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Orthodontic-surgical treatment of a Class II patient with mandibular hypoplasia and missing maxillary first molars: A case report

Gui-Feng Li, Cai-Xia Zhang, Juan Wen, Zi-Wei Huang, Huang Li

Abstract

BACKGROUND

Adult patients presenting with Angle Class II division1 malocclusions that have a strong skeletal etiology can be challenging for clinicians, particularly if accompanied by retrognathia of the mandible and a dolichofacial growth pattern.

CASE SUMMARY

In this case report, we describe the successful orthodontic and surgical management of a 20-year-old woman with an Angle Class II malocclusion with a severe anteroposterior skeletal discrepancy characterized by mandibular deficiency. She had incompetent lips, dental and skeletal and Class II malocclusion, high mandibular plane angle, mild mandibular crowding and two missing maxillary first molars. The treatment plan comprises: (1) Extraction of two mandibular second premolars to decompensate and retract mandibular incisors; (2) presurgical alignment, leveling and space closure of the teeth in both arches, and the second maxillary molars need to protract to close the maxillary space; (3) surgical treatment including a LeFort I osteotomy for maxillary retraction and rotation, a bilateral sagittal split osteotomy for mandibular advancement and rotation and a genioplasty for correctting the skeletal deformities; and (4) postsurgical correction of the malocclusion.

CONCLUSION

The patient's facial esthetics was significantly improved and a desirable occlusion was achieved after 16 mo treatment. Follow-up records after 2-years were stable in both esthetics and function.

Key Words: Orthodontic-surgical; Class II; Mandibular hypoplasia; Case report

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Core Tip: In this case report, we describe a combined surgical/orthodontic diagnosis and treatment of an Angle Class II, division 1 malocclusion with a severe retruded mandible and a vertical growth pattern and discuss the pros and cons of this approach.

The patient's chief concern washer retrognathic mandible, difficulty with lip closure and two missing maxillary first molars. These problems were satisfactorily relieved through comprehensive orthodontic treatment by closing the spaces of missing maxillary first molars through the maxillary second molars forward movement and retracting the proclined mandibular incisors, and orthognathic surgery for maxillary impaction, mandibular advancement and genioplasty. After the combined treatment, her retrognathic mandible was more forward, and the patient could close her lips effortlessly. And the genioplasty assisted in achieving a harmonious profile.

INTRODUCTION

Adult patients presenting with Angle Class II division1 malocclusions that have a strong skeletal etiology can be challenging for clinicians, particularly if accompanied by retrognathia of the mandible and a dolichofacial growth

pattern. As one of the important manifestations of class II malocclusion, mandibular hypoplasia can result from many congenital deformities and secondary reasons, including trauma, infection or bad habits during early childhood. Besides, condylar growth restriction resulted from arthritis, idiopathic condylar resorption (ICR), or condylar injury may also lead to mandibular hypoplasia. ICR is a disease which is occurred almost completely within young women, which results in mandibular deficiencies, causing a shorter mandibular ramus and body, and a vertical growth pattern[1]. Besides different degrees of facial deformity, mandibular deficiencies can also damnify breathing and occlusal function[2].

For correcting Class II malocclusions manifested as mandibular hypoplasia, many things such as the skeletal components and the patient's demands should be considered before undertaking any treatment protocol. Mandibular distraction osteogenesis (MDO) is becoming an attractive treatment choice for young patients[3]. The gradual lengthening of the mandibula and surrounding soft tissue of MDO makes the relapse decrease comparing with traditional orthognathic procedures[4]. However, for adult patients, secondary orthognathic surgery is usually needed after MDO because of the decreasing capacity for self-adaptation of the occlusal relationship. Furthermore, the disturbance to life and work of the devices of MDO is also a challenge for adults. Many adults prefer traditional orthognathic surgery to achieve their treatment goals. What's more, for the patients of mandibular hypoplasia resulted from ICR, the treatment is advised to operatewhen ICR no longer is active, and doctors should pay close attention to the position of the condyle during and post the treatment.

This case report describes a combined surgical/orthodontic treatment of an Angle Class II, division 1 malocclusion with a severeretruded mandible and avertical growth pattern and discuss the pros and cons of this approach.

CASE PRESENTATION

Chief complaints

This patient was a 20-year-old woman with an Angle Class II malocclusion and a severe vertical growth pattern with lip protrusion. Her chief concerns were her retrognathic mandible, difficulty with lip closure and two missing maxillary first molars.

