

Simultaneous Correction of Hard- and Soft-Tissue Facial Asymmetry: Combination of Orthognathic Surgery and Face Lift Using a Resorbable Fixation Device

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Abstract: The purpose of this study was to evaluate outcomes of simultaneous correction of the hard- and soft-tissue facial asymmetry with face lift procedure using a resorbable fixation device (Endotine Ribbon; Coapt Systems, Palo Alto, CA) during bimaxillary orthognathic surgery in cases with severe facial asymmetry. The samples consisted of 8 patients (mean age, 23.3 [SD, 4.4] years; 8 skeletal class III and 2 class II malocclusion) who received bimaxillary orthognathic surgery and a face lift procedure using a resorbable fixation device. Preoperative cephalometric evaluation of the maxillary occlusal plane cant and chin point deviation and data on surgical movement, site, time, and difficulty of face lift procedure were collected at 1 week before operation and during operation procedure. The amounts of lip cant between preoperation and postoperation were compared. Pain, stability of fixation, adverse effects, relapse, and patients' and surgeon's satisfaction were evaluated at 6 months after operation. Initial and final amounts of the lip cant were 4.15 (SD, 0.53) and 0.80 (SD, 0.48) mm (correction rate, 76.8%). The face lift procedure took 28.4 (SD, 3.3) minutes without difficulty. There were no severe complications such as hematoma, facial nerve injury, and postoperative scar. By the patients' and surgeon's view, all had satisfactory jowl elevation, lip canting correction, and achievement of the soft-tissue symmetry without evidence of recurrent asymmetry or loss of fixation. If the face lift procedure using a resorbable fixation device is done with proper vector control during orthognathic surgery, the hard- and soft-tissue facial asymmetry can be corrected simultaneously with satisfactory outcomes.

Key Words: Facial asymmetry, face lift, resorbable fixation device

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Traditionally, for the treatment of facial asymmetry, a 2-stage approach such as orthognathic surgery and soft-tissue surgery in sequential order has been recommended because of following reasons: (1) the hard- and soft-tissue changes after orthognathic surgery are less related in the vertical aspect than in the other ones^{1–3}; and (2) positioning of the soft tissues can be more easily planned after the jaws have healed and are functioning in their new positions.⁴

In cases with skeletal class II or III malocclusion and severe facial asymmetry, minor to moderate soft-tissue asymmetry can remain or even occur after correction of the skeletal asymmetry by bimaxillary orthognathic surgery (Fig. 1). The reasons seem to be due to incomplete correction of the lip cant and/or soft-tissue redundancy or droop of the gonial angle area (difference in the soft-tissue thickness of gonial angle area between the right and left sides).^{3,5}

Conventional face lift procedure^{6–10} and injection of botulinum toxin on the masseter muscle in the more bulky side^{11–14} and fat graft¹⁵ in the relatively deficient side can be used to resolve the volumetric difference of soft tissue between right and left sides and to correct the lip cant that remained after orthognathic surgery. However, these procedures seem to be time-consuming and troublesome work to both clinicians and patients. Therefore, it is needed to develop a protocol that can correct the hard- and soft-tissue facial asymmetry simultaneously and individually.

Recently, a kind of resorbable fixation device, Endotine Ribbon (82/18 L-lactide/glycolide; Coapt Systems, Palo Alto, CA), which was originally designed for brow and midface lift,^{16,17} is introduced as the jowl and neck lift material. It consists of a long slender leash with 34 tines that can be customized to the patient's anatomy by cutting either the tine-bearing area or the smooth leash area (Fig. 2). When implanted, the Endotine Ribbon (Coapt Systems) engages the superficial musculoaponeurotic system (SMAS)

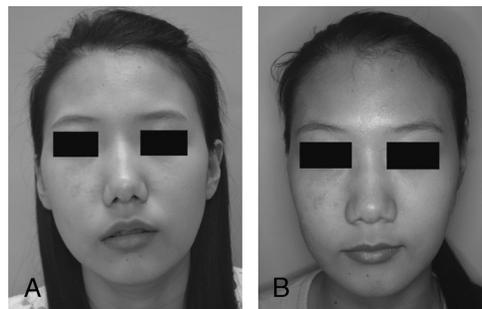


FIGURE 1. An example of the case that soft-tissue asymmetry was not fully corrected, although hard-tissue asymmetry was corrected by orthognathic surgery.

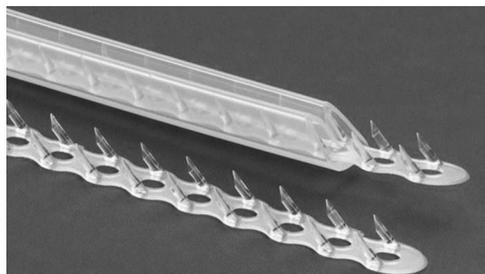


FIGURE 2. The newly developed Endotine Ribbon (Coapt Systems) for jowl and neck lift. It consisted of 2 faces: the inner face made of hook (tine) for anchorage and the smooth outer face for initial insertion and placement.

or platysma of the newly created surgical plane and is anchored to the temporal or mastoid fascia to maintain the vector of lift until biologic healing takes place. It can replace the conventional suspension suture in the lower face and neck and is an effective alternative to “thread lifting.”¹⁸ According to other reports,^{19,20} the effects of Endotine lift can be sustained after its complete resorption for its adhesion to skin flap and sublayer.

