

Characteristics of dentofacial deformities in a Saudi population

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هدف البحث إلى تحديد، أولاً الصفات الوجهية السنية للمرضى السعوديين المرشحين لعادة الجراحة التجميلية للفكين. وذلك من حيث التوزيع التكراري وحسب المريض وثانياً تقييم امتداد النسيج الرخو والتعويض السنخي السني لتغطية الجزء القحفي التحتي المغيب.

شملت الدراسة 115 مريضاً أحري هم الفحص السريري والتحليل السيفالومتري، ودلت النتائج على أن ارتفاع الزاوية القحفية من الصنف الثالث كان من أكثر العيوب شيوعاً بين المرضى الطالين للاستشارة فيما يتعلق بالغيب الوجهي السني لديهم، تلي ذلك الصنف الثاني فالصنف الأول من العيوب القحفية بنسب مئوية بلغت 46.1% و 39.1% و 14.8% على التوالي.

أعتبر كل من بروز الفكين والانتسامة اللثوية وزيادة ارتفاع الجزء السفلي من الوجه كعيوب من الصنف الأول للعيوب القحفية.

The aims of the present investigation were first, to determine the dentofacial characteristics of Saudi patients attending orthognathic surgery clinic, their frequency, gender distribution and secondly to evaluate the extent of soft tissue and dentoalveolar compensation for the underlying deformed skeletal part. The study involved 115 patients on clinical examination and cephalometric analysis were carried out. The finding revealed that the most dominant facial characteristics of Saudi patients who requested clinical consultation regarding their dentofacial deformity were high angle skeletal Class III deformity followed by skeletal Class II then skeletal Class I deformity at 46.1%, 39.1% and 14.8%, respectively. Bimaxillary protrusion, 'gummy smile' and increased lower facial height were considered a major defect of skeletal Class I.

Introduction

Prevalence and frequency distribution of the different types of dentofacial deformity vary among races. Skeletal Class III deformity have a strong genetic basis with a recorded incidence of 1% to 5% in Caucasian population¹, and 13% in Asian population.² Whereas, skeletal Class II deformity was the most prevalent in white population of northern Europe.³ Proffit and White⁴ extrapolated from an existing data concerned with malocclusion in the United States that there is a total of 1.2 million individuals in the American population who suffer from skeletal defects that require surgical orthodontic treatment for satisfactory correction. Among them 57.38% have skeletal Class II malocclusions, 24.59% have skeletal Class III malocclusions, and 18.03% have long face syndrome mainly combined with Class II skeletal deformity.

Several investigators concluded that mandibular retrusion was the most common contributing factor in Class II malocclusion, while a small percentage of patients revealed maxillary skeletal protrusion.⁵ Sassouni⁶ found that skeletal Class III relationship could be associated with characteristics of two types of vertical disproportion either skeletal deep bite or open bite.

A few cephalometric studies were conducted in Saudi Arabia, which in general showed a tendency of bimaxillary protrusion and increased lower facial height among Saudis.⁷⁻⁹ In comparison with Western population, Saudi patients showed a tendency for bimaxillary protrusion and high frequency of skeletal class III malocclusion.¹⁰

An extensive review of previous literature indicated a lack of adequate information regarding what is the frequency distribution of dentofacial deformity present in Saudi patients requiring corrective jaw surgery, patients' most common dentofacial features and the extent of their dentoalveolar and soft tissue compensation. Such information will add to a proper understanding and planning of orthodontic/surgical management. It will also facilitate in assessing the resources required such as manpower, skill, time, facilities and materials.

The aims of the present investigation were first, to determine the dentofacial characteristics of Saudi patients attending orthognathic surgery clinic, frequency and their gender distribution and secondly, to evaluate the extent of soft tissue and dentoalveolar compensation for the underlying deformed skeletal part.

Materials and Methods

This study was conducted on 115 patients who attended the orthognathic surgery clinic of orthodontic division of the College of Dentistry,

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King Saud University, Riyadh. The sample included all patients, who were screened and listed in the waiting list for orthognathic surgery during the period from 1997 to 1999. All the patients were adult Saudis with obvious dentofacial deformities and were aged from 17 to 35 years. Patients had not previous history of orthodontic treatment, no cleft lip and palate or severe genetic disturbance. Patient's personal data, which included name, gender, age and social status were registered.

