The differential diagnosis of Class III malocclusion in adolescents of Mosul city

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ABSTRACT

Aim: To evaluate the differential diagnosis of Angle Class III malocclusion in adolescents of Mosul city. **Materials and Methods**: A sample of 170 Iraqi subjects aged 12–15 years, 85 subjects with Class III malocclusion (42 males and 43 females) were selected on the basis of molar and incisor relationships. Eighty fife subjects with Class I normal occlusion (42 males and 43 females) were chosen. Lateral cephalometric radiographs were taken for each subject and thirty six measurements were determined (20 angular, 14 linear and 2 ratios). **Results**: There were 7 subgroups in Class III malocclusion. Pure maxillary retrognathism was the most common subgroup, which represented 31.8%; whereas pure mandibular prognathism was the second subgroup with 23.5%. When the lower anterior facial height (LAFH) was considered with both maxillary and mandibular position, 14 subgroups were found. The most common subgroup included subjects with retrognathic maxilla, normal mandible and normal (LAFH) with 16.5% of total sample. The second subgroup included subjects with retrognathic maxilla, normal mandible and increased (LAFH) with 15.3%. The third subgroup included subjects with normal maxilla, prognathic mandible and normal (LAFH) which represented 10.6%. **Conclusion**: the maxillary retrognathism is more common than mandibular prognathism in Mosul City.
Key Words: Differential diagnosis, Subgroups, Class III malocclusion.

INTRODUCTION

Class III malocclusion has long been viewed as one of the most severe facial deformities. Mandibular prognathism is not uncommon to find, the lower jaw projecting too far forwards, so that its fore teeth pass before those of the upper jaw, when the mouth is shut; which is attended with inconvenience and disfigure the face.[1]

The differential diagnosis has become more important during recent years as a result of refinement in orthodontic, orthopedic and surgical procedure.[2] Accurate diagnosis of skeletal and dental components of a given malocclusion is essential in determining the proper approach and timing of treatment.[3]

Class III malocclusion is one of the most difficult anomalies to understand and treat.[4] It is important to identify whether the etiology of Class III malocclusion is dental, functional or skeletal. If the problem is skeletal, it must be determined whether the cause is overdeveloped mandible, underdeveloped maxilla or combination of both.[5]

So, when treating Class III patients orthodontically whether they are growing children or mature adults, antero–posterior and vertical position of facial components as well as dental relationship must be considered so that the excess or deficiency may be treated where it actually exists.[6]

Many studies have been performed to establish the percentage of malocclusion in different countries. The prevalence of Class III malocclusion represents relatively low percentage among the population, also the prevalence is different among different ethnic groups and according to the method used in the Classification. In Iraq found that 2.4 % of 253 orthodontic patients have Class III malocclusion.[7] in a study performed in rural community, found that 6.3 %

of 268 Iraqi subjects had Class III malocc-lusion.[8]

The Class III malocclusion is not a homogenous entity but a mixture of vario-us patterns of deformity and have been Cl-assified into groups. Sanborn[9] divided Cl-ass III cases according to antero–posterior position of the maxilla and mandible as determined by SNA and SNB into 4 subgr-oups: (Figure 1)
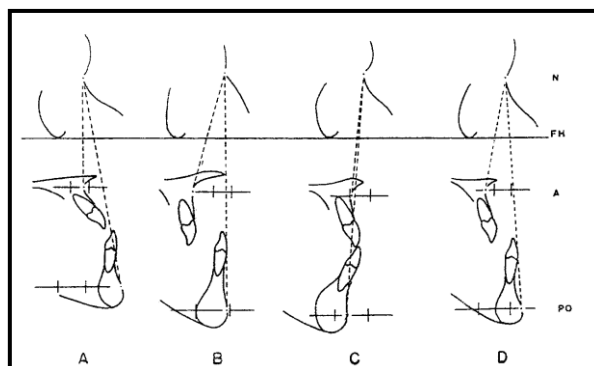

Figure (1): Main groups of Class III facial skeletal profile

Group A: Those presenting a maxilla with-in the normal range of prognathism and mandible beyond normal range of prognat-hism.

Group B: Those presenting a maxilla bel-ow normal range of prognathism and a mandible within the normal range of pro-gnathism.