History of present illness

Extraction of two maxillary first molars because of deep cavitiesone year ago.

Personal and family history

The patient denied any family history of present illness.

Physical examination

Pretreatment facial photographs showed a symmetrical face, a severe convex profile, protrusion of upper and lower lips, and hyperactivity of the mentalis muscle. The oral examination showed an Angle Class II Division 1 malocclusion with mandibular retrusion and two missing maxillary first molars (Figure 1). Model analysis showed 5mm crowding in the lower arch, and a large overjet of 6 mm. No temporomandibular joint (TMJ) disorder symptoms or signs were observed in the clinical examination or the questionnaire. But there was TMJ click during her teenager.

Imaging examinations

Cephalometric analysis presented a skeletal Class II malocclusion (SNA, 81.2; SNB, 70.2; ANB, 11), a high mandibular plane angle (MP-SN, 45), retroclined maxillary incisors were (U1-SN, 97.2) and proclined mandibular incisors (L1-MP, 108.9) (Figure 2A-E; Table 1). Cone-beam computed tomography (CBCT) showed two missing maxillary first molars and four impacted third molars. There was erosion and flattening of the TMJ condyles bilaterally, and the joint spaces between the condyles and the glenoid fossae were small (Figure 2F-H).

FINAL DIAGNOSIS

Angle Class II division1 malocclusion associated with mandibular hypoplasia and missing maxillary first molars.

TREATMENT

Treatment objectives

The treatment objectives included: (1) Obtain a balanced facial profile; (2) obtain aligned dental arches; (3) close the spaces of both arches; (4) establish ideal overjet and overbite; and (5) achieve a stable occlusion.

Treatment alternatives

For this patient, a number of treatment alternatives were considered, including: (1) Camouflage orthodontic retraction of anterior teeth with temporary anchorage devices (TADs), (2) LeFort I osteotomy, (3) mandibular distraction osteogenesis (DO), (4) bilateral mandibular sagittal split osteotomy (BSSO), and (5) genioplasty.

The first alternative is a camouflage treatment. This choice could correct the occlusal relationship, but there would be little improvement of the retrognathic mandible. The patient and her family were keen to improve the profile, so this option was not considered.

Considering the extremely short mandible ramus and body, DO was recommended to the patient. This option was declined due to scar formation as well asitsdisturbance to life and work.

Overall, the suitable option for correcting the skeletal problem was traditional orthognathic surgery including a LeFort I osteotomy for maxillary impaction and rotation, a BSSO for mandibular advancement and rotation, and genioplasty for profile improvement. Considering the retroclinedmaxillary incisors, mesial second molars movement was suitable for closing the spaces of missing maxillaryfirst molars, TADs or Class III

elastics would be suitable for it. To retract the proclined mandibular incisors, extraction of 2 mandibular first premolar teeth was indicated. After careful examination, 5 mm periodontal pocketing was detected around the two second premolar teeth, so the final decision was extracting two mandibular second premolars.What's more, we advised her to extract the impacted third molars, through there was no disturbance to orthodontic treatment. And we had informed the risk of orthognathic surgery to TMJs, the patient gave informed consent.

Treatment progress

The total treatment included 3 phases. The initial one was pre-surgical orthodontic treatment over 8 mo. A self-ligating 0.022 × 0.028-in slot appliance system (Damon Q, Ormco, Orange, California, United States) was used in both arches. Preoperative dental alignment and leveling were achieved with sequential nickel-titanium arch wires. Then Class III elastics (1/8 inch, 3.5 oz; Ormco) was used for maxillary second molars mesialization and mandibular incisors retraction with 0.018 × 0.025-inch stainless steel archwires in both arches. To control the anterior dental torque, a reverse curve of Spee in maxillary arch 0.018 × 0.025-inch stainless steel wire was used during the space-closing procedure. After the torque of the mandibular incisors returned to normal, power chain elastics was used to close the remaining space (Figures 3-5).

Following pre-surgical alignment, the second phase of orthognathic surgery was operated to resolve the skeletal deformity. The operation involved a LeFort I osteotomy for maxillary impaction (3 mm for the anterior sides) and retraction (3 mm), a BSSO for mandibular advancement (8 mm) and rotation, and a genioplasty (advancement of 12 mm) for chin reconstruction. However,after the LeFort I osteotomyand the BSSO, there was an acute massive hemorrhage when genioplasty was going to performed. The surgeon decided to delay the genioplasty for her life safety. And an occlusal splint was

used to fix the reestablished jaw relationship for 4 wk *via* after surgery (Figures 6 and 7).

