Original Article - Retrospective Study

A Retrospective Analysis of Dentofacial Deformities and Orthognathic Surgeries

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Abstract

Background: Information regarding the prevalence of surgical osteotomies used for the correction of dentofacial deformities in Iran is lacking. **Materials and Methods:** This retrospective cross-sectional study assessed the distribution of orthognathic surgeries performed (2011–2015) at major University hospital in Iran. Records of 103 orthognathic surgery patients were assessed (58 female, 45 males, aged = 23.47 [6.44] years). **Results:** Class III malocclusion (incisor classification, 45.6%) and Class II skeletal pattern (based on ANB angle, 51.5%) were the most prevalent type. Overall, 4.8%, 51.5%, and 43.7% of subjects had Class I, II, and III sagittal skeletal patterns, respectively. The most prevalent (66%) osteotomy was the bimaxillary osteotomy. The frequencies of reported and corrected asymmetries in the lower third of the face (35%) were similar among patients with different malocclusions ($\chi^2 = 4.134$, $P = 0.127$) or sagittal skeletal patterns ($\chi^2 = 2.133$, $P = 0.344$), as well as between Class II and III malocclusions ($P = 0.125$) or sagittal skeletal patterns ($P = 0.149$). **Conclusion:** Compared to Class II subjects, Class III (malocclusions or sagittal skeletal patterns) subjects had more bimaxillary osteotomies, indicating the higher prevalence of skeletal discrepancies affecting both jaws in Class III subjects.

Keywords: Dentofacial deformity, facial asymmetry, malocclusion, orthognathic surgery, prevalence

Introduction

The exact prevalence of significant dentofacial deformities that requires orthognathic surgery as a part of definitive treatment is not quite clear.[1] However, looking at the information collected about the severe and extreme forms of malocclusions (overjet> 7mm, reverse overjet> 3 mm, openbite > 3 mm) it can be estimated that about 5% of the UK or USA population present with dentofacial deformities that need orthognathic surgery as a part of their definitive treatment.[1,2] The estimated prevalence associated with a degree of underestimation because of the compensated malocclusions in patients with dentofacial deformities.[1] Orthognathic surgery describes several surgical procedures on either or both of the mandible or maxillae to realign the jaws into a more acceptable (normalized) or functional relationship. This often includes a course of orthodontic treatment before and after orthognathic surgery. Patients with dentofacial deformity frequently present with facial asymmetry and previous reports indicate that about 21%–67% of patients with prognathia or retrognathia had facial asymmetries,[3-6] with the chin deviation being the most remarkable feature of asymmetry.[4] In one study, deviation of the lower face was more common, and greater in length than that of the upper face (5%) as well as the middle face (36%),[7-9] and 74% of asymmetrical orthognathic patients had chin deviation.[4] According to Farkas, the incidence of periocular asymmetry was <2% in the normal population, and the periocular tissues were more symmetric than the nose (7%) or mouth (12%).[10,11]

Information regarding the prevalence of surgical osteotomies used for dentofacial deformities in Iran is lacking, and therefore, the aim of the present study was to assess, retrospectively, the type of orthognathic surgeries and dentofacial deformities treated

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in a University setting and affiliated hospitals. A secondary aim was to assess the frequency of asymmetries of lower third of the face in the present sample as reported by the treating clinician, such as chin deviation, and its relationship with different malocclusions and skeletal patterns (sagittal and vertical).

Null hypothesis

The null hypothesis was that the frequency of reported and corrected asymmetries of lower third of the face was different among subjects with different malocclusions or sagittal skeletal patterns.

Materials and Methods

A retrospective study was conducted on 103 individuals (58 females and 45 males, 16–45 years, mean [standard deviation] age = 23.47 [6.44] years) who had orthognathic surgery in Isfahan University of Medical Sciences (IUMS) or affiliated hospitals. The study material for the present study included the relevant records (pretreatment photos, cephalogram X-rays, and study casts), representing a period between September 2011 to June 2015. Orthognathic patients with cleft lip-palate or syndromes were excluded from the study.

