

A Surgery-first Approach in Surgical-orthodontic Treatment of Mandibular Prognathism – A Case Report

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The conventional approach in orthodontic surgery treatment of dentofacial anomalies requires a varied period of pre-surgical orthodontic treatment. This presurgical period is considered to be important for adequate surgical treatment and stable results. This period is usually long bothersome for patients because dental decompensation is required and there is consequent deterioration of aesthetics and function, especially in cases of skeletal Class III occlusion. At Chang Gung Craniofacial Center, a surgery-first approach (SFA), i.e. minimal pre-surgical orthodontics, is one of the treatment choices for Class III patients. In this report, we present a 19-year-old man with mandibular prognathism, an anterior open bite and severe dental crowding treated with SFA. The patient received orthognathic surgery a week after bracing of the teeth. The operation and recovery were uneventful as well as the following orthodontic treatment. The total treatment time was only four months, much shorter than with the conventional approach. The patient benefitted from immediate improvement of the facial profile after surgery, and a much shorter total treatment, and the results were not compromised. We believe in selected cases, SFA is a good and effective treatment alternative. (*Chang Gung Med J 2010;33:699-705*)

Key words: mandibular prognathism, malocclusion, Angle Class III, orthodontics, orthognathic surgery, surgery-first approach

The general guidelines for contemporary treatment of dentofacial anomalies require a variable period of orthodontic preparation before orthognathic surgery (OGS) and a certain period of post-operative orthodontic treatment afterwards.⁽¹⁾ Presurgical orthodontic management includes leveling and aligning the arches, relieving crowding, creating proper inclination of incisors (decompensation), coordinating upper and lower arches and removing occlusal interference.^(1,2) It is believed that inability to decompensate dentition before surgery will compromise not only the surgical result but also the stability. It usually takes 6 months to two years to create an “ideal”

presurgical occlusion and this seems to be the longest period of the whole treatment course.^(3,4) Besides the long preparation time, other well-known disadvantages of presurgical orthodontic treatment include the possibility of aggravating dental caries and periodontal problems, worsening occlusal function and deteriorating facial esthetics, especially in class III patients.^(1,2)

At Chang Gung Craniofacial Center, some OGS cases were found to be manageable with almost no pre-surgical orthodontic treatment. Usually these cases showed only simple orthodontic problems, such as anterior crowding, and posterior occlusion

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could be established easily without preoperative orthodontics. These patients were braced just before OGS, usually less than two weeks. Surgical simulation on cephalometric tracings and model surgery were carried as usual for planning and fabrication of surgical splints. OGS was then performed to correct the facial profile. Periodic orthodontic adjustment was begun as soon as the patient's physical condition permitted after surgery, usually around two to three weeks. The minimal presurgical orthodontic preparation required in this treatment algorithm is called the surgery-first approach (SFA). In this report, a case of class III malocclusion with an anterior open bite and severe dental crowding is presented.

CASE REPORT

A 19 year-old man was referred to our craniofacial center seeking improvement of his long mandible and "horse-like" facial appearance (Fig. 1). He also complained about poor chewing efficiency