The postsurgery orthodontic therapy (the third treatment phase) lasted about 6 mo until an optimal occlusion was established. Asymmetry elastics (3/16 inch, 3.5 oz; Ormco) were immediately used after the orthgnathic surgery for a short period to coordinate the midline of upper jaw and lower jaw and prevent the skelatal relapse. During the postoperative orthodontic therapy, the genioplasty (advancement of 12 mm) was operated to solve chin reconstruction.

The total active treatment lasted about 16 mo. After debonding the fixed appliances, vacuum-formed retainers were used for retention. The patient was asked to wear them full time for 1 year and at night for the next 2 years. The patient was reviewed 2 years into retention.

OUTCOME AND FOLLOW-UP

The patient's orthodontic problems were remarkably improved. A pleasant and harmonious profile was established. Intraorally, both arches were well-coordinated and ovoid-shaped. An interdigitated occlusion with Class I canine and full class III molar relationships, and an optimal overbite and overjet was obtained (Figure 8).

The posttreatment CBCT showed that all tooth roots were parallel to each other, and there was no significant root resorption or bone loss. The TMJs showed no morphologic change compared with the pretreatment images. Cephalometric analysis presented a decrease of the ANB angle (from 11.0° to 1.9°), a procline of maxillary incisors (U1-SN°: From 97.2° to 99.4°), and a retrocline the mandibular incisors (L1-NB°: From 45.3° to 30.6°). An advancement of the mandible, a setback of the maxilla, and a counterclockwise mandibular rotation (SN-GoGn°: From 44.0° to 39.2°) were shown on the superimposition of pre and post treatment lateral cephalograms (Figures 9 and 10).

After two years of retention, the posttreatment occlusion was stable. There was no skeletal or dental relapse, and both the patient and her families were satisfied with the results (Figure 11).

DISCUSSION

The patient's chief concern washer retrognathic mandible, difficulty with lip closure and two maxillary missing molars. These problems were satisfactorily relieved through comprehensive orthodontic treatment by closing the spaces of missing upper first molars and retracting the proclined mandibular incisors, and orthognathic surgery for maxillary impaction, mandibular advancement and genioplasty. After the combined treatment, her retrognathic mandible was more forward, and the patient could close her lips effortlessly. And the genioplasty assisted in achieving a harmonious profile.

Compared with traditional orthognathic surgery, distraction osteogenesis (DO) has becoming an attractive alternative treatment for skeletal discrepancies in the craniofacial complex[5]. Doctors has used DO in both maxillary and mandibula in patients[5,6]. One advantage of DO is the relatively brief time in the operating room. However, the follow-up is extensive. Another interesting possible advantage is its minimum damage to the inferior alveolar nerve. It's reported that up to 10 mm of DO of the mandibula produced minimal effects on inferior alveolar nerve function compared with orthognathic surgery[7]. Furthermore, the stability of DO was much better in adult patients[8]. It has been reported that in patients with cleft lip and palate, the stability of DO was greater than LeFort I osteotomy for maxillary advancement[9,10]. And in the mandible, DO appears to be more stable than BSSO when movement greater than 7 mm is considered[11].

For this patient, she had an extremely short mandibular ramus and body with a decreased S-Go of 66 mm and decreased face height ratio of 60.1%. We recommended DO of mandibular ramus and body as an alternative to improve her profile. Besides, she had an increased occlusal plane angle of 23°.

Orthodontic treatment could be used to adjust the maxillary occlusal plane. And intrusion of upper incisors and extrusion of posterior teeth were common alternatives to flatten the steep occlusal plane. The amount of incisor intrusion varies between different researchers[12-15]. However, this patient did not show maxillary vertical excess or gummy smile, so excess incisor intrusion was not indicated. Molar extrusion was also contra-indicated. The steep maxillary occlusal plane could not be adjusted by orthodontic treatment, secondary orthognathic surgery after DO would be needed to adjust the occlusion. Considering the scar, protracted discomfort and disturbance to life and work, and secondary orthognathic surgery, she refused DO and chose the conventional, fast and convenient orthognathic surgery-LeFort I osteotomy, BSSO, and genioplasty.And she and her families were satisfied with the results.

