Jong-Ryoul Kim, DDS, MSD, PhD
Professor
Department of Oral and Maxillofacial Surgery

Woo-Sung Son, DDS, MSD, PhD
Professor
Department of Orthodontics

College of Dentistry
Pusan National University
Pusan Metropolitan City, Korea

Seong-Geun Lee, DDS, MSD, PhD
Assistant Professor
Formerly, Department of Dentistry
College of Medicine
Kosin University
Pusan Metropolitan City, Korea
Currently, Department of Dentistry
College of Medicine
Ewha Wonmen's University
Seoul, Korea

Reprint requests:
Dr Jong-Ryoul Kim
Department of Oral and Maxillofacial Surgery
College of Dentistry
Pusan National University
10 Ami-Dong, Seo-Gu,
Pusan Metropolitan City, 602-739 Korea
Fax: +051-244-8334
E-mail:
jorkim@hyowon.pusan.ac.kr

A retrospective analysis of 20 surgically corrected bimaxillary protrusion patients

This paper presents a retrospective review and analysis of 20 bimaxillary protrusion patients who visited the authors' hospital between 1986 and 1998 following surgical correction. The lateral cephalometric radiographs of each patient were taken preoperatively (T_0), within 1 week after surgery (T_1), and at least 1 postoperative year later (T_2). Hard and soft tissue analysis was performed on each cephalometric radiograph. The matched pair t test was employed for T_0–T_1, T_1–T_2, and T_0–T_2 periods. The sample consisted of 20 Korean adult patients with bimaxillary protrusion (18 women and 2 men), aged 21 to 33 years. The first premolars were removed in 18 of the 20 cases. The Wunderer method was selected in 18 of the 20 maxillary cases, and the anterior subapical osteotomy was selected in all mandibular cases. Augmentation genioplasty was combined in 3 cases, and reduction glossoplasty was combined in 2 cases. Orthodontic treatment was accompanied in 8 cases. The statistical analysis of all the variables revealed that, except for overbites, there were significant differences between T_1–T_2 and between T_0–T_2 periods ($P < .01$*). This suggests that most of the bimaxillary patients want instant esthetic facial results and that their soft tissue profiles were improved significantly. However, the postoperative course should be cautiously observed.* (Int J Adult Orthod Orthognath Surg 2002;17:23–27)

A bimaxillary protrusion is a condition in which the maxillary and the mandibular incisor teeth protrude severely so that the lips cannot be closed together. The condition is usually considered as an Angle Class I,[1] and the anterior teeth are well aligned. However, it sometimes shows either mild crowding or spacing or mild vertical discrepancies ranging from an openbite to a deep bite.[2]

The majority of patients who suffer from this condition seek treatment more for the enhancement of facial esthetics than for dental esthetics and function.[3] Facial esthetic problems related to bimaxillary protrusion include extreme protrusion of the anterior teeth, lip incompetence, and strain with hypermentalis action on closure, thick-looking lips with an everted vermilion border, and a toothy appearance due to an apparent chin deficiency.[2] This profile is found predominantly in Africans and Asian adults—including the Chinese and the Japanese—and in Caucasians.[4–6] The faces of Asians and peoples of African descent are more prominent than those of Caucasians. The Chinese generally have a greater tendency toward dentoalveolar protrusion than Caucasians or even the Japanese.[7]

The treatment and cephalometric analysis of bimaxillary protrusion has been reported in Caucasians, Native Americans, and the Chinese.[4,6,8] This article reviews and analyzes 20 Korean bimaxillary protrusion patients who underwent anterior segmental osteotomies.