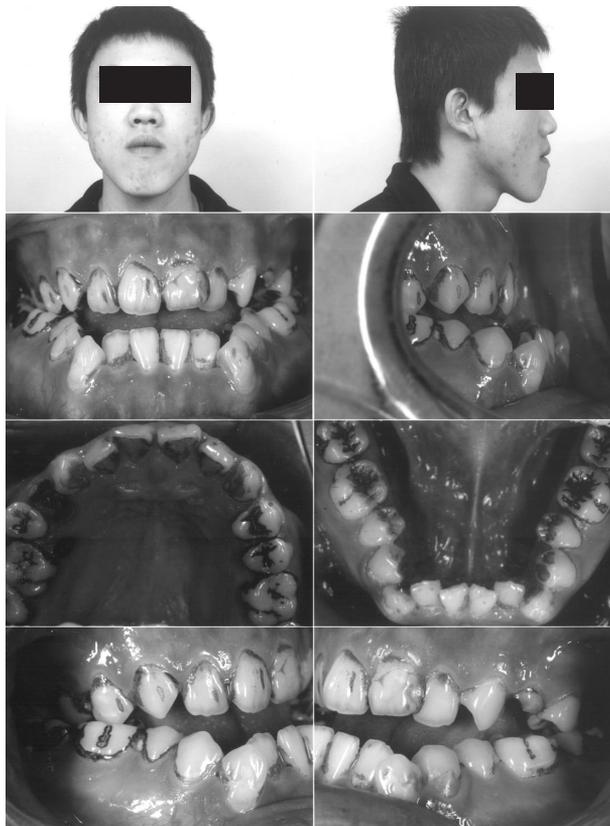


Fig. 1 Pretreatment extraoral and intraoral photographs.

and lip incompetence due to his open bite. He had no family history of a Class III facial appearance and no history of nasal allergy or mouth breathing. Photographs, radiographs and dental impressions were taken at his first visit, and a consultation with a detailed explanation was given a week later.

In the clinical examination, he had a straight facial profile with excess anterior facial height. No facial asymmetry was observed. The lips were hypotonic and showed incompetence at rest with a shallow mentolabial sulcus. The patient had passed his growth spurt according to cessation of his body height and his cephalometric radiograph also showed maturity of the skeleton. Occlusal examination showed bilateral Class III malocclusion with posterior cross-bite and anterior open-bite. The overjet and overbite were -6 mm and -4 mm, respectively. The midlines of the upper and lower dentition were not deviated and were coincident to the facial midline. Space analysis revealed moderate crowding in the upper and severe crowding in the lower dentition. The left upper first premolar was severely decayed and retained 1st primary molar roots were noted lingual to the left upper second premolar. Periodontal problems and temporomandibular joint disorders were not found.

The panoramic radiograph showed a good condylar contour and clear maxillary sinus. Cephalometric analysis showed an anterior positioned maxilla and mandible according to SNA and SNB values (Table 1). The mandibular plane was steeper and the gonial angle was higher than Chinese norms. The mandible exhibited a backward and downward rotation. The labiolingual inclination of the maxillary incisors was within the normal range but the mandibular incisors were extremely retroclined. From the above clinical and skeletal findings, the patient was diagnosed with skeletal Class III malocclusion with a long lower anterior facial height. Surgical correction was advised to achieve aesthetic and functional results in both the soft tissue and dental aspects.

After discussion between the orthodontists and surgeons, a surgical treatment plan was drawn up as follows:

1. Orthognathic surgery before orthodontic treatment.
2. A LeFort I posterior impaction by 3 mm, clockwise rotation of the maxilla with 3 mm

Table 1. Cephalometric Analysis

Skeletal analysis			
	Initial	Final	Chinese adult norm
Anterior-Posterior			
SNA	89°	92°	84° ± 3.7°
SNB	94°	88°	81.5° ± 3.7°
ANB	-5°	4°	2.5° ± 2.2°
NAP	-10°	3°	4.5° ± 5.0°
A-N Perp	1 mm	3.5 mm	1.0 mm ± 3.5 mm
Pog -N Perp	15 mm	3 mm	-2.3 mm ± 6.7 mm
Wits Appraisal	-20 mm	-6.5 mm	-1.0 mm ± 1.0 mm
SN-FH	2°	2°	7.0 ± 2.6°
Vertical			
SN-MP	34°	32°	29.1 ± 5.0
FMA	32°	30°	22.0 ± 5.0
SN-OP	11°	15°	14.4 ± 2.5
Soft tissue			
NLA	85°	110°	102.0° ± 8.0°
LL to E-line	2 mm	-0.5 mm	0.5 ± 2.0 mm
Dental analysis			
	Initial	Final	Chinese adult norm
U1-SN	114°	111°	109.9 ± 8.0°
U1-NA (Linear)	7.5 mm	4.5 mm	4.3 mm ± 2.7 mm
U1-NA (Angular)	22°	19°	22.8° ± 5.7°
L1-NB (Angular)	14°	31°	25.3° ± 6.0°
L1-NB (Linear)	6 mm	7.5 mm	4.0 mm ± 1.8 mm
FMIA	82.5°	60°	65.0° ± 8.5°
IMPA	63°	85°	99.2° ± 6.8°
U1-L1	148°	128°	121.9° ± 10.5°

of advancement at the ANS. This would augment the midface instead of lip protrusion and autorotate the mandible counterclockwise to decrease the lower facial height and to correct the anterior open bite at the same time.