Group C: Those presenting a maxilla and a mandible within the normal range of prog-nathism.

Group D: Those presenting a maxilla bel-ow normal range of prognathism and a mandible beyond the normal range of pro-gnathism.

Ellis and McNamara[10] divided the measurements of craniofacial structures of adult Class III surgical patients into 4 hori-zontal components; maxillary skeletal pos-ition, maxillary dental position, mandibul-ar dental position and mandibular skeletal position and one vertical components. Wh-en each of these five components is divid-ed into 3 Classes: Protruded, normal and retruded, permits 243 possible subgroups; actually 69 subgroups were found.

Guyer *et al.*[6] considered the skeletal components: Maxillary skeletal position, mandibular skeletal position and vertical facial height were yielded 27 possible sub-groups. They reported that the actual com-binations and their percentage were differ-ent in the different age groups.

The main aim of this study was to de-termine the different subgroups of Class III malocclusion by determining the differ-ent combinations of skeletal variability ta-king into account the antero–posterior and vertical relationships.

MATERIALS AND METHODS

The sample of this study was collect-ed from 21 secondary schools in Mosul ci-ty, a total of 8276 students were examined. The study was carried out on 170 subjects age range between 12–15 years: 85 subjec-ts with Class I normal occlusion; 42 males and 43 females and 85 subjects with Class III malocclusion; 42 males and 43 females.

The Criteria for Selecting Class I Control Group:

1. Full set of permanent dentition in both arches.[11]
2. Bilateral Class I molar and canine relati-onship, the mesiobuccal cusp of upper fi-rst molar occlude in the buccal groove of the lower first molar, the upper canine occlude in the embrasure between lower canine and lower first premolar.[12]
3. Normal overbite and overjet 2–4 mm.[13]
4. Less than 3 mm crowding.[14]
5. Negligible rotations or spacing (less than 1.0mm).[15]
6. Harmonious facial proportions, balanced profile with normal lip seal.[16]
7. No history of orthodontic treatment or orthognathic surgery, extensive restorati-ve dentistry or carious teeth.[17]
8. Good health with no major medical pro-blems and no history of craniofacial

trauma.[18]

9. All subjects are Iraqi in origin and live in the center of Mosul City.

Criteria for Selecting Class III Sample:

1. Full set of permanent dentition.

2. Bilateral Class III molar relationship to the extent which is slightly more than one half the width of a single cusp on each side.[12]

3. Edge to edge incisor relation and negateve overjet cases were included in this study.[19]

4. No detected functional displacement.[20]

5. No history of orthodontic treatment or orthognathic surgery.[21]

6. No cleft or other congenital craniofacial anomalies.[21]

7. All subjects are Iraqi in origins who live in the center of Mosul City.

Lateral cephalometric radiographs were taken for each subject under standardized conditions using Cranex Panoramic/Cephalometric imaging system (Soredex, Orion corporation, Helsinki, Finland).

The subject was set in a standing position with his head fixed by two ear rods laterally and a plastic stoppers on the bridge of the nose anteriorly so that the Frankfort horizontal plane was kept parallel to the floor. Then the radiographs were traced and the obtained measurements included SNA, SNB and lower anterior facial height (LAFH) as measured from anterior nasal spine to Menton.[22]

Analysis of Components Combination

The neutral ranges for SNA, SNB and lower anterior facial height (ANS–Me) were established from Class I normal occlusion group as the mean $\pm$ standard deviation. Values less than neutral range indicated a retrusive position for the maxilla or mandible and short lower anterior facial height. Values greater than the neutral range indicated a protrusive position of maxilla or mandible or long lower anterior facial height. So, each value could then be classified as low, neutral or high. To evaluate the frequencies, with which various skeletal components occurred in Class III patients, an evaluation of the maxillary and mandibular skeletal components was made using the neutral ranges of SNA and SNB. Thus 9 possible subgroups may be found; however not all of them are actually exist. From the combination of the variables SNA, SNB and LAFH, 27 possible subgroups may be found; however not all of them are actually exist.[6]

RESULTS

Subgroups of Class III Malocclusion According to Maxillo–mandibular Positions:

From the 9 possible subgroups, 7 subgroups were actually found (Table 1 and Figure 2). The most prevalent subgroup included those who had pure maxillary retrognathism which represented 31.8% of the sample; the next most prevalent subgroup included those pure mandibular prognathism with 23.4% and the third subgroup had neutral maxilla and mandible with 16.5%, while the forth subgroup included those with bimaxillary prognathism which formed 11.8%. The fifth subgroup included those who had combined maxillary retrognathism and mandibular prognathism with 8.2%. Bimaxillary retrognathism formed the sixth subgroup with 7% while the seventh subgroup included one case which had neutral maxilla and retrognathic mandible with 1.2%.

Table (1): Subgroups of Class III malocclusion according to the Combination of maxillary and mandibular skeletal variables of listed in order of prevalence

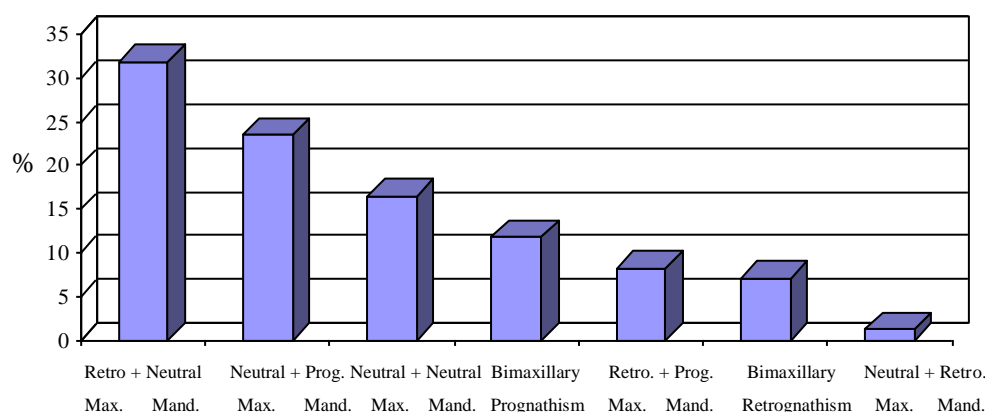| Groups	Number	percentage	Maxillary Skeletal Position	Mandibular Skeletal Position
I	27	31.8	Retrognathic	Neutral
II	20	23.4	Neutral	Prognathic
III	14	16.5	Neutral	Neutral
IV	10	11.8	prognathic	Prognathic.
V	7	8.2	Retrognathic	Prognathic
VI	6	7.1	Retrognathic	Retrognathic
VII	1	1.2	Neutral	Retrognathic
Total	85	100	—	—

Figure (2): Subgroups of Class III Total sample according to combination of maxillary and mandibular skeletal position

Subgroups of Class III malocclusion according to Maxillo–mandibular Position and Lower Facial Height:

From 27 possible combination subgroups, 14 subgroups were actually found as shown in Table (2) and Figure (3). The most prevalent subgroup included those with pure maxillary retrognathism and neutral LAFH with 16.5%. The next included those with pure maxillary retrognathism and long LAFH and represented 15.3% of the total sample. The third subgroup included those with pure mandibular prognathism and neutral LAFH with 13%. The forth subgroup included those with neutral maxilla, neutral mandible and increased LAFH with 10.6%; whereas the fifth and sixth subgroups included those with bimaxillary prognathism and neutral LAFH and those with pure mandibular prognathism and increased LAFH with 8.2% for each. The seventh subgroup included those with bimaxillary retrognathism and increased LAFH with 7%. The eighth subgroup included those with neutral maxilla neutral mandible and neutral LAFH with 5.9%; whereas the ninth subgroup included those with retrognathic maxilla, prognathic mandible and neutral LAFH with 4.7%. The tenth subgroup included those with bimaxillary prognathism and increased LAFH with 3.5%. The eleventh and twelfth subgroups included those pure mandibular prognathism and decreased LAFH and those with retrognathic maxilla, prognathic mandible and increased LAFH with 2.3% for each. The last 2 subgroups included those with retrognathic maxilla, prognathic mandible and increased LAFH and those with neutral maxilla, prognathic mandible and neutral LAFH with 1.2 % for each.