Cephalometric radiographs were taken as initial records for all involved patients. All cephalometric radiographs were checked for quality and standard head posture. Cephalometric analysis (COGS) developed by Burstone et al¹¹ was used to describe the horizontal and vertical relationship of the facial bones as well as the dentoalveolar relationships. In addition, Legan cephalometric analysis was used to describe the relationship of various parts of facial soft tissue.¹²

All lateral cephalometric radiographs were digitized by the author using Dentofacial Planner Plus 1.5 (software program*) which produced an integral cephalometric and facial imaging. Software claim accuracy and high resolution where measurements are calculated to the nearest 0.1mm or 0.1 degree. Pearson correlation and paired t-test were applied to detect method error.

Dentoalveolar compensation was assessed in the vertical and sagittal direction by both linear and angular measurements. Linear measurement was carried out from the tip of lower incisor perpendicular to mandibular plane (LI-Mp mm). Angular measurement was performed from the upper incisor with nasal floor (U1-NF) and lower incisor with mandibular plane (L1-MP). Cephalometric landmarks are presented in Fig. 1. For patients where dentoalveolar compensation exist, the finding was recorded as "Yes" and "No" if no dentoalveolar compensation existed.

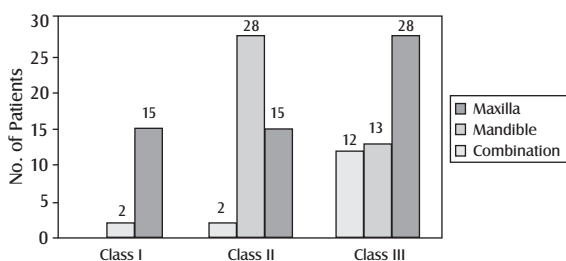


Fig. 1. Dentofacial deformity among a group of Saudi patients requiring corrective surgery.

*Dentofacial Software Inc. Toronto, Ontario, Canada M5X 1C9

The normal ratio of hard to soft tissue convexity (1:3) was used for assessment of soft tissue compensation.¹² When the ratio was more than 1:3, it indicated some sort of soft tissue compensation, and the finding was expressed as "Yes", and if no soft tissue compensation existed, the finding was expressed as "No". The patient's facial asymmetry was assessed clinically with the patient in an upright position, Frankfurt plane parallel to the floor, mandible in centric relation and soft tissue in repose.¹³ Premature contact and mandibular shift were taken into consideration during assessment of facial asymmetry. Dental floss was used to assess coincidence of dental and facial midline.

Results

Method error as tested by Pearson correlation and paired t-test showed high degree of correlation (0.911-0.998) with no significant difference between the two observations for all variables. Cephalometric data of skeletal and soft tissue measurements are presented in Tables 1 & 2.

The frequency distribution of skeletal deformity was found to be more toward Class III skeletal pattern followed by skeletal Class II, then skeletal Class I deformity being 46.1%, 39.1%, and 14.8%, respectively. In addition, analysis of vertical skeletal relationship revealed that 78.3% of the patients expressed high jaw angle while 21.7% of them showed low jaw angle (Table 3). Further analysis of skeletal Class III deformity patients revealed that the majority (52.8%) were due to a combination of protruded mandible and retruded maxilla, whereas 24.5% were only due to mandibular protrusion, and 22.6% were due to maxillary retrusion alone. On the other hand, 62.2% of skeletal Class II patients were mainly due to mandibular retrusion. Combination of maxillary protrusion and mandibular retrusion were recognized in 33.3% of skeletal Class II patients and only 4.4% were due to maxillary protrusion alone (Fig.3). Bimaxillary protrusion and increased lower facial height were typical features of patients with skeletal Class I deformity.

Anterior open bite was recorded in 62.6% of total sample, 50% of them were in combination with Class III skeletal deformity, while the remaining were in combination with skeletal Class II and Class I deformity (29.1% and 20.9%, respectively). Clinical examination of facial asymmetry revealed that 24.3% of the total sample

Table 1. Cephalometric data of skeletal measurements.

