liban.

Matériels et méthodes

Évaluer la distribution de la malocclusion avec ses différents types selon la classification d'Angle et le sexe et enregistrer les anomalies occlusales dans les trois sens sagittal, vertical et transversal puis repérer une corrélation possible entre eux.

Résultats

La classe II (49%) est la plus fréquente alors que la classe III subdivision est la moins fréquente (2,20%). Une différence statistiquement significative est observée chez la classe normale du surplomb, de la supraclusie, de l'articulé croisé, légère déviation de la ligne inter-incisive, ANB, NL/ML, NSL/ML selon le sexe et entre FMA, NL/ML, NSL/ML chez les hypodivergents et les hyperdivergents, et entre ANB - AOBO chez les types normaux et les types de classe II.

Conclusion

Les patientes libanaises de classe II ont la plus grande motivation pour le traitement orthodontique, une différence significative est trouvée entre les angles du sens sagittal et ceux du sens vertical.

Mots clés : Malocclusion – Classification d'angle – Sexe – Sens sagittal – Sens vertical – Sens transversal – Corrélation

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Introduction

Malocclusion is not a disease, but a morphological variation which may or may not be associated with a pathological condition[1]. Good documentation of occlusal status is valuable from an epidemiologic standpoint because it describes the range of occlusal variations within the community in which orthodontic treatment may be undertaken[2]. Prevalence studies on malocclusion have also been closely associated with the assessment of orthodontic treatment needs in various communities[3-7]. Information from such studies provided the basic information for the planning and progress of orthodontic delivery service to the public as well as the training of orthodontic specialists to meet the orthodontic needs and demands.

The recognition of malocclusion as an important problem in the public dental health services for children implies a need for rational planning of preventive and therapeutic orthodontic measures. It is necessary to carry out epidemiologic studies of malocclusion in groups of boys and girls at various stages of development and from different geographic areas. Analysis of the prevalence rates of malocclusion in such groups may also contribute to an understanding of the causes of malocclusion[8].

The methods of recording occlusal traits can be broadly divided into qualitative and quantitative measurements[9]. Qualitative methods commonly used include British Standard Institute (BSI) of incisor classification and Angle's classification for molar relationship[10-11]. These methods are useful in describing the occlusal traits for means of categorizing various types of dental malocclusions for quick and easy documentation as well as providing a common channel of communication among dental professionals. Literature shows that these methods have been used extensively in numerous malocclusion prevalent studies. Quantitative methods such as overjet and overbite measurements in millimetres had also been used in population studies[12-13]. These methods are useful in describing the extent of deviation of an occlusal trait in a numerical format as an independent descriptor or as a component in the scoring of a malocclusion for the purpose of establishing the severity of malocclusion and treatment prioritization[14].

Variables such as the differences in classification of occlusal relationships, the developmental period of the study sample, examiner differences in determining the bounds of normal, and differences in sample sizes can affect the results. Instead of differentiating normal and abnormal in a population, determining frequencies of different types of malocclusions in a referred population may also give valuable information[15].

The aim of this study was to determine the prevalence of malocclusion in Lebanese orthodontic patients by investigating and recording: (1) the frequencies of different types of malocclusion according to sex, (2) the frequencies of sagittal, vertical and transverse occlusal abnormalities according to sex by linear and cephalometric variables and possible correlation between them.

Material and Methods

Subjects and sampling

A total of 410 patients consisting in 258 girls, 152 boys referred to the Department of Orthodontics in Saint-Joseph University at Beirut were evaluated in this study. The mean age of the patients was 16,7 +/- 5,27 years selected from the register of all treated patients in the Department, original from different regions in Lebanon representing Lebanese Community regarding socio-economic standard, health, education and geographic location. Subjects at stage DS6, defined for eruption of all permanent teeth anterior to the first molar with or except canines are selected.

None of the subjects had undergone previous orthodontic treatment.

Patients with systemic diseases and cranio-facial syndromes were excluded.

Data was collected in a specially designed form by three trained examiners in the Department of Orthodontics who completely agreed on the criteria of examination. Data was obtained from study models and cephalometric analysis of treated patients.

Criteria of examination
1. Antero-posterior dimension
1.1 Angle classification was used to determine the antero-posterior dental arch relationship. The readings taken either from the first permanent molar relationship, or in the case of its absence or extraction, the canine relationship was marked. Class I,

II/1, II/2, II subdivision, III, and III subdivision malocclusions. Asymmetry was designated by the subdivision : Class I one side and Class II the other side or Class I one side and Class III the other side. Patients with Class II from one side and Class III from the other side were excluded.