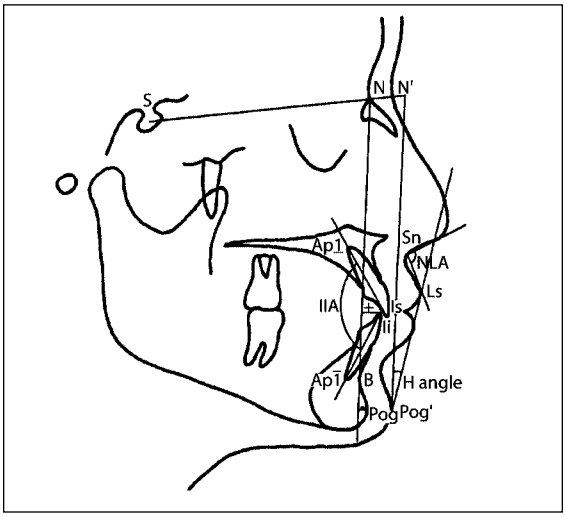

Fig 1 Cephalometric landmarks and hard and soft tissue measurements used in this study: S = sella; N = nasion; Sn = subnasale; Ls = labrale superius; Pog = pogonion; B = supremental; Ii = incision inferius; Is = incision superius; Ap$\underline{1}$ = apicale $\underline{1}$; Ap$\bar{1}$ = apicale $\bar{1}$; IIA = interincisal angle; NLA = nasolabial angle; H ratio = Holdaway ratio (1-NB†/Pog-NB*); H angle = Holdaway angle. A prime mark indicates a soft tissue landmark.

Table 1 Measurements made in the study

Parameter	T_0	T_1	T_2	T_0–T_1(t)	T_1–T_2(t)	T_0–T_2(t)
Interincisal angle (deg)	107.7 ± 8.6	127.4 ± 7.1	125.3 ± 7.5	–13.564**	4.663**	–10.673**
Overbite (mm)	1.7 ± 2.7	2.5 ± 1.0	2.2 ± 1.2	–1.608	2.442*	–1.094
Overjet (mm)	4.4 ± 2.4	2.9 ± 1.1	3.6 ± 1.7	3.348**	–2.933**	2.073*
U1 to F plane (mm)	16.3 ± 3.9	7.4 ± 3.7	8.1 ± 4.0	4.834**	–2.689**	4.657**
L1 to F plane (mm)	11.9 ± 4.8	4.4 ± 3.2	4.8 ± 3.3	12.637**	–2.636**	13.592**
H ratio	10.8 ± 8.6	2.2 ± 1.1	2.6 ± 1.5	11.841**	–3.405**	11.676**
Nasiolabial angle (deg)	91.8 ± 11.3		104.8 ± 7.6			–6.894**
H angle (deg)	24.7 ± 3.3		16.2 ± 2.1			11.833**

U1 and L1 to F plane = upper and lower central incisors to the facial plane; H ratio = Holdaway ratio, calculated using the formula 1-NB†/PogNB*; H angle = Holdaway angle; T_0 = taken preoperatively; T_1 = taken within 1 week postoperatively; T_2 = taken at least 1 year postoperatively.
Values are given as mean ± SD.
The matched pair *t* test was used for the statistical analysis for periods T_0–T_1, T_1–T_2, and T_0–T_2.
*$P \leq .05$.
**$P \leq .01$.

Patients and methods

The sample consists of 20 adult Korean patients with bimaxillary protrusion who visited the Pusan National University Hospital between 1986 and 1998. All patients were treated for the correction of bimaxillary protrusion by anterior segmental osteotomies with the extraction of either the first or the second premolars. Augmentation genioplasty was combined in 3 cases, and orthodontic treatment was accompanied in 8 cases.

Lateral cephalometric radiographs were taken in centric occlusion with the lips in repose and with the same cephalometer. The radiographs were taken preoperatively (T_0), within 1 week postoperatively (T_1), and at least 1 year postoperatively (T_2) for each patient.

The cephalometric analysis was done by the same researcher and included 12 landmarks and reference lines, as defined by Holdaway[9] (Fig 1). To assess the systematic and accidental errors of the cephalometric analysis, 50 randomly selected cephalograms were retraced, redigitized, and calculated using Dahlberg's formula for each variable.[10,11] Eight specific measurements were selected to evaluate the hard and soft tissue changes from presurgery to postsurgery (Table 1). The matched pair *t* test was used for T_0–T_1, T_1–T_2, and T_0–T_2 periods.