Skeletal Measurements	Norm	Skeletal Class I (14.8%)		Skeletal Class II (39.1%)		Skeletal Class III (46.1%)	
		Range	Mean	Range	Mean	Range	Mean
Horizontal							
N-APg ^o	3.9	-1.2 → 9.1	6.4	18.3 → 30.4	24.2	-28.1 → -3.3	15.6
N-A mm	0.0	-1.3 → 3.6	2.7	1.4 → 3.9	3.7	-16.0 → -1.2	-9.9
N-B mm	- 5.3	-8.2 → 1.4	-3.2	27.8 → -12.7	-26.9	1.4 → 9.2	6.3
N-Pg mm	- 4.3	-8.4 → 4.2	-4.1	28.9 → -14.3	-26.2	1.9 → 10.1	7.2
Vertical							
N-ANS mm	54.7	60.1 → 64.2	62.1	53 → 61.9	56.4	54.7 → 64.6	58.1
ANS-Gn mm	68.6	70.1 → 93.7	89.4	64.4 → 82.2	78.2	64.8 → 81.2	73.2
PNS-N mm	53.9	58.9 → 63.3	61.4	54.2 → 59.2	58.2	53.9 → 66.7	59.9
MP-HPo	23	27.5 → 40.9	37.9	23 → 67.6	47.9	19.1 → 44.5	32.8
Max-Mand							
PNS-ANS mm	57.7	53.4 → 56.7	55.1	52.3 → 57.9	55.7	50.1 → 57.5	51.7
Ar-Go mm	52	52.1 → 60.1	59.2	23.9 → 55.4	45.6	51.2 → 61.1	57.1
Go-Pg mm	83.7	81.4 → 85.0	83.6	51.7 → 67.4	59.6	91.6 → 94.9	92.8
B-Pg mm	8.9	8.1 → 8.9	8.4	5.1 → 7.9	7.2	12.3 → 14.1	13.2
Ar-Go-Gn ^o	119.1	119.3 → 139	129.9	112 → 169.2	145.3	118.1 → 154	149.4

Table 2. Cephalometric data of soft tissue measurements.

Skeletal Measurements	Norm	Skeletal Class I (14.8%)		Skeletal Class II (39.1%)		Skeletal Class III (46.1%)	
		Range	Mean	Range	Mean	Range	Mean
G-N-Pgo	12	10.3 → 14.9	12.6	18.3 → 36.4	25.1	8.2 → -9.5	-4.7
G-Sn mm	6	5.1 → 6.9	6.1	2 → 13.7	7.4	-5.7 → 8.3	4.4
G-Pg` mm	0	-1.9 → 2.4	0.9	-33 → -10	-23.9	-5.9 → 19.5	8.3
G-Sn mm	71.3	73.7 → 87.4	80.8	70.7 → 88.5	79.9	70.4 → 91.1	81.1
Sn-Me` mm	75	79 → 98.6	87.4	61.8 → 85.4	79.5	73.8 → 91.5	85.9
Cm-Sn-Lso	102	77.4 → 135	99.2	67.1 → 122.6	97.5	66.9 → 107.7	92.3
Ls(Sn-Pg`) mm	3	3.1 → 8.1	5.2	3.7 → 9.9	7.1	-0.6 → 4.6	3.2
Li(Sn-Pg`) mm	2	5.9 → 9.8	6.4	0.6 → 13.1	6.9	3.2 → 11.3	7.7
Si-(Li-Pg`) mm	4	3.9 → 7.1	4.9	5.5 → 10.5	8.4	1.2 → 6.8	4.4
Stms-Stmi mm	0-2	0.7 → 5.1	4.2	0.6 → 16.9	4.2	0.6 → 7.4	4.9

had obvious facial asymmetry, almost equally distributed between skeletal Class III and Class II. (Table 4)

A large number of patients in this study have shown various degrees of dentoalveolar as well as soft tissue compensations for the underlying deformed skeletal part (78.3% and 66.1%, respectively). However, it was frequently noted that compensations failed to mask the severity of skeletal deformity. Soft tissue compensation was

mainly manifested in the subnasale region in skeletal Class III patients.

Gender distribution among the present sample indicated that 58.3% of the patients were males and 41.7% were females. In addition, the majority of patients were single (92.2%), and 7.8% were married. The age of the investigated subjects ranged from 17 to 35 years with a mean of 21.4 years old.

Table 3. Frequency distribution of vertical skeletal relationship among different class of malocclusion (n = 115).