3. A bilateral sagittal split osteotomy of the mandibular ramus to set back the mandible by 16 mm and to achieve a bilateral Class I molar relationship.
4. A 45-degree sliding genioplasty to advance the chin by 2 mm and shorten it by 2 mm at

the same time.

5. Extraction of 18, 28, 38, 48 during orthognathic surgery.

The patient was braced one week before OGS and dental impressions were taken. During model surgery, the upper and lower dental casts were put together with restoration of the Class I molar relationship and optimum dental interdigitation with minimal canine interference. A surgical splint was then fabricated. Two days before the operation, the surgical splint was fitted in with placement of a 0.016 x 0.022 inch super-elastic NiTi wire in the upper arch and a 0.18 inch NiTi wire in the lower arch.

The surgery was performed smoothly and the patient went home 3 days later without any complications. One week later, radiographs including panoramic and cephalometric films showed a good facial profile and correction of the anterior open bite. During the first two weeks after the operation, intermaxillary fixation (IMF) was applied to ensure post-operative stability. After release of the IMF, the patient started a semi-soft diet for another 3 weeks. The whole recovery course was uneventful.

After release of the IMF, the patient came back every three weeks for orthodontic adjustment and a lingual holding arch was placed. On the 5th orthodontic adjustment, three months after surgery, the dental crowding was almost totally relieved. After another two visits for finishing and detailing, all orthodontic braces were removed. The orthodontic results were maintained with fixed retainers and an invisible retainer. The total post-operative orthodontic treatment took only four months.

The patient and his family were quite surprised and happy with the dramatic facial profile improvement immediately after the operation and the very rapid completion of the orthodontic treatment. A symmetric, harmonious relationship of the facial soft tissue and a pleasant profile was obtained after treatment (Fig. 2). Lip competence was also achieved. Significant improvements in the vertical facial proportions and occlusal function were noted. Occlusal records revealed well interdigitated and aligned dentition. A Class I occlusion on both sides and a normal overjet and overbite were established. The panoramic radiograph revealed good root parallelism. Lateral cephalometric films showed proper labiolingual angulation of the upper and lower incisors and an improved position of the mandible

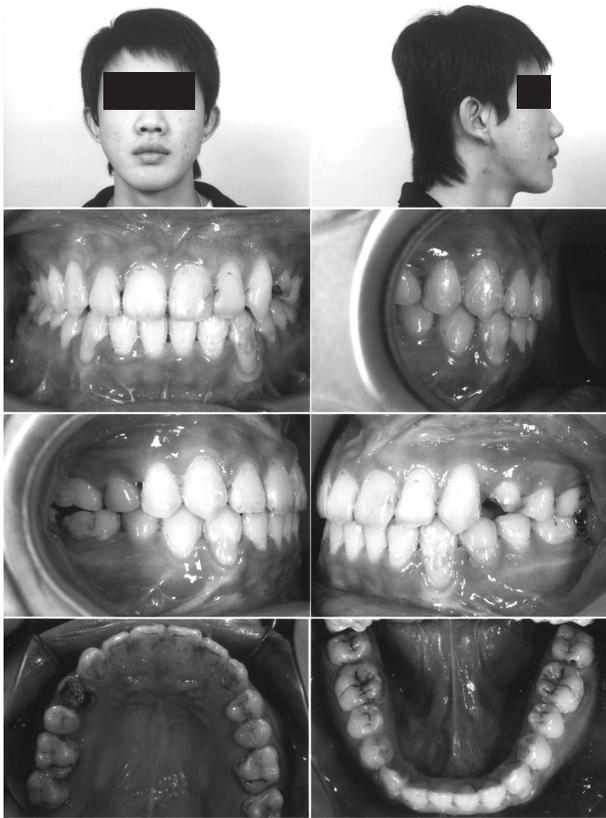


Fig. 2 Post-treatment extraoral and intraoral photographs.