Results

The 20 bimaxillary patients were composed of 18 women and 2 men. Their anterior teeth were relatively well aligned. Yet there were 5 cases of gummy smiles, 5 of deep bites, 4 of openbites, 13 of severe overjets, and 2 of anterior diastema. The patients' mean age was 27 years, with the range being 21 to 33 years. The first premolars were removed in 18 cases, and the second premolars were removed in 2 cases. For the retraction of the anterior maxillary segment, we used the Wunderer method in 18 cases, with interincisal osteotomy in 1 of the 18 cases; we also used the Wassmund method in 1 case and the Cupar method in 1 case with interincisal osteotomy. Anterior segmental osteotomy was performed in all mandibular cases, and interincisal osteotomy in 2 cases. Augmentation genioplasty was combined in 3 cases, and reduction glossoplasty was combined in 2 cases. Orthodontic treatment was performed in 8 cases. Postoperative complications were composed of wound dehiscence in 2 cases and lower lip paresthesia in 3 cases.

In a statistical analysis of all the independent variables, there were significant differences at the T_0–T_2 period ($P < .01$), except for overbites. There were significant changes in the underlying hard tissue following the surgical correction of the bimaxillary protrusion. The interincisal angle was increased by a mean of 17.6 degrees during the T_0–T_2 period. The overbite and the overjet were reduced by a mean of 0.5 mm and 0.8 mm, respectively. During the T_0–T_2 period, the maxillary and the mandibular incisors were respectively retracted by a mean of 8.2 mm and 7.1 mm. During the T_0–T_2 period, the Holdaway ratio was reduced by a mean of 8.2. Also, during the T_0–T_2 period, a soft tissue analysis revealed that the nasolabial angle was increased by 13.0 degrees, and the Holdaway angle was reduced by a mean of 8.5 degrees. On the other hand, all the independent variables analyzed during the T_1–T_2 period were found to be statistically significant ($P < .01$; Table 1).

Discussion

The distribution of the subjects' gender and their mean age revealed that mostly female patients seek this treatment, and they are usually at the period beyond active orthodontic treatment. Also, female patients want more facial esthetic results than dental esthetic ones,[12] as indicated by the fact that only 8 of the 20 cases combined with orthodontic treatment. However, in all circumstances, clinicians must attempt to obtain the best facial esthetics without compromising dental esthetics and function.[13]

Prior to surgery, teeth to be extracted are selected, considering the shape of both the arch and the alignment of the anterior teeth.[2] The first premolars are usually the choice of extraction, as shown by our results. However, to avoid a severe buccal step difference, additional surgery such as interincisal osteotomies or the extraction of second premolars may also be considered.[2,13,14] For the retraction of the anterior maxillary segment, 1 of 3 surgical approaches—the Wassmund method,[15] the Wunderer method,[16] or the Cupar method[17]—is selected. The Wassmund method provides an excellent dual vascular supply to the anterior maxillary segment. However, with this method, it is technically more difficult to gain access to the superior and the palatal aspects of the anterior maxilla, and final adjustments to activate the preplanned occlusion may be difficult.[18] For this reason, we used the Wunderer method as the dominant procedure for the retraction of the anterior maxillary segment in 18 cases. We used the Cupar method in only 1 case, a case of a moderate gummy smile.

Despite the apparent clinical success of the Wunderer method, fatal postoperative complications such as necrosis of the anterior teeth and segments, and the ankylosis of the canine teeth may occur.[2,19] In the current study, such sequelae did not occur, except for mild complications such as wound dehiscence at the osteotomy site and temporary lower lip paresthesia. Therefore, we speculate that this surgical approach is a safe and predictable procedure.