1.2 Incisor relationship : measured by a metal ruler

Normal between 0-4 mm, overjet 4-8 mm and exaggerated overjet > 8 mm.

Anterior cross bite < 0mm was recorded when one or more upper incisor teeth were palatal to the lower incisor teeth[16].

1.3 Cephalometric variables :
SNA (78-86), SNB (76-82), ANB (0-4), AoBo (-3, 7).

2. Vertical dimension

2.1 Incisor relationship : Normal overbite 50% height : half or less than the lower central incisor is covered by the upper central. Overlap > 50% height : more than half of the lower central is covered by the upper central incisor but less than the total crown. Total overlap of incisors 100% height, or mandibular incisors in contact with the palatal mucosa.

2.2 Cephalometric variables [17] : FMA (22-28o) : angle between FH plane and mandibular plane.

NL/ML (25-31o) : angle between palatal plane and mandibular plane.

NSL/ML (29-35o) : angle between SN plane and mandibular plane.

Vertical index (0.65-0.75) : the ratio of posterior facial height to anterior facial height.

3. Transverse dimension

3.1 Posterior cross-bite : included teeth in an edge-to-edge position

Unilateral cross-bite when one or more lower posterior teeth distal to the lateral were placed buccal to the upper posterior teeth at maximum intercuspidation in one side while bilateral cross-bite in both side [2].

3.2 Scissors-bite : one or more lower posterior teeth in any quadrant distal to the lateral were lingually placed with respect to the upper posterior teeth at maximum intercuspidation

3.3 Midline deviation : shifting of the midline of the upper or lower teeth from the facial midline at centric occlusion :

Slight 0-2 mm, Medium 2-5mm, high > 5mm

Statistical analysis

Descriptive statistics for the distribution of occlusal traits of the total sample were presented using frequencies and percentages. The associations between some variables (Angle classification, Overjet, Overbite, Cross-bite, Midline deviation) and (Sex), cephalometric variables in each sagittal (ANB and AoBo) and vertical dimension (FMA, NL/ML and NSL/ML) separately, were assessed using Chi-square test. Student test « t » was used for comparing the distribution of cephalometric variables (SNA, SNB, ANB, AoBo, FMA, NL/ML and NSL/ML) between male and female. The alpha level was set at 0.05 (2-tailed).

Results

Malocclusion types (Table 1 and fig. 1)

Class I malocclusion was found in 86 patients, which represented 20.98% of the total sample. Class II malocclusion (division 1 and 2) was diagnosed in 201 patients which represented 49% of the total sample, Class III malocclusion group consisted of 30 individuals which represented 7. 32%.

Class II subdivision and class III subdivision were found respectively in 84 patients (20.49%) and 9 patients (2.2%). Class II had the highest frequency 49%.

No significant difference in the distribution of malocclusion according to Angle classification between male and female was found.

TABLE 1
Distribution of malocclusion types according to Angle and Sex.

Angle Classification	Male		Female		Total		
CI I	34	8,29	52	12,68	86	20,98	0,90 NS
CI II	76	18,54	125	30,49	201	49,02	0.06 NS
CI II, Sub	26	6,34	58	14,15	84	20,49	0,66 NS
CI III	14	3,41	16	3,90	30	7,32	
CI III, Sub	2	0,49	7	1,71	9	2,20	
Total	152	37,07	258	62,93	410	100,00	

*Statistical comparison could not be done because of the small size of the sample
N.S. Non significant group differences.*

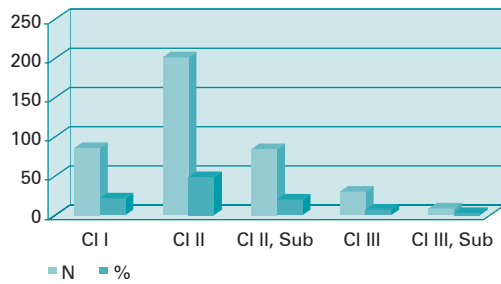## Malocclusion types distribution according to Angle classification

Fig. 1 Bargraph of malocclusion types according to Angle classification.

Occlusal relationship in the anteroposterior dimension Distribution of Overjet (Table 2 and fig. 2).

