

Combined Surgical and Orthodontic Treatment of Bimaxillary Dento-Alveolar Protrusion: A Report of Case

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INTRODUCTION

Bimaxillary dentoalveolar protrusion refers to a condition in which the maxillary and mandibular incisor teeth are so severely protruded that the lips cannot be closed without strain. The condition may or may not accompany relative protrusion of the jaws themselves.¹⁾

There is a racial variation in degree of protrusion of the teeth as well as jaws. In general, the faces of blacks and orientals are more prominent than those of caucasoids. An explanation for interracial differences in dental protrusion is that the soft tissue contours related to greater prominence of the cheekbones allow more dental protrusion in some groups than others. The variance in dental protrusion seems to be related to both racial and soft tissue differences.^{1,2)}

Therefore, the hallmarks of excessive dental protrusion are lip strain and lip incompetence. Since bimaxillary protrusion is compatible with excellent occlusal relationship of the teeth, the patient's problems are primarily esthetic.^{1,3,4)}

Patients with bimaxillary protrusion may have mild crowding or spacing of teeth within the dental arches but usually have good alignment. There may be mild vertical discrepancies, ranging from open bite to deep bite.⁴⁾ If the maxilla-

ry incisors protrude more than the mandibular incisors, crowding, an accentuated curve of Spee, and an accompanying dental deep bite may be found.^{1,3,4)} The incisor teeth can be seen to be positioned forward relative to any cephalometric vertical reference line. The N-A, N-B, A-Pog, and N-Pog lines are used for this purpose.^{1,5,6)} The various soft-tissue cephalometric measurement, such as the Ricketts or Holdaway lines, reveal lip protrusion.^{1,5)} Orthodontic treatment for bimaxillary protrusion was first attempted in the late 19th century and was carried out quite successfully in the early 1900's.

The technique involved removing the first premolars and retracting the protruding incisors orthodontically.⁷⁾ Successful treatment required development of full-banded appliances so that roots could be positioned properly. This was done concurrently by Edward Angle and Calvin case in the early 1900's.^{1,5,7)} The modern techniques for orthodontic management of bimaxillary protrusion were worked out independently by two of Angle's students, Charles Tweed and Raymond Begg.⁷⁾ Whatever the orthodontic treatment approach, the challenge in successful management of bimaxillary protrusion is to close the extraction space by retraction of the incisors, maintaining the posterior teeth in their original position and thus "protecting the posterior anchorage."

Treatment time in nongrowing individuals was 24 to 30 months.^{5,7)} To retract and frequently to intrude the protruding incisors, significant contributions to the anterior maxillary segmental surgery were made by Wassmund,⁸⁾ Cupar,⁹⁾ and Wunderer.¹⁰⁾ The anterior mandibular segmental osteotomies were evaluated in detail by Kole.¹¹⁾ Correlated surgical and orthodontic treatment has been emphasized in American papers during the 1970's.⁴⁾ In this case, the patient complained of bimaxillary dentoalveolar protrusion and wanted to be treated for bimaxillary protrusion as soon as possible. This is to report a case corrected by anterior segmental osteotomies and orthodontic treatment.

CASE REPORT

HONG, D. H., a 22 year-old male, originally sought orthodontic treatment for the spacing of upper incisors and deep over-bite and overjet. Physical examination showed that there were very severely protruded maxillary and mandibular incisors, and anterior spacing of upper arch and lip strain on closure.

PROBLEM LIST

A. Esthetics

In frontal view, his face was good facial contour and symmetry. Lip strain was evident in both views if the teeth were covered. In profile, this patient showed extreme lip protrusion, but the chin was a little deficient.

B. Cephalometric Analysis

Angle's class II division I with extreme upper anterior maxillary protrusion (N-A (Hp); 6 mm A-B (op); 7 mm), relatively more labioversion with lower incisors as compared with upper incisors (L1-MP hp; 52.5 mm L1-MP angle; 115°), was shown as in Table 1.

C. Occlusal Analysis

His dental arch form was U-shaped. There was an anterior spacing of upper arch and mild crowding in the premolar areas of lower ar-

ch. He had an accentuated curve of spee in the mandibular arch.

TREATMENT PLAN

A. Presurgical Treatment

Gingivectomy was performed on the upper six anterior teeth area due to alveolar bone resorption and deep periodontal pocket. As presurgical orthodontic treatment, closing of upper anterior spacing with fixed appliances was worked out for 3 months.