As a growth center, the mandibular condyle can affect the mandibular shape, size and function and overall facial form secondarily. Conceptually, TMJ disabilities included undergrowth and overgrowth pattern. The undergrowth deformities such as idiopathic condylar resorption (ICR), juvenile idiopathic arthritis (JIA) associated condylar growth restriction, traumatic condylar injury or posttraumatic TMJ hypomobility, and the resection of the condyle because of tumors in children may result in mandibular hypoplasia[16]. ICR is well-documented but poorly-understood that predominantly affects young women, particularly during the pubertal growth spurt. It is characterized with a shorter mandibular condyloid process, ramus and body, and an increase facial vertical dimension resulted from bilateral and progressive volume loss of the TMJ condyles and mandibular rami. Although without standard guidelines for treatment of ICR by now, management of ICR should depend on the severity of condylar resorption and the activity of the disease. If ICR is inactivity and there is a reliable centric relationship provided from enough condylar mass, routine orthognathic

surgery can be opertated, however, condylar/ramus reconstruction is required with active ICR[17].

For this patient, we have noticed the bone mass loss and the flattening of the condyle of TMJ from CBCT images, and the clinical characteristic meets the criteria for ICR. We have recommended her to take MRI images of the TMJ in other hospitals because the equipment was not available in ours. But she delayed it because she had no symptoms in TMJ. There was a continuous white line of cortex on her two condyles of TMJ, we considered the resorption of condylar was at rest, ICR was inactive. Literatures have reported that conventional orthodontia and orthognathic surgery could be operated for the resultant deformity when the condylar resorption is quiescent[16]. We advised her to notice the symptoms of TMJ, with any discomfort she should go and check.

CONCLUSION

The efficient and successful correction of this adult skeletal Class II patient with mandibular hypoplasia relied on a comprehensive diagnostic protocol and a rational treatment design. Moreover, the combination of bimaxillary orthognathic surgery and genioplasty facilitate to improve the facial esthetics. This case report highlights a multidisciplinary cooperation to correct a severe dentofacial deformity for a patient-centered outcome.

Figure Legends

Figure 1 Pretreatment facial and intraoral images. A-D: Facial images; E-I: Intraoral images.

Figure 2 Pretreatment. A-E: Panoramic and lateral cephalometric radiographs; F and G: Pretreatment cone-beam computed tomography images; H: Temporomandibular joint images.

Figure 3 Facial and intraoral images during the presurgical orthodontic treatment. A-D: Facial images; E-I: Intraoral images.

Figure 4 Facial and intraoral images before surgery. A-D: Facial images; E-I: Intraoral images.

Figure 5 Cone-beam computed tomography images images before surgery.

Figure 6 Facial and intraoral images after surgery I. A-D: Facial images; E-G: Intraoral images.

Figure 7 Cone-beam computed tomography images after surgery I.

Figure 8 Facial and intraoral images after treatment. A-D: Facial images; E-I: Intraoral images.

Figure 9 Cone-beam computed tomography. A-F: Cone-beam computed tomography images after treatment.

Figure 10 Cephalometric superimposition of pre and post treatment lateral tracings.

Figure 11 Facial and intraoral images 2 years after debonding.

Table 1 Cephalometric analysis

Group/Measurement	Pretreatment	Presurgery	Posttreatment	Norm	Std Dev
SNA (°)	81.2	81.2	80.3	82	3.6
SNB (°)	71.2	70.5	76.9	80	3.2
ANB (°)	10.0	10.6	3.4	2	1.7
MP-SN (°)	46.2	49.3	40.4	33	4.2
Interincisal angle (U1-L1) (°)	107.7	114.4	131.0	131	8.5
IMPA (L1-MP) (°)	108.9	99.4	90.6	93	6.2
U1-SN (°)	97.2	96.9	98.0	101.4	6.0
Occ Plane to SN (°)	30.0	29.1	22.4	14	3.9
L1-NB (mm)	11.0	9.2	6.1	4	2.0
U1-NA (mm)	3.0	2.2	3.8	4	2.3
U1-NA (°)	16.0	15.8	17.7	22	5.9
L1-NB (°)	46.3	39.2	27.9	25	5.6
Pog-NB (mm)	-5.4	-3.1	1.8	-0.3	1.7
Soft tissue convexity (°)	118.7	119.7	132.9	143.3	4.0
Lower lip to e-plane (mm)	13.0	11.8	-3.7	-2	2.2
Upper lip to e-plane (mm)	8.7	8.3	-4.0	3	1.9

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