TABLE 2
Distribution of Overjet according to sex

Overjet	Male		Female		Total		
	N		N		N		P value
< 0 mm	12	2,93	9	2,20	21	5,12	†
0 mm	8	1,95	16	3,90	24	5,85	†
0-4 mm	69	16,83	123	30,00	192	46,83	0,05*
4-8 mm	41	10,00	77	18,78	118	28,78	0,22 NS
> 8 mm	22	5,37	33	8,05	55	13,41	0,92 NS
Total	152	37,07	258	62,93	410	100,00	

Statistical comparison could not be done because of the small size of the sample
*Significant group differences p < 0, 05. N.S. Non significant group differences.

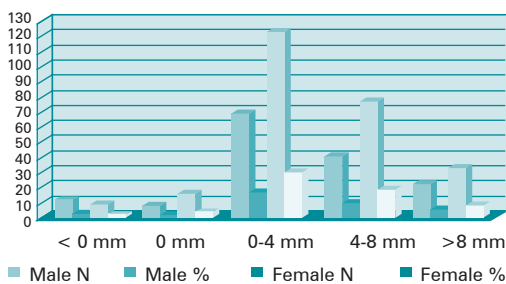## Overjet distribution according to sex

Fig. 2. Bargraph of Overjet distribution according to Sex.

46.83% of the total sample had an overjet between 0 to 4 mm which could be regarded as normal anteroposterior incisor relationship and was the most prevalent. 5.82% had 0 mm overjet, 5.12% had reverse anterior overjet, 28.78% had a great overjet between 4 and 8 mm and 13.41% had an overjet greater than

8 mm that could be considered as severe and potentially handicapping.

A significant difference in the overjet distribution between male and female was found in the normal group (0-4 mm); the female group was the most prevalent (30%).

Distribution of ANB and AoBo (Table 3)

A significant difference was noted between the two cephalometric angles, ANB and AoBo, representing the sagittal relationship between upper and lower jaws among the normal ANB (0-4) o, AoBo (-3,7mm) and distal group ANB > 4 o, AoBo > 7mm.

Occlusal relationship in the vertical dimension

Distribution of Overbite (Table 4 and fig. 3)

Normal overbite (50% crown height) was displayed by 48.29% of patients followed by 37.56% representing the overbite group (>50% crown height).

Minimal overbite (0-0,5 mm) accounted for 5.37%, deep overbite (100% crown height) and open bite (< 0mm) represented the same percentage 4.39%.

Similarly to overjet distribution, a significant difference in overbite distribution between male and female was found in the normal group (50% crown height), female group had the higher percentage (33.17%).

Distribution and comparison of angles of the vertical dimension: FMA, NL/ML, NSL/ML (Table 5).

The vertical dimension divided into three groups (hypodivergent, normodivergent and hyperdivergent) was described by three main angles: FMA, NL/ML, and NSL/ML

FMA revealed the highest prevalence (46.34%) for the normodivergent group, NL/ML (42.93%) for the hypodivergent group and NSL/ML (43.17%) for the hyperdivergent group. A significant difference was found between these angles in the hypo and hyperdivergent groups and no significant difference in the normodivergent group.

Distribution of vertical index (Table 6)

Vertical index showed the normodivergent group (0.65 - 0.75) as having the highest prevailance one (50.98%).

Occlusal relationship in the

TABLE 3
Distribution of ANB and AoBo

	ANB	N	Per cent	AoBo	N	Per cent	Chi-square P
Mesio	< 0	37	9,02	Mesio	49	11,95	0,79 NS
Normal	0-4	205	50,00	Normal	342	83,41	< 0,0005****
Disto	> 4	168	40,98	Disto	19	4,63	0,0022***
Total		410	100,00		410	100,00	

N.S. Non significant group differences. *Significant group differences p < 0, 05.