All the independent variables, except for overbites, analyzed during the T_0–T_2 periods were found to be statistically significant ($P < .01$), including overjets ($P < .05$). The interincisal angle was increased by a mean of 19.02 degrees, ranging from 12.2 degrees to 20 degrees.[20,21] Our measured value was increased by a mean of 17.6 degrees, whereas Finnoy et al[22] reported that it was increased by only 9.80 degrees after orthodontic treatment of Caucasian subjects whose anterior teeth were more upright than our subjects'. The overbite was increased by 0.5 mm, and the overjet was reduced by 0.8 mm; these are similar to the values reported by Keating.[21] However, the change in the overbite was statistically insignificant during the T_0–T_2 periods. Nadkarni[8] reported that the anterior maxillary and the anterior mandibular segments were respectively retracted by 9.06 ± 3.04 mm and 5.42 ± 2.56 mm in surgically treated cases. In our study, they were retracted by a mean of 8.2 mm and 7.1 mm, respectively, as shown in the values of U_1 or L_1 to the F plane, which are similar to Keating's results.[21]

On the other hand, Lew[20] reported that the anterior maxillary and the anterior mandibular segments were less retracted by 5.9 ± 1.5 mm and 4.6 ± 1.2 mm, respectively, following orthodontic treatment, compared to the results following surgical correction. In the current study, the H ratio was decreased from 2.6 ± 1.5 to 10.8 ± 8.6. This suggests that the chin contour could be improved following an anterior mandibular osteotomy. Dewan and Marjadi[23] reported improved chin contours following anterior mandibular osteotomies without augmentation genioplasty, while Connole and Small[24] do not favor augmentation genioplasty. However, Bell and Condit[25] have suggested augmentation genioplasty to restore a receding chin. In 3 of our 20 cases with a severely receding chin, the chin contour was improved following augmentation genioplasty.

The soft tissue profile was evaluated by the Holdaway analysis.[9] The H angle is an angular measurement of the Holdaway line to the soft-tissue facial plane. Ten degrees are ideal when the convexity measurement is 0 mm. However, measurements of 7 to 15 degrees are also in the optimal range. Ideally, as the facial convexity increases, the H angle must also increase. In this study, the H angle was 16.2 ± 2.1 degrees in post-treatments, compared to 12.1 degrees reported by Dewan and Mariadi[23] in surgically treated cases. This indicates that in this study, the protrusion of the upper lip was less reduced, relative to soft tissue chin. Nadkarni[8] reported that the nasolabial angle was increased by 10.55 degrees following orthognathic surgery in a sample of Indian patients. Our results increased by 11.2 degrees, similar to Nadkarni's results. In contrast, some authors have reported an increase in the nasolabial angle, ranging from 6.5 to 8.9 degrees, following orthodontic treatment.[20,22,26] We speculate that the nasolabial angle was slightly more increased in surgically treated cases than in orthodontically treated cases. Also, while Lew[20] reported that the increased nasolabial angle of almost 90 degrees approached the normal values of Chinese people, Farrow et al[5] found that a slightly more convex profile instead of Caucasian orthodontic norms was the most attractive for 15 African American patients. Our value, 104.8 ± 7.6 degrees, supports Farrow's results more than those of Lew.

On the other hand, all the independent variables analyzed during the T_1–T_2 period were significant ($P < .01$), including overbites ($P < .05$). This indicates that postoperative relapses occurred in both soft and hard tissues. Therefore, although teeth stability in a new position is usually obtained by lip pressure and not tongue pressure,[27] reduction glossoplasty was performed in 2 cases with functional macroglossia.

In summary, most bimaxillary patients want facial esthetic results instantly without orthodontic treatment and have improved profiles greatly following surgical correction. Otherwise, this suggests that clinicians should pay more attention to postoperative course.