B. Surgical Treatment Plan

Anterior maxillary and mandibular segmental osteotomies were designed to retract and intrude the protruding maxillary and mandibular incisors. In order to establish a necessary anterior maxillo-mandibular relationship, after both first premolar teeth with cast model was removed, six anterior segmented areas were retracted and fixed. After the cutout paper tracing & cast model surgery on the articulator, resin plates with upper & lower arches were made.

SURGICAL PROCEDURE

Under general anesthesia with nasoendotracheal intubation, this patient was placed on the operating table with supine position. His entire face was prepared with Zepharon and Betadine soap. His whole body was draped with sterile sheets. By means of Wunderer technique of anterior maxillary osteotomy, a vertical incision was made through the mucoperiosteum in the depth of the vestibule and carried down to the interdental space immediately anterior to the site of the planned osteotomy. Buccal osteotomy of lateral maxilla was done through retracted wound margins. An arcing incision through the palatal mucosa was carried from the interdental space anterior to site of the planned vertical osteotomy on one side to the contralateral interdental space. Transpalatal osteotomy was carried through retracted mucosal wound margins. The anterior maxilla was fractured,

Table 1 Cephalometric analysis of the patient before and after surgery

	Average (LEE)	Pre-Operative	Post-Operative
* Cranial base			
Ar-PTM (HP)	36.6±2.9	37	37
PTM-N (HP)	49.9±3.3	55	55
* Horizontal			
N-A-Pg angle	4.1±7.5	12	9.5
N-A (HP)	- 0.9±3.2	6	- 1
N-B (HP)	- 3.3±5.1	- 5.5	- 7.5
N-Pq (HP)	- 1.8±5.4	- 4	- 4
* Vertical			
N-ANS (HP)	60.3±3.6	61	61
ANS-Me (HP)	71.6±4.7	71.5	71.5
PNS-N (HP)	55.8±4.3	49	49
Mp-HP angle P	28.1±4.4	26	26
UI-NF 1 (HP)	31.1±2.6	39	39
L1-MP (HP)	46.4±2.5	52.5	49
U6-NF (HP)	26.7±3.6	28	28
L6-MP (HP)	38.0±2.3	42	42
* Max., Md.			
PNS-ANS (HP)	54.4±3.5	52	52
Ar-Go linear	55.2±5.3	60	60
Go-Pg linear	84.4±5.0	81	81
Ar-Go-Gn	119.4±5.5	121	121
B-Pg (MP)	7.2±1.5	5.5	7
* Dental			
OP-HP angle	12.9±3.7	12	13
A-B (OP)	- 2.0±2.4	7	2
U1-NF angle	116.2±5.9	114	104
L1-MP angle	95.4±5.6	115	103

cf) Facial Esthetic line by Ricketts

Lower lip	2 ± 1.5	10	4
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free of most of its bony attachments by superior movement of the segment. Segment was split by malleting a fine, sharp osteotome between the sectioned fragments. Nasal crest of the anterior maxilla was excised with the segment raised. Repositioned maxilla was fixed to the adapted resin plate with arch wire.

By means of Kole technique of anterior subapical osteotomy, the incision was carried laterally and posteriorly into the most lateral part

of the buccal vestibule and terminated at least 1cm posterior to the planned vertical osteotomy or osteotomy site. Planned vertical and horizontal osteotomies were etched into the mandible with a surgical saw. Mobilized segment was tipped lingually to allow necessary bone sculpturing.

Repositioned mandible was fixed to the resin

plate with arch wire. After thorough irrigation, water-tight suture and pressure bandage were done.

DISCUSSION

Bimaxillary dentoalveolar protrusion is found in many patients with dental crowding, but extremely protrusive teeth usually are well aligned.^{1,4)} Lip incompetence and lip strain on closure are important diagnostic features.^{1,2)} The modern techniques for orthodontic management of bimaxillary protrusion were worked out independently by Tweed⁷⁾ and Begg. Their opinions were to close the extraction space of first premolar by retraction of the incisors, maintaining the posterior teeth in their original position and thus "protecting the posterior anchorage". But it usually takes more than 2 years.^{1,4,5,7)}