(Fig. 3). Cephalometric tracings revealed that almost every value had been brought into the normal range (Table 1).

DISCUSSION

In the traditional combined orthodontic and surgical treatment of dentofacial anomalies, pre-surgical orthodontics is aimed at relief of dental crowding and decompensation. Its purpose is to provide stable occlusion, a proper position for the teeth and arch coordination after the operation.^(1,2) Pre-surgical decompensation takes the most time in the total treatment course, roughly around 6 months to 2 years, and varies among patients and orthodontists.⁽³⁻⁶⁾ During this period, patients may experience deterioration of both the facial profile and function.^(1,2,7)

In skeletal class III cases, the lower incisors are usually crowded and retroclined while the maxillary incisors are commonly flared out. One of the goals of presurgical orthodontics is to position incisors in a proper angulation to the jaw bone, so the surgeon can set back the jaw bones to their maximum.⁽²⁾ Sometimes extraction is required for retraction of the upper anterior teeth and relief of lower crowding. This also increases the time needed for pre-surgical preparation.

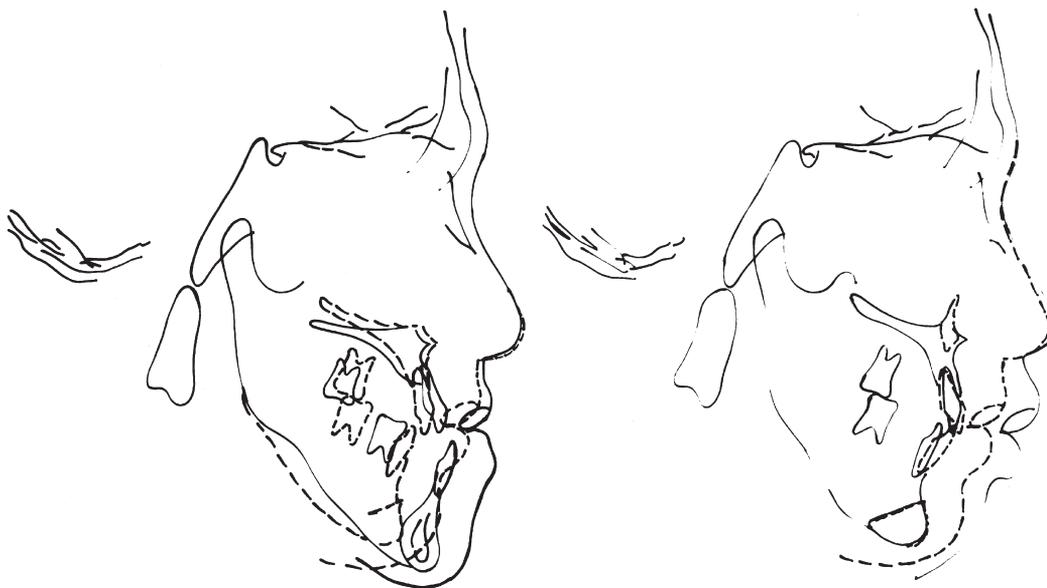


Fig. 3 Left: Superimposition of initial (solid line) and final (dotted line) cephalometric tracings. Right: Superimposition of immediate post-orthognathic surgery (solid line) and final (dotted line) cephalometric tracings.

The position of anterior teeth is important and related to the amount of mandibular setback.⁽⁸⁾ In SFA, restoration of a Class I molar relationship is considered first and adjustment of the anterior teeth is managed postoperatively. Problems with facial aesthetics, especially facial balance and chin position, are mainly managed by surgery. Deliberate rotation of the maxillo-mandibular complex can effectively change the relationship between the A point and B point as well as proper midface projection and provide enough setback of the chin point.⁽⁹⁾ A concomitant genioplasty to adjust lower face proportions also helps to achieve this goal.

The principles of orthodontics required in OGS cases are considered to be opposite to those of conventional orthodontics.^(1,2,7) As in the demonstrated case, SFA restores the facial profile and relationship of the jaw bones first. This immediately changes the facial appearance. Consequent orthodontic mechanics follow traditional principles and solve remaining problems on the basis of Class I occlusion and a near-normal facial profile.