References

1. Graber TM. Orthodontic Principles and Practice. Philadelphia: Saunders, 1972:232.
2. Proffit WR, Bell WH. Bimaxillary protrusion. In: Bell WH, Proffit WR, White RP (eds). Surgical Correction of Dentofacial Deformities. Philadelphia: Saunders, 1981:1015–1057.
3. Kiyak HA, Zeitler DL. Self-assessment of profile and body image among orthognathic surgery patients before and two years after surgery. J Oral Maxillofac Surg 1988;46:365–371.
4. Lew KK, Loh FC, Yeo JF, Loh HS. Profile changes following anterior subapical osteotomy in Chinese adults with bimaxillary protrusion. Int J Adult Orthod Orthognath Surg 1989;4:189–196.
5. Farrow AL, Zarrinnia K, Azizi K. Bimaxillary protrusion in black Americans—An esthetic evaluation and the treatment considerations. Am J Orthod Dentofac Orthop 1993;104:240–250.
6. Keating PJ. Bimaxillary protrusion in the Caucasian: A cephalometric study of the morphological features. Br J Orthod 1985;12:193–201.
7. Lin WL. A cephalometric appraisal of Chinese adults having normal occlusion and excellent facial types. J Osaka Dent Univ 1985;19:1–32.
8. Nadkarni PG. Soft tissue profile changes associated with orthognathic surgery for bimaxillary protrusion. J Oral Maxillofac Surg 1986;44: 851–854.
9. Holdaway RA. A soft-tissue cephalometric analysis and its use in orthodontic treatment planning. Part I. Am J Orthod 1983;84:1–28.
10. Burstone CJ, James RB, Legan HL, et al. Cephalometrics for orthognathic surgery. J Oral Surg 1978;36:269–277.
11. Dahlberg G. Statistical Methods for Medical and Biological Students. London: Allen & Unwin,1940.
12. Berscheid E. An overview of the psychological effects of physical attractiveness. In: Lucker GW, Ribbons KA, McNamara JA (eds). Psychological Aspects of Facial Form. Ann Arbor: University of Michigan, 1980:1–23.
13. Jacobs JD, Bell WH. Combined surgical and orthodontic treatment of bimaxillary protrusion. Am J Orthod 1983;83:321–333.
14. Lew KK. Orthodontic considerations in the treatment of bimaxillary protrusion with anterior subapical osteotomy. Int J Adult Orthod Orthognath Surg 1991;6:113–122.
15. Wassmund M. Lehrbuch der Praktischen Chirurgie des Munds und der Kiefer. Leipzig: H Meusser, 1935:282.
16. Wunderer S. Die prognathie operativen mittels frontal gestiertem maxilla fragment. 0st Z Stomatol 1962;59:98.
17. Cupar I. Die chirurgische Behandlung der Form und Stellungs veranderungen des oberkiefers. 0st Z Stomatol 1954;51:565.
18. Loh FC. Surgical refinement of the anterior maxillary subapical osteotomy. J Oral Maxillofac Surg 1993;51:332–334.
19. Scheideman GB, Kawamura H, Finn RA, Bell WH. Wound healing after anterior and posterior subapical osteotomy. J Oral Maxillofac Surg 1985; 43:408–416.
20. Lew K. Profile changes following orthodontic treatment of bimaxillary protrusion in adults with the Begg appliance. Eur J Orthod 1989; 11:375–381.
21. Keating PJ. The treatment of maxillary protrusion: A cephalometric consideration of changes in the inter-incisal angle and soft tissue profile. Br J Orthod 1986;13:209–220.
22. Finnoy JP, Wisth PJ, Boe OE. Changes in soft tissue profile during and after orthodontic treatment. Eur J Orthod 1987;9:68–78.
23. Dewan SK, Marjadi UK. Soft tissue changes in surgically treated cases of bimaxillary protrusion. J Oral Maxillofac Surg 1983;41:116–118.
24. Connole PW, Small EW. Combined maxillary and mandibular osteotomies: Discussion of three cases. J Oral Surg 1971;29:572–578.
25. Bell WH, Condit CL. Surgical-orthodontic correction of adult bimaxillary protrusion. J Oral Surg 1970;28:578–590.
26. Tan TJ. Profile changes following orthodontic correction of bimaxillary protrusion with a preadjusted edgewise appliance. Int J Adult Orthod Orthognath Surg 1996;11:239–251.
27. Proffit WR, Knight JM. Tongue pressures and tooth stability after anterior maxillary osteotomy. J Oral Surg 1977;35:798–801.