On the other hand, as surgical treatment of bimaxillary protrusion, the anterior maxillary segmental surgery was made by Wassmund,⁸⁾ Cupar,⁹⁾ and Wunderer,¹⁰⁾ the surgical techniques advocated by these men still remain in use. The anterior mandibular segmental osteotomies were described in detail by Kole.¹¹⁾ The osteotomies in both arches provide a certainty of maximal retraction. Both maxillary and mandibular segments can be intruded as they are moved posteriorly, without producing any strain on anchorage by this tooth movement. But it is unlikely that extraction sites can be totally closed by surgery alone, and patients usually require some root paralleling by postsurgical orthodontic treatment. There are three major advantages¹⁾ to surgical repositioning of alveolar segments:

- ① The incisor segment can be repositioned vertically as well as horizontally once it is freed surgically.
- ② The requirements for patient's cooperation in treatment are lessened.
- ③ Augmentation genioplasty can be performed at the same time as the retraction.

Bimaxillary protrusion can be handled by combined surgical and orthodontic treatment^{1,4)} in

two ways:

First, using maxillary and mandibular segmental osteotomies to retract the teeth and finishing the case by establishing proper occlusal relationship with an orthodontic appliance.

Second, using orthodontic forces to align and retract the mandibular arch and then performing an osteotomy to retract the maxillary teeth. In general, if the maxillary and mandibular incisors are well aligned initially, and if there is no severe curve of spee in the mandibular arch, the first method may be selected. If the mandibular teeth are irregular, they should be aligned prior to retraction, and it is almost always necessary to have the mandibular arch reasonably level before maxillary retraction can begin, the second method may be selected. This case should be selected the method combined in two ways.^{1,2,4)}

In 1965, a study by Bell¹²⁾ using adult rhesus monkeys as experimental models was designed to delineate the biological processes of wound healing after maxillary osteotomy. Microangiographic and histologic techniques demonstrated that intraosseous and intrapulpal circulation to the anterior maxillary segment was maintained, when soft tissue was kept intact. Osteonecrosis was minimal and vascular ischemia was only transient when the anterior maxillary bone segment was pedicled to the labiobuccal or palatal mucoperiosteum.^{12,14)} Surgery for the maxillary osteotomy may take one of three forms. An initial discussion of the possibilities for surgical intervention was presented by Cohn-Stock in 1921.¹⁵⁾ The single stage, predominantly labial approach was first reported by Wassmund⁸⁾ in 1926. The single-stage "downfracturing" technique by Cupar⁹⁾ (1955) provided direct access to the superior maxilla and excellent visualization of the bony area. Wunderer¹⁰⁾ technique (1963) provided a palatally oriented approach to the sectioning and repositioning of the anterior maxillary segment. In 1942, Hofer¹⁶⁾ used a similar intraoral approach to accomplish the forward movement of the anterior mandibular segment.

In 1959, Kole¹¹⁾ provided surgical technique of subapical osteotomy to depress incisors.

In this case, anterior maxillary osteotomy used a Wunderer¹⁰⁾ technique and anterior mandibular osteotomy used a Kole¹¹⁾ technique. With both anterior segments mobile, intermaxillary fixation by acrylic interocclusal splint orthodontic wire may be needed postoperatively for 6 weeks. But in this case, resin plate with upper & lower arches were made, it was not necessary to make an intermaxillary fixation with wire. Only intramaxillary fixation of anterior mobile segments with resin plate was carried out for 8 weeks.

Complications^{1, 4, 12, 13)} related to treatment of bimaxillary protrusion fall into two categories: problems related to the surgery itself and problems related to relapse.

In any segmental surgical procedure, if an adequate soft tissue pedicle to the mobilized segment was maintained, complications due to loss of blood supply should not have occurred. Clinical experiences as well as experimental evidence from work with monkeys by Bell^{1, 12)} had demonstrated these facts.

Only if the osteotomy cuts pass through the apices of the teeth is the blood supply to the pulp interrupted so that pulp vitality is lost. Since canines have the longest roots, the osteotomy should cut pass above 3 mm from the apices of canines.

As complications related to relapse, we worry that tongue pressure will push the maxillary and mandibular teeth forward again after they have been retracted. But this rarely happens. Probably the much more important factor in determining whether the teeth will be stable in the new position is attainment of proper lip function postoperatively.^{2, 14)}

If lip incompetence is due to vertical excess as well as horizontal protrusion, anterior maxillary and mandibular surgery may not be enough to create sufficient lip competence after treatment.^{1, 2, 4)}

When vertical dimension is excessive, total

maxillary osteotomy to obtain posterior intrusion along with incisor retraction may be necessary to obtain a stable result.¹³⁾

In comparison with orthodontic treatment alone, combined surgical and orthodontic treatment of bimaxillary protrusion offers advantages in control of anchorage, in ease and duration of treatment, and in the degree of facial change possible.