Variables measured and recorded

Skeletal sagittal and vertical relationships

The cephalometric variable of ANB angle (A point [subspinale]-nasion-B point [supramentale]) was used to measure the relative position of the maxilla to mandible [Figure 1]. The ANB angle can be also calculated from the formula: ANB = SNA − SNB.

The ANB angle was used to classify the skeletal relationship between maxilla and mandible relative to the anterior cranial base (the line joining the Sella and Nasion) as follows; Class I (1< ANB <4), Class II (ANB >4), and Class III (ANB <1).

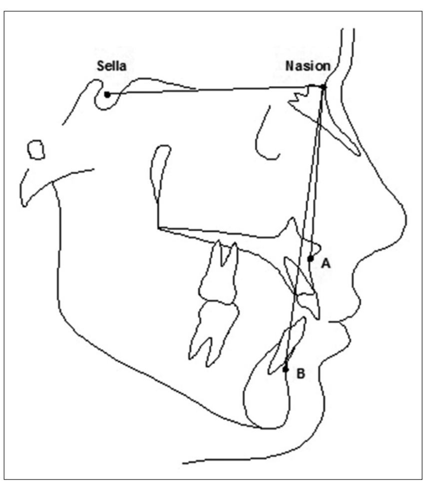

Figure 1: The ANB angle was used to classify the sagittal skeletal relationship as follows: Class I (1< ANB <4), Class II (ANB >4), and Class III (ANB <1)

The lower anterior face height percentage (ANS-Me/N-Me, 53%–57%[12]) was calculated or extracted from the records and used for the assessment of the vertical dimension.

Malocclusion

This was classified based on the British standard incisor classification[13] as follows:

- Class I, the lower incisal edges occlude with or lie immediately below the cingulum of the upper incisors
- Class II Division I, the lower incisal edge occludes behind the cingulum of the upper central incisors, and the upper incisors are proclined
- Class II Division II, the lower incisal edge occludes behind the cingulum of the upper central incisors, and the upper incisors are retroclined
- Class III, the lower incisal edge occludes in front of the cingulum of the upper incisors.

Significant facial asymmetry in the lower third of the face was recorded, if it was reported as a part of orthognathic correction by the treating surgeon. This was also reconfirmed after examining the available posteroanterior cephalometric radiographs and frontal photo views.

Osteotomy type

This was classified broadly as Le Fort I, bilateral sagittal split osteotomy (BSSO), bimaxillary osteotomy, and genioplasty. The types of surgical movements such as advancement, setback, and the impaction of maxilla were also recorded.

Statistical analysis

The Chi-square test was used to determine the differences in type of osteotomies as well as the asymmetries of the lower third of the face among malocclusions and sagittal skeletal patterns. $P < 0.05$ was considered statistically significant.

Results

We did not identify any orthognathic patients who had orthognathic surgery due to medical ground (sleep apnea). The rigid fixation was used for all patients. Class III malocclusion and Class II skeletal pattern were the most prevalent type (45.6% and 51.5%, respectively) in the present orthognathic sample. There were 9, 42, 5, and 47 subjects with Class I, Class II Division I, Class II Division II, and Class III malocclusions, as well as 4.8%, 51.5%, and 43.7% of subjects

Table 1: Assessment of vertical dimension in orthognathic subjects according to the malocclusion type

Malocclusion	Vertical assessment			Total
	Short face	Average	Long face	
Class I	0	2 (13.4)	7 (9.9)	9 (8.8)
Class II	16 (94.1)	5 (33.3)	26 (36.6)	47 (45.6)
Class III	1 (5.9)	8 (53.3)	38 (53.5)	47 (45.6)
Total	17	15	71	103

with Class I, Class II, and Class III sagittal skeletal bases, respectively. Vertical skeletal assessment revealed that 16.5%, 14.6%, and 68.9% had short, average, and long face profiles, respectively [χ^2 = 19.519, df = 4, P < 0.001, Table 1].