The treatment course was quite short in this particular case, less than four months totally. The patient was young and healthy and had no metabolic disease interfering with alveolar bone health. Two reasons for this extraordinary clinical course are possible. The first reason might be the restored relationship between the jaws and facial soft tissue. Dental compensation of dentofacial anomalies which have developed during growth is considered to be a result of unbalanced force from soft tissue. Although the lip force applied on the lower teeth is quite light, its persistence is considered to be an effective force to move teeth and consequently retrocline the lower anterior teeth in Class III cases.⁽⁷⁾ In the conventional approach, because of the unsolved malposition of the mandible, it can be expected that heavier orthodontic force is required to oppose the balancing force to move the incisors out of its neutral zone. Contrarily in SFA, restoration of a proper jaw relationship is first achieved by OGS, and the teeth may move more effectively without the counteracting force from investing soft tissue.

Another possible reason to explain the short treatment course might be the "regional acceleratory phenomenon" (RAP), reported by Frost in 1989.^(10,11) He found that reorganizing activity of osseous hard tissue adjacent to injured surgical wound is greatly

accelerated. This phenomenon begins a few days after insult and reaches its peak in 1 to 2 months. The RAP was found in several animal experiments in orthopedic research.⁽¹²⁻¹⁴⁾ These models showed increased bone turnover and osteoclastic activity adjacent to the surgery site. Similarly, it was found that orthodontic tooth movement could be accelerated following selective labial and lingual decortication of alveolar bone.⁽¹⁵⁾ This new technique was called "accelerated osteogenic orthodontics" (AOO). Significant shortening of the treatment time for mandibular crowding was seen with AOO.⁽¹⁶⁾ In the present case, relief of dental crowding and interdigitation were accomplished in three months. This might correspond to the rapid bone turnover rate from the RAP in the first three to four months and possibly rapid tooth movement such as in AOO. Although no available studies have proven rapid dental movement after OGS related directly to the RAP, clinical observation of rapid dental movement after OGS or facial bone trauma is not uncommon in our practice. More animal and clinical studies are needed to observe details of the RAP in orthognathic cases.

Although the conventional surgical-orthodontic approach can reliably treat dentofacial anomalies, the prolonged period of orthodontic treatment required, especially in the pre-operative period, is cumbersome and time consuming. In particular cases when an ideal skeletal position can be expected without occlusal interference after surgery, SFA seems to be an alternative approach. In this reported case, SFA was used to effectively treat severe mandibular prognathism with severe dental crowding. In our experience, patients who are treated with this approach are satisfied and impressed with the immediate improvement in their facial profile after OGS. The shortened total treatment time might be an extra benefit in these cases but the physiological mechanism requires further study.

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以手術先行方式進行下顎骨前突的正顎手術-齒列矯正治療 — 病例報告

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正顎手術治療通常需要不等時間的術前齒列矯正。一般認為，如果去除這段術前的矯正工作會嚴重影響手術的結果與穩定度。在這段術前的準備時期，必須對齒列作去代償的移動，因此會造成顏面外觀醜化與上下齒列差距的惡化。而且這段時期會佔整體療程的大部份時間，並造成病患接受手術前的長期困擾。這種狀況尤以第三類骨性咬合不良最為顯著。手術先行的正顎治療方式 (SFA)，即無需術前齒列矯正時期直接進行正顎手術，在長庚醫院顱顏中心，是治療第三類骨性咬合不良病人的常見方式之一。本報告提出一個成功以 SFA 治療的 19 歲下顎骨前凸，合併前開咬與嚴重齒列擁擠的男性病例。該病例於正顎手術一週前，接受齒列矯正器的置放。手術與恢復過程皆順利。術後的矯正進行過程也十分平順，整體治療時間總計只有四個月。相較傳統的正顎手術治療至少需要十八個月的治療時間，縮短許多。接受 SFA 的病患可以迅速接受手術，改善臉型，整體治療時間也更短，而且結果與傳統的治療無異。我們認為，SFA 在特定的病例是個優異且有效的治療選擇。(長庚醫誌 2010;33:699-705)

關鍵詞：下顎骨前凸，安格氏第三類咬合不良，齒列矯正，正顎手術，手術先行治療方式

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