SUMMARY

The authors treated a case of bimaxillary dentoalveolar protrusion corrected by anterior segmental osteotomies:

As presurgical treatment & process, closing of the upper anterior spacing with fixed appliances was worked out, cephalometric prediction & model surgery was done, and fabrication of intra-arch acrylic resin splints were made.

It was not necessary to make an intermaxillary fixation with wire after surgery. Only intramaxillary fixation of anterior retracted mobile segment with resin plate was required for 8 weeks. After surgical treatment, leveling of the upper and lower arch with rectangular arch wire were accomplished as the intrusion of anterior teeth proceeded.

We will continue to improve the class II molar relationship by using class II elastics and have a good occlusion through the orthodontic treatment.

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— 국문초록 —

전방부분절 골절단술에 의한 상하악 전돌증의 악교정 1 예

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영남대학교 의과대학 부속병원 치과 · 구강외과에 상 · 하악 전돌을 가진 환자가 안모 추형으로 인한 심미적 장애와 상악 전치부 치간이개 및 하악전치부 치열부정을 주소로 내원하였다.

안면치조기형에 대한 육안적평가, 방사선학적검사, 두부측측사진분석 및 진단 모형분석 등 다각적인 분석 결과 상 · 하악 치조 전돌증으로 진단을 내렸으며, 내원 당시 본 환자는 전반적으로 치주병학적 문제점을 가지고 있었고 개인적으로 군입매라는 특수상황하에 있었기 때문에 치주조직에 대한 손상을 최소로 하면서 치료기간을 최대한 단축시킬 수 있는 치료계획을 세웠다. 상하악 전치부에 대한 술전교정 치료 후 상악골은 전방부분절 골절단술로 후방으로 이동시키고 하악골은 전방부분 치근단 하방 골절단술로 후하방으로 이동시키므로써 상하악 전돌증에 대한 악교정 외과적 처치를 하여 좋은 결과를 얻었기에 이에 보고하는 바이다.

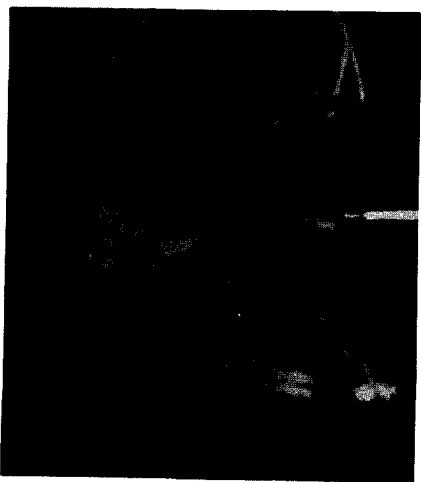


Fig. 1. Cephalogram on initial evaluation

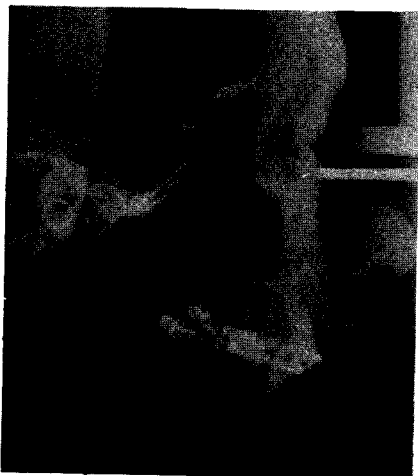


Fig. 2 Postoperative cephalogram during the orthodontic treatment

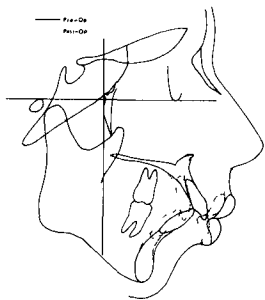


Fig. 3 Cephalometric superimposition before (solid line) and after (broken line) surgery. Note the improved esthetic line and nasolabial angle and interincisal angle.