TABLE 4
Overbite distribution according to Sex

Overbite	Male		Female		Total		
	N		N		N		P value
< 0 mm	8	1,95	10	2,44	18	4,39	†
0 mm	9	2,20	13	3,17	22	5,37	†
50% h	62	15,12	136	33,17	198	48,29	0,0065***
> 50 % h	61	14,88	93	22,68	154	37,56	0,19 NS
100% h	12	2,93	6	1,46	18	4,39	
Total	152	37,07	258	62,93	410	100,00	

†Statistical comparison could not be done because of the small size of the sample
*Significant group differences p < 0, 05.
N.S. Non significant group differences
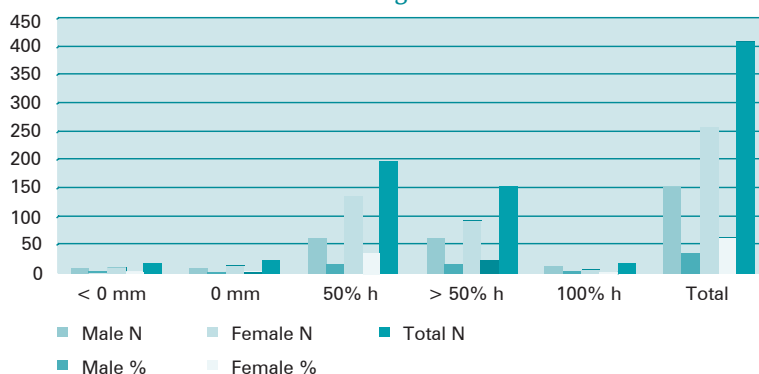
Overbite distribution according to sex

Fig. 3.Bargraph of overbite distribution according to Sex.

TABLE 5
Distribution of vertical angles : FMA, NL/ML, NSL/ML.

Vertical angles	FMA		NL/ML		NSL/ML		Chi-square
	N	Per cent	N	Per cent	N	Per cent	P
Hypo	125	30,49	176	42,93	70	17,07	0,0003****
Normal	190	46,34	164	40,00	163	39,76	0,38 NS
Hyper	95	23,17	70	17,07	177	43,17	0,00005*****
Total	410	100,00	410	100,00	410	100,00	

*Significant group differences p < 0, 05.
N.S. Non significant group differences

TABLE 6
Distribution of Vertical index

Vertical index	N	
Hypo < 0,65	122	29,76%
Normal 0,65-0,75	209	50,98%
Hyper > 0,75	79	19,27%
Total	410	100,00%

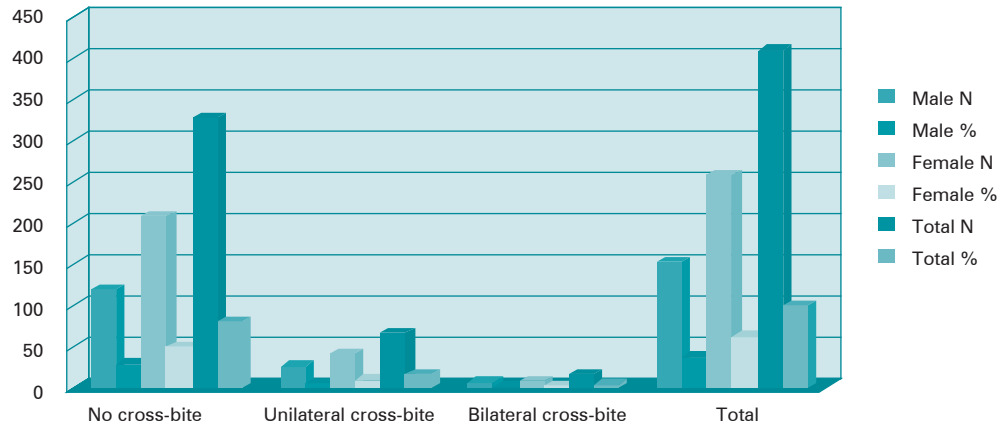### Cross-bite distribution according to Sex

Fig 4 : bargraph of Cross-bite distribution according to Sex.

TABLE 7
Cross-bite distribution according to sex.

Cross-bite	Male		Female		Total		
	N		N		N		P value
No cross-bite	119	29,02	208	50,73	327	79,76	0,00015****
Unilateral cross-bite	26	6,34	41	10,00	67	16,34	0,88NS
Bilateral cross-bite	7	1,71	9	2,20	16	3,90	
Total	152	37,07	258	62,93	410	100,00	

Statistical comparison could not be done because of the small size of the sample
*Significant group differences p < 0,05.
N.S. Non significant group differences

TABLE 8
Distribution of middline deviation according to Sex.