DISCUSSION

Subgroups of Class III Malocclusion According to Maxillo–mandibular Positions:

Table (3) showed the comparison of the result of this study with previous studies. There were 7 possible subgroups in Class III malocclusions in the total sample of this study.

Pure maxillary retrognathism represented the most common subgroup in the total sample which was found in 31.8%, close to that found by Dietrich[20] and also Sanborn[9] in his adult sample; but it was higher than that found by Jacobson *et al*.,[23] Ellis and McNamara,[10] Guyer *et al*.,[6] Lew and Foong[24] and Delaire.[25] It was lower than that found by Williams and Anderson,[2] Tom[26] and Mouakeh.[21] Pure mandibular prognathism formed the second subgroup which was found in 23.4% of the total sample, close to that found by Guyer *et al*.[6] and also close to Ellis and McNamara[10] in their adult sample; but it is lower than that of Dietrich,[20] Tom[26] and also Sanborn[9] and Lew and Foong[24] in their adult sample, it was higher than that of Jacobson *et al*.,[23] and Delaire[25] while Mouakeh[21] found that no case with Class III malocclusion had pure mandibular prognathism among Syrian children

Table (2): Subgroups of Class III malocclusion according to the combination of the maxillary skeletal position, mandibular skeletal position and lower vertical height listed in order of prevalence

| Groups	Number	percentage	Maxillary Position	Mandibular Position	LAFH
I	14	16.5	Retrognathic	Neutral	Neutral
II	13	15.3	Retrognathic	Neutral	↑
III	11	13.0	Neutral	Prognathic	Neutral
IV	9	10.6	Neutral	Neutral	↑
V	7	8.2	Prognathic	Prognathic	Neutral
VI	7	8.2	Neutral	Prognathic	↑
VII	6	7.0	Retrognathic	Retrognathic	↑
VIII	5	5.9	Neutral	Neutral	Neutral
IX	4	4.7	Retro	Prognathic	Neutral
X	3	3.5	Prognathic	Prognathic	↑
XI	2	2.3	Neutral	Prognathic	↓
XII	2	2.3	Retrognathic	Prognathic	↑
XIII	1	1.2	Retrognathic	Prognathic	↓
XIV	1	1.2	Neutral	Retrognathic	Neutral
Total	85	100	—	—	—

↑: Increase; ↓: decrease.
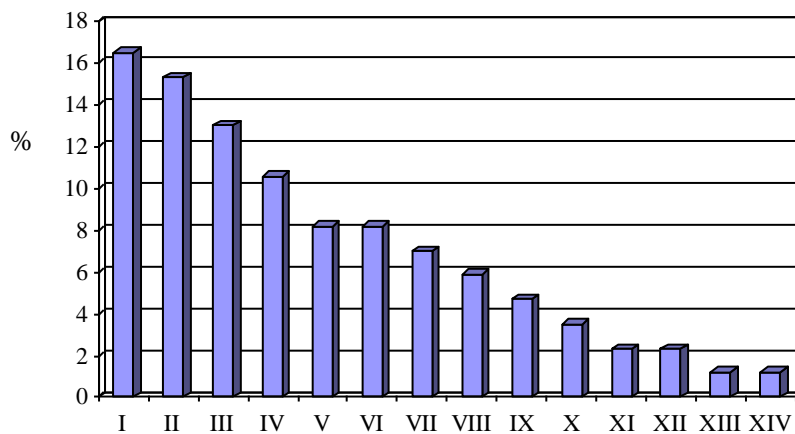
Figure (3): Subgroups of Class III total sample according to the combination of maxillary skeletal position, mandibular skeletal position and lower anterior facial height. (I. Retro. Max. Neutral Mand. Neutral LAFH   II. Retro. Max. Neutral Mand. ↑ LAFH III. Neutral Max. Prog. Mand. Neutral LAFH IV. Neutral Max. Neutral Mand. ↑ LAFH   V. Prog. Max. Prog. Mand. Neutral LAFH   VI. Neutral Max. Prog. Mand. ↑ LAFH   VII. Retro. Max. Retro. Mand. ↑ LAFH   VIII. Neutral Max. Neutral Mand. Neutral LAFH   IX. Retro. Max. Prog. Mand. Neutral LAFH X. Prog.. Max. Prog. Mand. ↑ LAFH   XI. Neutral Max. Prog. Mand. ↓ LAFH. XII. Retro. Max. Prog. Mand. ↑ LAFH. XIII. Retro. Max. Prog.. Mand. ↓ LAFH. XIV. Neutral Max. Retro. Mand. Neutral LAFH.)