To the authors’ knowledge, simultaneous correction of the hard- and soft-tissue facial asymmetry with a combination of orthognathic surgery and face lift using a resorbable fixation device has not been reported. Therefore, the purpose of this study was to evaluate outcomes of simultaneous correction of soft-tissue asymmetry with

face lift using a resorbable fixation device (Endotine Ribbon) during orthognathic surgery in cases with severe facial asymmetry.

PATIENTS AND METHODS

The samples consisted of 10 cases with severe facial asymmetry (3 males and 7 females; mean (SD) age, 23.3 (4.4) years; range, 18–33 years; 8 patients with mandibular prognathism, chin point deviation, and lip cant; 2 patients with mandibular retrusion and lip cant), who received a bimaxillary orthognathic surgery for the hard-tissue facial asymmetry correction and a face lift procedure using the Endotine Ribbon (Coapt Systems) for simultaneous correction of the soft-tissue facial asymmetry. All cases had undergone bimaxillary orthognathic surgery, and 3 cases had additional genioplasty (Table 1). The amount of initial lip cant was 4.15 (SD, 0.53) mm (Table 2). All procedures were performed by 1 surgeon (C.J.Y.) from January 2007 to January 2008 at the Department of Oral and Maxillofacial Surgery in Seoul National University Dental Hospital.

After the bimaxillary orthognathic surgery for correction of the hard-tissue facial asymmetry had completed, the face lift procedure using a resorbable fixation device for correction of soft-tissue asymmetry was performed. After surgical field preparation was done on the preauricular area, local anesthetics was administered with tumescent solution (normal saline with lidocaine 1000 mg/L, epinephrine 1 mg/L, sodium bicarbonate 10 mg Eq/L, triamcinolone 10 mg Eq/L).²¹ Between dermis and subcutaneous fatty layer of the buccal cheek, 100 mL of tumescent solution was injected using liposuction syringe. Fifteen to 20 minutes after tumescent solution

TABLE 1. Patients’ Demographic Data and Operative Procedure

Patients (Age/Sex)	Preoperative Cephalometric Evaluation		Operative Procedures			
	Occlusal Plane Canting at the Upper 1st Molar Level	Maxilla and Chin Point Deviation	Surgical Movement of Orthognathic Surgery	Face Lift Site	Time, min	Difficulty of Use*
1 (21 y/female)	4-mm Difference (longer at the left side)	Chin: 4-mm shift to the right side	Maxilla: canting correction, #16, 2.5-mm elongation; #26, 2.5-mm impaction; #16 and 26, posterior impaction 2 mm; total setback 3 mm Mandible: BSSRO setback	Left side	35	++
2 (27 y/male)	4-mm Difference (longer at the right side)	Maxilla: 1.5-mm shift to the right side Chin: 4.5-mm shift to the left side	Maxilla: canting correction, #16, 2-mm impaction; #26, elongation 2 mm; #16 and 26 posterior impaction 2 mm; midline correction 2 mm to the left side; anterior elongation, 1 mm; total advancement, 3 mm Mandible: BSSRO setback	Right side	30	+
3 (19 y/female)	3-mm Difference (longer at the right side)	Chin: 4-mm shift to the left side	Maxilla: canting correction, #16, 3.5-mm impaction; #26, impaction 0.5 mm; #16 and 26, posterior impaction 2 mm; no AP/vertical change at the incisors Mandible: BSSRO setback; vertical reduction and setback genioplasty	Right side	32	++

TABLE 1. (Continued)

Patients (Age/Sex)	Preoperative Cephalometric Evaluation		Surgical Movement of Orthognathic Surgery	Operative Procedures		
	Occlusal Plane Canting at the Upper 1st Molar Level	Maxilla and Chin Point Deviation		Face Lift Site	Time, min	Difficulty of Use*
4 (33 y/male)	4-mm Difference (longer at the right side)	Maxilla: 2-mm shift to the left side Chin: 1.5-mm shift to the left side	Maxilla: canting correction, #16 3-mm impaction, #26 0 mm; anterior elongation, 2 mm; midline correction, 2 mm to the right; total advancement, 1.5 mm Mandible: BSSRO setback	Right side	26	+
5 (22 y/female)	3-mm Difference (longer at the left side)	Chin: 4-mm shift to the right side	Maxilla: canting correction, #16, 2mm elongation; #26, impaction 2 mm; #16 and 26, posterior impaction 2 mm; no AP/vertical change at the incisors Mandible: BSSRO setback; vertical reduction and setback genioplasty	Left side	27	+
6 (20 y/female)	3.5-mm Difference (longer at the right side)	Maxilla: 2-mm shift to the left side Chin: 6-mm shift to the left side	Maxilla: canting correction, #16, 2-mm impaction; #26; elongation, 2 mm; #16 and 26, posterior impaction 2 mm; incisal setback, 3 mm; midline correction, 2 mm to the right side; no vertical change at the incisors Mandible: BSSRO setback	Right side	25	+
7 (24 y/female)	3.5-mm Difference (longer at the right side)	no	Maxilla: canting correction, #16, 2-mm impaction; #26, elongation 2 mm; no posterior impaction; no AP/vertical change at the incisors Mandible: BSSRO advancement; vertical reduction genioplasty	Right side	28	+
8 (18 y/female)	5-mm Difference (longer at the right side)	no	Maxilla: canting correction, #16, 2.5-mm impaction; #26, elongation 2.5 mm; no posterior impaction; no AP/vertical change at the incisors Mandible: BSSRO advancement	Right side	30	+
9 (24 y/male)	4.5-mm Difference (longer at the right side)	Chin: 6.5-mm shift to the left side	Maxilla: canting correction, #16, 2.5-mm impaction; #26, elongation 2.5 mm; #16 and 26, posterior impaction 2 mm; no AP/vertical change at the incisors Mandible: BSSRO setback	Right side	26	+