Middline Deviation	Male		Female		Total		
	N		N		N		P value
Middline Deviation 0-2 mm	107	26,10	192	46,83	299	72,93	0,00044****
Middline Deviation 2-5mm	41	10	57	13,90	98	23,90	0,52 NS
Middline Deviation > 5mm	4	0,98	9	2,20	13	3,17	†
Total	152	37,07	258	62,93	410	100,00	

Statistical comparison could not be done because of the small size of the sample
*Significant group differences p < 0, 05.
N.S. Non significant group differences

transverse dimension

Distribution of cross-bite (Table 7, fig. 4)
Unilateral cross-bite in 16.34% and bilateral cross-bite in 3.90% were found in the total sample. The frequency of the normal group with no cross-bite was the highest (79.76%). No statistically significant difference between male and female for the unilateral and bilateral cross-bite group was noted except for the normal group where female had the highest frequency 50.73%.

Distribution of midline deviation (Table 8, fig. 5).
The frequency of midline deviation was higher in the slight midline deviation (0-2 mm) group (72.93%), followed by (23.90%) for the (2-5) mm group and (3.17%) for the great (>5mm) group. A statistical difference was found in the slight midline deviation (0-2 mm) group between male (29, 02%) and female (50, 73%).

Distribution of cephalometric variables according to sex (Table 9)
Among the angles of the sagittal dimension (SNA, SNB, ANB, AoBo) only ANB revealed a statistical difference between male and female. (p = 0.0068) while the angles of the vertical dimension as FMA is tangentially statistically significant p = 0.054, NL/ML p = 0,025 and NSL/ML p = 0, 000017 are highly statistically significant.

Distribution of midline deviation according to sex
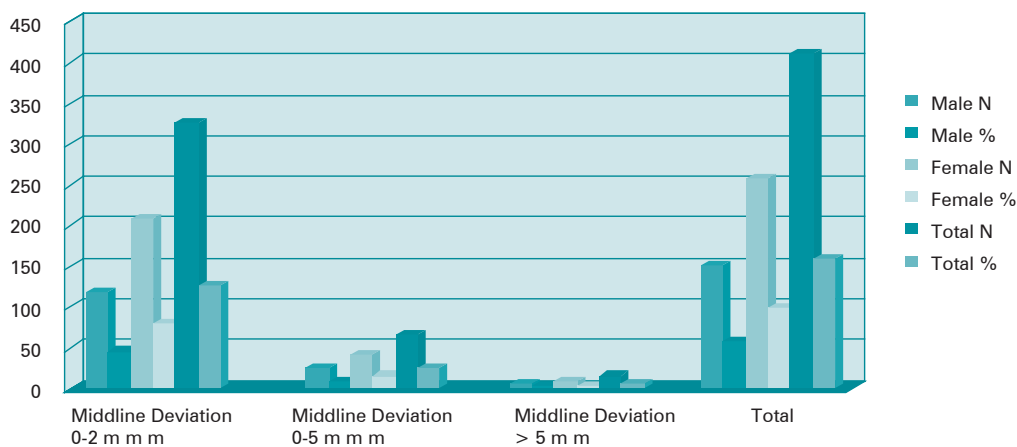

Fig 5.Bar graph of the distribution of midline deviation according to Sex.

TABLE 9
Distribution of cephalometric variables according to sex.

| Angles | Male | | Female | | Sex |
	Average	S.D.	Average	S.D.	P value
SNA	80,5	3,67	80,45	3,58	0,8 NS
SNB	76,73	5,56	76,69	3,66	0,85 NS
ANB	3,36	3,03	3,83	2,75	0,0068***
AoBo	1,67	4,56	1,32	3,77	0,09 NS
FMA	24,02	6,08	24,5	5,87	0,054*
NL/ML	25,22	6,37	25,81	6,71	0,025*
NSL/ML	33,82	6,63	34,97	6,71	0,000017*****

*Significant group differences p < 0, 05.
N.S. Non significant group differences

Discussion

Although numerous studies[18-20] have been published describing the prevalence of malocclusion and its different types, some authors[21-22] have found many difficulties to compare these findings because of the great variability of methods and indices used by one examiner and another to access and record occlusal relationships. The evaluation of referred patients with many variables (including age differences, specific objectives and differing sample sizes) and the distribution of malocclusion types may give valuable information for planning orthodontic services.

According to our results, Angle Class II was considered the common feature which represents 49% of the sample. The frequency of class I was (20. 98%), Class III malocclusion was observed in (7. 32%), Class II subdivision

(20.49%) and Class III subdivision (2.2%). However our results do not represent the prevalence of malocclusion in the Lebanese population because this study evaluated only subjects seeking orthodontic treatment, it is not surprising that Class II malocclusion was the highest.