Classification of malocclusion		High angle	Low angle
Class I	number percent (%)	17 100.0%	0.0 0.0
Class II	number percent (%)	32 71.1%	13 28.9%
Class III	number percent (%)	41 77.4%	12 22.6%
TOTAL		90 78.3%	25 21.7%

Table 4. Frequency distribution of anterior open bite and facial asymmetry among the different class of malocclusion (n = 115)

Type of deformity	Class I	Class II	Class III	TOTAL
Anterior open bite Number Percent (%)	15 20.9%	21 29.1%	36 31.3%	72 62.6%
Facial asymmetry Number Percent (%)	0.0 0.0	14 12.15%	14 12.15%	28 24.3%

Discussion

The study sample included all patients (115) that were assigned for orthognathic surgery at the College of Dentistry, King Saud University, Riyadh, during the period between 1997 and 1999. Dentofacial deformity patients who had undergone orthodontic treatment were not included in the present sample, since alteration might have occurred in vertical length and/or in axial inclination of teeth, which might interfere with the measurement of dentoalveolar compensation. Cleft lip and palate or other severe genetically disturbed patients were also excluded from the present sample. This is due to the difference in their treatment strategies and underlying cause of the deformity.⁴

This measurements which are among the most specific cephalometric analysis as mentioned literature for orthognathic surgery are COGS analysis, which was developed by Burstone¹¹ for hard tissue analysis and the one by Legan et al¹² for soft tissue analysis. Both COGS and Legan analyses were used in this study to evaluate dentofacial deformity.

The results revealed that the majority of patients who sought clinical evaluation regarding

their dentofacial deformity were diagnosed as high jaw angle Class III skeletal deformity followed by Class II skeletal deformity. This finding is in contrast with the findings reported by Proffit et al⁴ on American sample where they found that Class II high jaw angle the most frequent type of facial deformity was followed by skeletal Class III deformity. The findings may suggest that Saudi patients with skeletal Class III deformity seek clinical evaluation more than the American population. It might also indicate that the percentage of different types of dentofacial deformity indeed do vary among different ethnic groups. Furthermore, skeletal Class III deformity patients in this study were mainly a result of a combination of protruded mandible and retruded maxilla. A combination of defective mandible and maxilla add to the exaggeration of the deformity, which might explain the increased number of skeletal Class III patients seeking clinical consultation. Toms⁹, on a similar ethnic group, found that a protruded mandible was the main cause of skeletal Class III patients. The difference between the two investigations is most likely due to a difference in the target group. This study concentrated on patients with obvious skeletal deformity, whereas Tom's study was done on ordinary orthodontic patients.

Facial asymmetry was shown in 24.3% of the patients and was found equally distributed between Class III and Class II facial deformities. It seems to indicate that dentofacial deformity in the saggital direction tend to be combined with tender deformity in either vertical and/or transversal direction. For example, skeletal Class II or III deformity patients were often combined with facial asymmetry or increased lower facial height. Bimaxillary protrusion, increased lower facial height and gummy smile were recorded as common features in Class I skeletal deformity. This is in agreement with Proffit et al.⁴

When the total number of patients involved in this study is considered, skeletal Class II patients recorded lower frequency (39.1%) compared to skeletal Class III (46.1%). This may be due to the fact that patients with skeletal Class II could hide their skeletal defect either by forward protrusion of the mandible (Sunday bite) or by camouflaging their defect through growing a beard (in male patients), which in turn make them more socially accepted than individuals with a long face or skeletal Class III. The main cause of skeletal Class II deformity in the present sample was due to mandibular retrusion (62.2%), and this corresponded well with findings by Hunter¹⁴ and

McNamara¹⁵.

Assessment of dentoalveolar compensation was carried out for each patient. Anterior teeth showed significant compensation in the sagittal direction especially in skeletal Class III patients. This was confirmed by the anterior proclination of the maxillary frontal teeth and posterior retroclination of the mandibular frontal teeth. This is in agreement with the findings of Toms.⁹ In skeletal Class II deformity, dentoalveolar compensation was not manifested as much as seen in skeletal Class III deformity, whereas in patients with anterior open bite, dentoalveolar compensation was manifested by over eruption of the upper and lower incisors.

Conclusions

1. Most of Saudi patients who requested clinical consultation regarding their dentofacial deformity were single and belong to an age group ranging from 17-35 years.
2. The dominant dentofacial characteristic of Saudi patients who required corrective jaw surgery was high angle skeletal Class III deformity (46.1%), followed by skeletal Class II, (39,1%) and class I deformity (14.8%).
3. Patients who sought consultation in the orthognathic clinic revealed severe dentofacial deformity that was not masked by either soft tissue or dentoalveolar compensations.

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