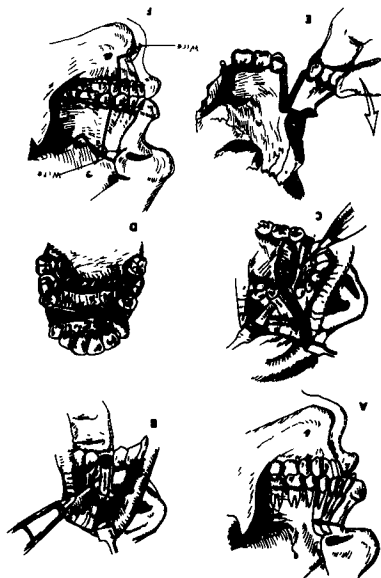


Fig. 4. Schematic Diagram of Surgical procedure by Wunderer technique of anterior maxillary osteotomy (A-F)



Fig. 5. Schematic Diagram of Surgical Procedure by Kole technique of mandibular subapical Osteotomy (A-H)



Fig. 6 Panoramic view on initial evaluation. Note the upper anterior spacing and extruded lower anterior teeth.



Fig. 7. Panoramic view after surgery. Note the endodontic treatment of 12 and 21 and closing of upper anterior teeth.



Fig. 8. Intraoral lateral view on presurgical treatment. Note labioversion on the upper anterior teeth and severe overjet and overbite.

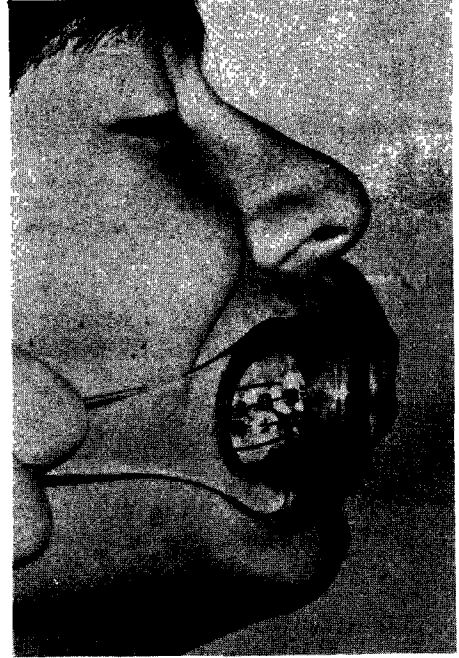


Fig. 9. Intraoral lateral view with orthodontic appliance after surgery. Note the improved incisor relationship.

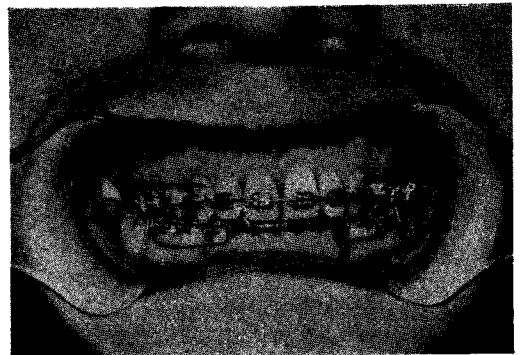


Fig. 10. Occlusion with orthodontic appliance after surgery



Fig. 11. Frontal view on initial evaluation, Note a lip incompetence and lip strain



Fig. 12. Frontal view after postoperative treatment



Fig. 13. Profile on initial evaluation

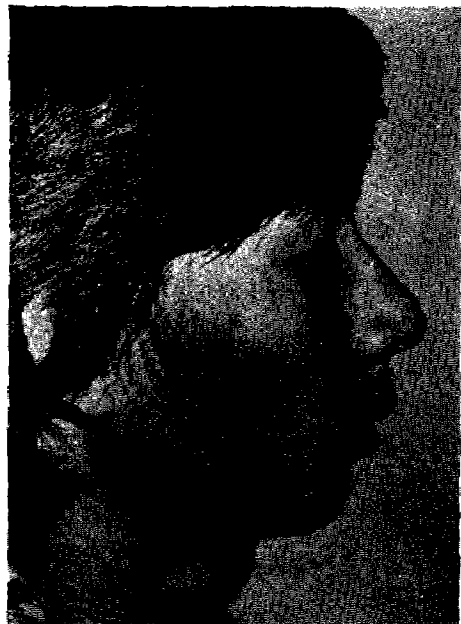


Fig. 14. Profile after postoperative treatment, Note the improved nasolabial angle and lip line.