Table (3): Comparison of the subgroups of Class III malocclusion according to combination of maxillary and mandibular components of the present study with other studies

Present and Previous Studies	Age (years)	Max. Retro. (%)	Mand. Prog. (%)	Max. Mand Neutral (%)	Max. Mand. Prog. (%)	Comb (%)	Max. Mand. Retro. (%)	Mand. Retro. (%)
Present Study	12−15	31.8	23.4	16.5	11.8	8.2	7.1	1.2
Sanborn (1955)	16−36	33.3	42.5	9.5	−	9.5	2.4	−
Dietrich (1970)	12−17.5	36.8	30.9	23.5	1.5	1.5	5.9	−
Jacobson *et al.* (1974)	6−16	8.8	13.3	59.2	6	−	8.8	3.8
Ellis and McNamara (1984)	≥17	19.5	19.2	4.6	14.9	30.1	7.9	1.6
Williams and Anderson (1986)	10−12.5	41	33	−	4	8	4	−
Guyer *et al.* (1986)	13−15	22.8	20	-	11.4	34.3	5.7	2.92
Tom (1989)	10−21	40.5	32	21	−	−	−	−
Lew and Foong (1993)	19−27	22.5	38.75	7.5	11.25	18.75	1.25	−
Delaire (1997)	3.5−20	11.5	16.1	8	13.8	6.9	34.5	5.2
Mouakeh (2001)	5−12	43.5	−	1.45	−	29	23.2	2.9

Mand: Mandibular; prog: Prognathism; max: Maxillary; retro: Retrognathism; Comb: Combined maxillary retrognathism and mandibular prognathism .

Dentoalveolar Class III malocclusion with neutral maxillary and mandibular position represented the third subgroup and found in 16.5% of the total sample, close to that found by Tom;[26] but it was higher than that found by Sanborn,[9] Ellis and McNamara,[10] Lew and Foong,[24] Delaire[25] and Mouakeh,[21] lower than that of Dietrich[20] and Jacobson *et al.*,[23] while Williams and Anderson[2] and Guyer *et al.*[6] did not find any case within this group.

Bimaxillary prognathism formed the forth subgroup with a relatively high percentage in Class III Cases which was about 11.8%, close to that found by Guyer *et al.*[6] and Delaire,[25] and also Ellis and McNamara[10] and Lew and Foong[24] in their adult samples; but it was higher than that found by Dietrich,[20] Jacobson *et al.*[23] and Williams and Anderson;[2] whereas Sanborn[9] and Mouakeh[21] did not find any case with prognathic maxilla and mandible.

The combined maxillary retrognathism and mandibular prognathism formed the fifth subgroup with only 8.2 % of the total sample, close to that found by Sanborn,[9] Williams and Anderson[2] and Delai-

re,[25] higher than that of Dietrich[20] and lower than that found by Guyer *et al.*[6] and Mouakeh[21] and also Ellis and McNamara[10] and Lew and Foong[24] in their adult samples; whereas, Jacobson *et al.*[23] and Tom[26] found no case within this group.

Class III cases with bimaxillary retrognathism formed the sixth subgroup which formed about 7.1% of the sample, close to that found by Dietrich,[20] Jacobson *et al.*,[23] Guyer *et al.*,[6] Williams and Anderson[2] and also Ellis and McNamara[10] in their adult sample. It was lower than that found by Delaire[25] and Mouakeh;[21] whereas it was higher than that of Sanborn[9] and Lew and Foong[24] in their adult samples.

The last subgroup included only one Case with normal maxilla and retruded mandible which represented 1.2% of the total sample, close to that found by Jacobson *et al.*,[23] Ellis and McNamara,[10] Guyer *et al.*,[6] Delaire[25] and Mouakeh;[21] whereas, Tom[26] and Lew and Foong[24] found no case within this subgroup.