In this study, asymmetry in the lower third of the face was reported and corrected in 35% (n = 36) of the sample. As shown in Table 2, the frequency of reported and surgically corrected asymmetries was not different among different malocclusions (χ^2 = 4.134, df = 2, P = 0.127) and sagittal skeletal patterns (χ^2 = 2.133, df = 2, P = 0.344) as well as between Class II and Class III malocclusion/sagittal skeletal patterns (P > 0.05). Therefore, the null hypothesis for this study was fully rejected.

Table 2: Distribution of the asymmetries of the lower third of face in the sample according to the malocclusion type and sagittal skeletal pattern

	Malocclusion			Total
	Class I	Class II*	Class III*	
Asymmetry				
No	4 (44.4)	35 (74.5)	28 (59.6)	67 (65)
Yes	5 (55.6)	12 (25.5)	19 (40.4)	36 (35)
Total	9	47	47	103
	Sagittal skeletal pattern			**Total**
	Class I	**Class II****	**Class III****	
Asymmetry				
No	3 (60)	38 (71.7)	26 (57.8)	67 (65)
Yes	2 (40)	15 (28.3)	19 (42.2)	36 (35)
Total	5	53	45	103

The frequency of asymmetries was not different among different malocclusions (χ^2=4.134, df=2, P=0.127) and sagittal skeletal patterns (χ^2=2.133, df=2, P=0.344). *When Class II and Class III malocclusions were compared the difference was not significant (χ^2=2.3584, P=0.125), **When subjects with Class II and Class III sagittal skeletal patterns were compared the difference was not significant (χ^2=2.0814, P=0.149)

The most prevalent type of orthognathic surgery was the bimaxillary type osteotomy (66%). Bimaxillary osteotomy was used in 37 (78.7%) of Class III and 25 (53.2%) of Class II malocclusions. Considering the sagittal skeletal relationship, 80% of patients with Class III and 43.4% of Class II skeletal bases had bimaxillary osteotomy.

Le Fort I osteotomy was used in 73.7% (n = 76) of orthognathic procedures in the present sample; 42 patients (89.3%) with Class III, and 27 (57.4%) with Class II malocclusions. Mandibular osteotomies, including BSSO, were used in 42 (89.3%) of Class III malocclusions, and 45 (95.7%) of Class II malocclusions. Genioplasty was used in 12 (11.6%) subjects and in all patients in combination with other procedures. Table 3 shows the osteotomies distribution among different malocclusion (χ^2 = 132.855, df = 28, P < 0.001).

Discussion

To the best of our knowledge, the present study is the first reporting on the characteristics of performed orthognathic procedures in a university-affiliated hospital in Iran. We assume the number of performed orthognathic surgeries in the city of Isfahan (Iran) to be higher that what we reported as we did not have access to the data in hospital not affiliated with the IUMS or private clinics. The dentofacial deformity is defined as a deviation from normal facial proportions

Table 3: Distribution of different osteotomies in the sample according to the malocclusion type (χ^2=132.855, df=28, P<0.001)

Osteotomy type/malocclusion	Class I	Class II	Class III	Total
Single jaw osteotomy				
Maxillary impaction	1	2	0	3 (2.9)
Maxillary advancement	0	0	4	4 (3.9)
[a]SARPE	0	0	1	1 (1)
Mandibular advancement	0	17	0	17 (16.5)
Mandibular advancement + genioplasty	0	2	0	2 (1.9)
Mandibular setback	0	0	4	4 (3.9)
BSSO[b]	2	0	1	3 (2.9)
BSSO + genioplasty[b]	0	1	0	1 (1)
Double jaw osteotomy				
Maxillary impaction + mandibular advancement	2	21	1	24 (23.3)
Maxillary impaction + mandibular setback	1	0	10	11 (10.7)
Maxillary impaction + genioplasty	0	4	1	5 (4.8)
Maxillary impaction + BSSO[b]	2	0	0	2 (1.9)
Maxillary advancement + mandibular setback	0	0	21	21 (20.4)
Maxillary impaction and advancement + mandibular setback	0	0	1	1 (1)
Maxillary advancement + mandibular setback + genioplasty	1	0	3	4 (3.9)
Total	9	47	47	103 (100)

