CASE REPORT

Orthodontic and surgical perspectives in management of a severe skeletal open bite

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SUMMARY

In orthognathic correction of skeletal discrepancy, different treatment options should be considered to give optimum results to the patient with minimal postoperative problems caused by extensive bi-jaw surgery. In a case of severe vertical dysplasia with a large open bite, the orthodontist with the help of advanced diagnostic tools such as imaging software had planned bi-jaw surgery. However, there was a difference in opinion with the oral surgeon who considered only single jaw surgery to get adequate results. The possibility of only maxillary Le Fort I surgery creating autorotation of the mandible was considered, as 0.5° of autorotation results with 1° of maxillary posterior segment clockwise rotation thus avoiding bi-jaw surgery. After performing the Le Fort I superior repositioning of maxilla, the mandibular autorotation was not adequate, so a mandibular bilateral sagittal split osteotomy (BSSO) for mandibular advancement had to be performed to achieve favourable results.

BACKGROUND

In this case where there is severe vertical dysplasia with large open bite, following treatment options were considered.

1. Only maxillary Le Fort I superior repositioning with autorotation of mandible.
2. Bi-jaw surgery—bilateral sagittal split osteotomy (BSSO) along with maxillary Le Fort I impaction.
3. Genioplasty—advancement of chin.

This report presents the treatment of open bite malocclusion with severe vertical skeletal dysplasia, the severity of which demanded an orthognathic bi-jaw correction.

CASE PRESENTATION

A 25-year-old male patient presented with the complaint that his upper and lower front teeth were not meeting and he was having problem biting food. No relevant medical and dental history was recorded.

Facial analysis revealed accentuated vertical skeletal dysplasia with anterior open bite. The patient also had a severe convex facial profile. Clinical examination revealed open bite with Angle's Class II molar relation, narrow maxillary arch, bilateral posterior cross bite, with lower midline shifted towards the patient's right side and moderate amount of crowding in the maxillary and mandibular anterior region (figure 1).

INVESTIGATIONS

Extraoral and intraoral photographs, study models, lateral cephalogram, orthopantomogram and video recording of the patient were conducted. Dolphin orthodontic imaging software was used for cephalometric analysis and treatment simulation.

DIFFERENTIAL DIAGNOSIS

Study model analysis confirmed bilateral posterior cross bite, with open bite of 8 mm, mandibular midline shifted 2 mm towards the patient's right side.

Cephalometric analysis revealed class II skeletal relationship (ANB=8.5°), maxillary retroposition (SNA=75°) and severe mandibular retrognathism (SNB=66.5°) in relation to anterior cranial base, dolichocephalic facial morphology and predominance of vertical facial growth pattern (Y-axis=67°). Maxillary incisors presented increased axial inclination and were protruded in relation to their alveolar base (L1 to NA=29° and L1 to NA=6 mm), mandibular incisors also showed increased axial inclination and were protruded in relation to their alveolar base (T 1 to NB=35° and T 1 to NB=11 mm; table 1).

TREATMENT

The main goals of the orthognathic treatment were to rotate the maxillary posterior segments upward and forward, and maxillary anterior segment downward and backward and to rotate the mandible anticlockwise to correct the open bite. This treatment plan was decided based on increased posterior maxillary height as was evident from the following cephalometric values (N-PNS, U6-NF-linear, PP-OP-angular). The aim of the pre-surgical orthodontic phase was to correct the dental disharmonies and the narrow maxillary arch in order to facilitate the skeletal correction. It was decided to avoid extractions in the lower arch, to decompensate because initially it was planned as a single jaw surgery case.

Initially, preadjusted edgewise orthodontic fixed appliance (MBT McLaughlin, Bennet & Trevisi Gemini 3M 0.022"×0.028" slot) was assembled for alignment, levelling of the teeth and expansion. The required dentoalveolar expansion was performed simultaneously with a removable expansion plate and canine tiebacks were given in the maxillary arch (figure 2). The treatment time for presurgical orthodontics was 9 months.

On the basis of facial analysis, surgery was planned and treatment outcome was simulated with a cephalometric prediction, which suggested bi-jaw surgery. From the oral surgeon's perspective, it was

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Figure 1 Pretreatment extraoral, intraoral photographs and lateral cephalogram.

suggested that single jaw surgery would suffice. However preparation and planning was carried out for single as well as bi-jaw surgery. Accordingly mock surgery was carried out and surgical splint was fabricated (figure 3). After completing Le Fort I impaction, the posterior maxillary dental height was reduced and the maxillary anterior segment was rotated in a downward and backward direction. The resultant autorotation of mandible

was not enough to fulfil treatment objectives. Thus, the second option of performing bi-jaw surgery had to be undertaken and performed accordingly for a successful outcome.

After surgery (figure 4), the patient came to the department for postsurgical orthodontics, which took 8–9 months. Settling elastics were given for the settling of the occlusion, canine torque was corrected and rotations in the mandibular anterior

Table 1 Cephalometric analysis values

Measurements	Normal values	Pretreatment	Post-treatment
Angular			
Sella-Nasion-Point A angle SNA	82	75	74
Sella-Nasion-Point B angle SNB	80	66.5	70
Point A-Nasion-Point B angle ANB	2	8.5	4
Mandibular plane-Frankfort Horizontal plane angle MP-FH	25	44	34
Angle of convexity	0	10	6
Y-axis	59.6	67	62
Palatal plane-Occlusal plane angle PP-OP	11	21	13
Occlusal Plane-Mandibular Plane angle OP-MP	14	18	16
Gonial angle	119	129	124
Incisor mandibular plane angle IMPA	90	99	96
Upper Incisor to Nasion-Point A angle $\perp$ 1 to NA	22	29	25
Upper incisor to Sella-Nasion angle $\perp$ 1 to SN	102	101	96
Lower incisor to Nasion-Point B angle T 1 to NB	25	35	32
Linear (mm)			
Nasion-Anterior nasal Spine N-ANS	54.7	55	54
Anterior nasal spine-Gnathion ANS-Gn	68.6	82	78
Nasion-Posterior nasal spine N-PNS	53.9	57	52
Gonion-Pogonion Go-Pog	83.7	69	78
U1-NF	30.5	33	33
U6-NF	26.2	33	29
Lower incisor-mandibular plane L1-MP	45	51	45
Lower molar-mandibular plane L6-MP	35.8	35	33