Subgroups of Class III Malocclusion According to Maxillo–mandibular Positions and Lower Anterior Facial Height:

There were 14 actual subgroups of

Class III malocclusion in the total sample of this study when the LAFH is considered along with SNA and SNB. Table (4) showed the comparison of the results of this study with that of Guyer *et al*.[6]

The most prevalent subgroup was pure maxillary retrognathism and neutral LAFH with 16.5%, this subgroup represented only 5.7% in the sample of Guyer *et al*.[6]

Table (4): Comparison of the subgroups of Class III malocclusion according to the skeletal components combinations of present study with previous study

Group	Skeletal Components			Present Study		Guyer *et al*. (1986)	
	Maxilla	Mandible	LAFH	Number	%	Number	%
I	Retrognathic	Neutral	Neutral	14	16.5%	2	5.7%
II	Retrognathic	Neutral	↑	13	15.3%	5	14.3%
III	Neutral	Prognathic	Neutral	11	13.0%	6	17.1%
IV	Neutral	Neutral	↑	9	10.6%	—	—
V	Prognathic	Prognathic	Neutral	7	8.2%	3	8.6%
VI	Neutral	Prognathic	↑	7	8.2%	1	2.9%
VII	Retrognathic	Retrognathic	↑	6	7.0%	2	5.7%
VIII	Neutral	Neutral	Neutral	5	5.9%	—	—
IX	Retrognathic	Prognathic	Neutral	4	4.7%	4	11.4%
X	Prognathic	Prognathic	↑	3	3.5%	1	2.9%
XI	Neutral	Prognathic	↓	2	2.3%	—	—
XII	Retrognathic	Prognathic	↑	2	2.3%	8	22.8%
XIII	Retrognathic	Prognathic	↓	1	1.2%	—	—
XIV	Neutral	Retrognathic	Neutral	1	1.2%	1	2.9%
XV	Prognathic	Neutral	↑	—	—	1	2.9%
XVI	Retrognathic	Neutral	↓	—	—	1	2.9%
Total				85	100%	35	100%

Max: Maxilla; Mand: Mandible; LAFH: Lower anterior facial height;↑: Increased; ↓: Decreased

The second subgroup was pure maxillary retrognathism and long LAFH and represented 15.3% of the total sample, which formed the third subgroup in the sample of Guyer *et al*.[6] and represented 14.3%. Whereas Guyer *et al*.[6] found that the most common subgroup was retrognathic maxilla, prognathic mandible and increased LAFH with 22.8%, which formed only 2.3% of the sample of this study, the second subgroup in their study was pure mandibular prognathism and neutral LAFH which formed 17.1%; while it formed the third subgroup in this study with 13%. The forth subgroup in this sample included neutral maxilla, neutral mandible and increased LAFH with 10.6%; whereas no case was found within this group in the sample

of Guyer *et al*.[6] The fifth subgroup included bimaxillary prognathism with neutral LAFH with 8.2% close to that found by Guyer *et al*.[6] The subgroups including neutral maxilla, neutral mandible with neutral LAFH, pure mandibular prognathism with decreased LAFH and combined maxillary retrognathism and mandibular prognathism with decreased LAFH, which were found in this study, did not present in the sample of Guyer *et al*.;[6] whereas the subgroups including maxillary prognathism and neutral mandible with increased LAFH and pure maxillary retrognathism with decreased LAFH were not found in this study; however they represented the last two subgroups in the sample of Guyer *et al*.[6]

The results of this study indicated that both skeletal and dento–alveolar components usually contribute to the production of most of Class III malocclusion in adolescents in a variable way. Some differences were found between the results of this study and other studies in different population, this is due to ethnic and individual variations, mean age, sample size and variation in the criteria of sample selection

CONCLUSION

Different types of Class III malocclusion exist. When the anteroposterior positions of the maxilla and mandible were considered, there were 7 possible subgroups; pure maxillary retrognathism was more common than pure mandibular prognathism.

When the lower anterior facial height (LAFH) was considered with both maxillary and mandibular position, 14 possible subgroups were found; the most common subgroup included subjects with pure maxillary retrognathism and normal (LAFH).

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