[a]SARPE = Surgically assisted rapid palatal expansion; [b]BSSO = Bilateral sagittal split osteotomy; BSSO was mainly used to correct the mandibular asymmetry.

and dental relationships that are severe enough to be handicapping.[14] Individuals with dentofacial deformities may experience problems with chewing normally, or having difficulty comfortably bringing their lips together, swallowing, speaking, or even breathing (sleep apnea).

The most prevalent malocclusion in the present sample was the Class III malocclusion (45.6%) followed by Class II Division I (40.7%). The Class II skeletal pattern was the most prevalent finding in the present sample, accounting for nearly half (51.5%) of the cases. The Class III malocclusion/sagittal skeletal pattern can be due to hypoplastic maxillae, prognathic mandible, or a combination of both, leading to a concave profile.[14,15] In addition, Class III individuals can present with a short anterior cranial base with an acute saddle angle, a normal, excessive, or deficient vertical facial proportions along with proclined maxillary incisors and retroclined mandibular incisors.[14,15]

The dominance of Class III individuals in the present sample was similar to the findings of previous studies in the Brazil,[16] Saudi Arabia,[17] Hong Kong,[18] the UK,[18,19] Norway,[20] and the USA.[21] There seems to be a universal trend for more Class III individuals-seeking orthognathic surgery, compared to Class II individuals.[21] This finding suggests that a Class III individual may perceive to have more problems and therefore requests orthognathic surgery. We also noted that nearly 80% of Class III orthognathic patients had bimaxillary surgery, highlighting the presence skeletal disproportion in both jaws. Genioplasty was performed in 11.6% of the operated orthognathic cases and in combination with other procedures. Indeed, manipulation of the sliding segment in genioplasty allows for corrections of the horizontal, vertical, and transverse chin abnormalities, making genioplasty a very versatile technique.[22] However, reports suggest that many plastic surgeons, unlike oral maxillofacial surgeons, use alloplastic implants for chin augmentation genioplasty as it generally requires less operative time and is easier to accomplish,[22] despite various reported complication such as infection, chronic inflammation, extrusion, bone resorption, capsular contraction, displacement, and chin ptosis.[22]

Although symmetry is the fundamental goal of orthognathic surgery, tools for measuring this facial symmetry have been limited and subjective.[23] Similar to the present findings, some authors claimed that facial asymmetry was equally prevalent among skeletal Class I, II, and II patients;[24] however, other authors reported that asymmetry is most frequently associated with Class III malocclusions,[16,25] or less frequently associated with Class II.[4] The trend toward an increased incidence of facial asymmetry in the Class III population was interesting, but this was not statistically significant that could be due to the composition and size of our sample. We acknowledge that measurement bias can be possible in the subjective evaluation of facial asymmetry by treating practitioners (surgeons who reported surgical correction of asymmetry), and ideally, a standard reproducible examination method should be used in all case assessments.

Overall, compared to Class II subjects, orthognathic patients with Class III malocclusions or Class III sagittal skeletal bases had more bimaxillary osteotomies and tended to present with asymmetry, indicating higher presence of skeletal discrepancies in both jaws in Class III subjects. When the IOFTN used to asses the functional needs in the present sample, subjects with Class III sagittal skeletal patterns or malocclusions demonstrated higher percentages of grade 5 IOFTN scores (62.2% and 59.6%), compared to Class II sagittal skeletal patterns or malocclusions (18.9% and 21.2%).[26] The distribution of functional needs between malocclusions or sagittal skeletal patterns were also different ($P < 0.01$).[26]

Conclusion

Based on the present sample, compared to Class II subjects, Class III (malocclusions or sagittal skeletal patterns) subjects had more bimaxillary osteotomies, indicating the higher prevalence of skeletal discrepancies affecting both jaws in Class III subjects.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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