The type of malocclusion is an important factor that affects patient motivation to seek treatment. Wilmant and coll.[23] reported that patients with a severe sagittal Class II deformity had a higher motivation for orthodontic therapy than class III patients.

Jones[24] investigated malocclusion and facial types in 132 Saudi Arabian patients referred for orthodontic treatment and reported that 53.8% had Class I, 28.8% had Class II division 1, 4.5% had Class II division 2, and

12.9% had Class III malocclusions. However, these results do not represent the prevalence of malocclusion in a referred Saudi Arabian population because of the insufficient sample size. Yang[25] evaluated 3305 patients who had visited the Department of Orthodontics at Seoul National University Hospital from 1985 to 1989. He reported that percentages of Class I, Class II division 1, Class II Division 2 and Class III were 35.9%, 13.4%, 1.5%, and 49.1%, respectively. The higher reported frequency of Class III malocclusion is noticeable and may be because of the ethnic differences.

In the present study we did not find sex difference in Angle malocclusion type.

The confusing meaning of subdivision has resulted in a disparity in the classification of a unilateral malocclusion. Angle[26] says that a subdivision is the occurrence of a unilateral malocclusion whereby one side is normal and the other is abnormal, he neglects to specify whether the subdivision is the normal or the abnormal side. As a result orthodontists in the United States cannot agree on the meaning of a Class II Division1, subdivision malocclusion and made a research project by surveying 34 chairpersons of United States orthodontic departments to determine their view points and ascertain the criteria on which they base them[27]. They naturally form a point of view based on an assessment of the replies, subdivision would refer to the defective side in the Class I malocclusion. We have supported this opinion and found in this study 20.49% of Class II subdivision and 2.2% of Class III subdivision, this probably had reduced Class I from 43.67% to 20.98%.

The Angle classification, a universally accepted reliable system doesn't incorporate sagittal, vertical, and transverse abnormalities of both buccal and incisor segments[28].

Analysing incisor segments in both the sagittal and vertical dimensions revealed the highest percentages in normal groups where overjet was between 0 and 4 mm (46.83%) and 50% crown height was displayed in 48.29%.

A statistically significant difference in the overjet, overbite and transverse distributions according to sex in the normal groups was found. The highest percentages characterised females. For overjet 30%, overbite 33.17% and transverse dimension « without cross-bite » 50.73% and minor midline deviations 46.83%.

Appraising the horizontal disharmony of the face, the ANB angle is the most commonly used measurement. Relating jaws to cranial reference planes and points presents inherent inconsistencies because of variations in physiognomy including craniofacial skeletal variations like antero-posterior spatial relationship of nasion relative to jaws and rotational effect of the jaws relative to cranial reference planes. When evaluating severity of antero- posterior jaw disharmony, the jaws must of necessity be related to each other and neither to cranial and extra cranial landmarks.

Relation of jaws in the antero-posterior dimension described by two angles ANB and « Wits » appraisal AoBo revealed a significant difference in the normal ANB (0-4), AoBo (-3,+7) group and distal group ANB > 4o, AoBo > 7mm.

According to our results the « Wits » appraisal provides a reliable indication of the extent or severity of antero-posterior skeletal disharmony of the jaw. This was also confirmed by Jacobson[29]; when ANB is 7 degrees in each instance of Class II malocclusion and normal occlusion, the « Wits » appraisal whereas the reading for the normal occlusion is 0 mm.

The relation of jaws in the vertical dimension referred to three angles FMA, NL/ML and, NSL/ML revealed no correlation between them although a significant difference exists according to sex, but FMA and the « Vertical index » prevailed in the normal group.

Conclusion

The motivation for treatment has distinguished lebanese orthodontic patients, especially females, revealing moderate occlusal abnormalities in sagittal, vertical and transverse relationships.

- In a sample of orthodontically referred Lebanese patients Class II, (49%), was the most frequently seen malocclusion. Class I was 20.98%, Class III 7.32%, Class II subdivision 20.49% and Class III subdivision 2.2% the least common.
- Patients with sagittal Class II deformity have a higher motivation for orthodontic therapy. Subdivision would refer to the defective side in the Class I malocclusion.
- « Wits » appraisal provides a reliable indication of the extent in severity of antero- posterior relation of jaws.
- No correlation in vertical sense between FMA, NL/ML and NSL/ML while concordance between FMA and « Vertical Index » was found.

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