Figure 2 Presurgical intraoral, extraoral photographs and orthopantomogram.

teeth were corrected. The proclination of the upper anteriors was also corrected because of the combined effect of dentoalveolar expansion and clockwise rotation of upper anterior segment. Fixed bonded retention was delivered after appliance removal. The total treatment duration was 18 months.

OUTCOME AND FOLLOW-UP

At the end of the treatment, functional occlusion was observed with normal overjet, overbite and adequate intercuspation, with class I molar relation and class I canine relation bilaterally, nearly coincident midlines, normal maxillary and mandibular incisor proclination. Vertical skeletal dysplasia with open bite was eliminated, cephalometric measurements showed maxillary clockwise rotation and mandibular anticlockwise rotation contributing to improved facial profile. Maxillary and mandibular incisor axial inclinations were corrected (figures 5 and 6; table 1). The case could have been finished better but, as the patient was satisfied with the treatment results and not too keen to prolong the treatment, it was decided to debond the case.

DISCUSSION

Anterior open bite can be due to lack of eruption of anterior teeth but most often is caused by rotation of the jaws or excessive eruption of posterior teeth. On cephalometric analysis, the major indicators of a skeletal relationship that predispose an individual to open bite (the 'skeletal open bite' pattern) are a

short mandibular ramus and downward rotation of the posterior maxilla. Both tend to produce a downward-backward rotation of the mandible that increases anterior face height and separates the anterior teeth.¹ Open bite can be corrected in patients who are beyond the adolescent growth spurt with a multiloop edgewise technique, but the major effect is extrusion of anterior teeth rather than intrusion posteriorly.² Once excessive vertical development has occurred, orthognathic surgery is the only way to correct the jaw rotations and reduce anterior face height.

It is very important to understand the component of facial discrepancy in order to outline an accurate and effective treatment plan. The cephalometric analysis determines if the discrepancy is related to maxilla or mandible or both and in respect to all the three planes of space. It also determines how the discrepancy is associated with dental compensations.

Surgical orthodontic treatment combined with BSSO and intrusion of the molars using titanium screws can reduce surgical invasion by the avoidance of maxillary surgery and can be effective for correcting the facial profile and occlusion in open bite cases.³

Similar cases of open bite with a severe vertical dysplasia have also been treated by surgically assisted rapid palatal expansion.⁴ It was not warranted in this case as dental expansion was carried out by removable orthodontic appliance as an adjunct to presurgical orthodontics. Also, in rapid maxillary expansion

Figure 3 Mock surgery and surgical splint photographs.

Figure 4 Postsurgical intraoral, extraoral photographs and lateral cephalogram and orthopantomogram.

Figure 5 Pre-removal intraoral and extraoral photographs.

Figure 6 Post-removal intraoral and extraoral photographs.

because of downward and forward movement of the maxilla there is autorotation of mandible in a downward and backward direction thereby increasing the vertical dysplasia.

Mandibular distraction osteogenesis is also carried out in some cases instead of BSSO for mandibular advancement.⁵ However, it increases the mandibular plane angle hence was not recommended.

Genioplasty to increase the mandibular prominence is also suggested in some cases.^{4,5} It was not conducted in this case as the patient was happy with the outcome.

Superior repositioning of the maxilla by Le Fort I osteotomy is the most stable orthognathic procedure during the first postsurgical year. Although it is possible to correct open bite by mandibular ramus surgery as an isolated procedure, bi-jaw surgery generally is preferred when the mandible must be repositioned in patients with open bite. Superior repositioning of the maxilla is used to obtain the correct face height and mandibular ramus osteotomies are used to adjust the anteroposterior position of the mandible (usually, to further advance it) if it does not rotate into the correct position after the maxilla is moved.^{6,7}

Clinically, the overall improvement in facial appearance and the predictability and stability of the results have made this a most versatile and effective procedure when carried out with good planning, proper execution and attention to detail. In the hierarchy of surgical stability, maxillary impaction is among the most stable of all orthognathic surgical procedures.⁴

Therefore in such cases the viable options are only maxillary Le Fort I superior repositioning with autorotation of mandible or BSSO along with maxillary Le Fort I impaction, which was considered in this case.

Careful diagnosis and treatment planning combined with interdisciplinary discussions on planning the surgical aspects determine the success of orthognathic cases. It is said that orthodontists talk in millimetres and angles whereas the oral surgeon thinks in centimetres. Hence, periodic assessment of the patient through the treatment progress by both teams would ensure that the case falls on track. Attaining the presurgical goals with rigid arch wires in place and preparation of surgical splint are steps that need careful detailing. The presented case is an example of

good understanding between the specialists concerned as well as the patient.

Learning points

- Emphasis should be placed on a thorough understanding of facial discrepancy in orthognathic surgical treatment planning.
- In severe vertical discrepancy just maxillary surgery is not sufficient but bi-jaw surgeries give better results.
- Use of advanced diagnostic tools facilitates diagnosis and treatment planning.
- Orthodontist can be a team leader in such interdisciplinary treatments.
- Combination of orthodontic and orthognathic surgery can expand the scope of treatment delivery.

Competing interests None.

Patient consent Obtained.

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