Continued on next page

TABLE 1. (Continued)

Patients (Age/Sex)	Preoperative Cephalometric Evaluation		Operative Procedures			
	Occlusal Plane Canting at the Upper 1st Molar Level	Maxilla and Chin Point Deviation	Surgical Movement of Orthognathic Surgery	Face Lift		
				Site	Time, min	Difficulty of Use*
10 (25 y/female)	2.5-mm Difference (longer at the left side)	Chin: 4.0-mm shift to the left side	Maxilla: canting correction, #16, 1.5-mm elongation; #26, 1.5-mm impaction; no posterior impaction 2 mm; no AP/vertical change at the incisors Mandible: BSSRO setback; inferior border contouring Zygoma: malar reduction (left side)	Left side	25	+

BSSRO = bilateral sagittal split ramus osteotomy; AP = anteroposterior.

*The scale of difficulty used is as follows: +, means easy; ++, moderate; +++, difficult.

injection, a preauricular incision was extended to the temporal area by hockey-stick extension (Fig. 3A).

To obtain enough room for the Endotine Ribbon (Coapt Systems), undermining of the subcutaneous fatty layer was proceeded mesially to the zygomatic body, buccal cheek, and inferiorly to inferior border of the mandible.

After confirming that the Endotine Ribbon (Coapt Systems) holds SMAS layer, it was pulled until the lip canting could be corrected and soft-tissue redundancy of the gonial angle area can be resolved and anchored with 3-0 polydioxanone to the temporal fascia. The pulling vector was superior-posterior direction for lip cant correction and superior direction for soft-tissue droop correction of the gonial angle area, and excess leash of the Endotine Ribbon (Coapt Systems) was cut out. After traction of the facial skin to the temporal area, excess facial skin was excised (Figs. 3B–D). Subcutaneous suture was done with 3-0 or 4-0 Vicryl and skin suture, with 5-0 nylon (Fig. 3E).

The data on occlusal plane cant at the upper first molar level, maxilla and chin point deviation, surgical movement, site, time, and difficulty of face lift procedure were collected at 1 week before operation (T0) and during operation procedure (Table 1). The amounts of lip canting between preoperative and postoperative data were compared (Fig. 4; Table 2). Pain, stability of fixation, adverse effects, relapse, and patients' and surgeon's satisfaction were evaluated at 6 months after operation (T1) (Table 3).

RESULTS

In the T0 stage, cant of the maxillary occlusal plane was present in all patients (mean, 3.70 [SD, 0.75] mm; range, 2.5–5 mm) (Table 1). Three patients had the cant of the maxillary occlusal plane toward the right side and 7 patients toward the left side (Table 1).

TABLE 2. Comparison of the Lip Canting Between Preoperative and Postoperative Data

Patients	Sex	Age, y	Preoperative Stage (T0), mm			Postoperative Stage (T1), mm			Change, mm	Rate, %
			Vr	VI	Difference	Vr	VI	Difference		
1	F	21	73	77.5	4.5	73	73	0	4.5	100
2	M	27	82	77.5	4.5	78	77	1	3.5	77.8
3	F	19	75.5	72	3.5	73	72.5	0.5	3.0	85.7
4	M	33	80	75	5.0	75	74	1	4.0	80.0
5	F	22	73.5	77	3.5	73	74	1	2.5	57.1
6	F	20	78	74.5	3.5	75	74	1	2.5	71.4
7	F	24	77	73	4.0	74	72.5	1.5	2.5	62.5
8	F	18	76	71.5	4.5	72	71	1	3.5	77.8
9	M	24	77.5	73	4.5	75	74	1	3.5	55.6
10	F	25	74	78	4.0	74	74	0	4.0	100.0
Mean (SD)		23.3 (4.4)	76.7 (2.9)	74.9 (2.5)	4.2 (0.5)	74.2 (1.7)	73.6 (1.6)	0.8 (0.5)	3.4 (0.7)	76.8 (15.8)

Vr, indicates a linear distance from the right medial canthus to the right cheilion; VI, a linear distance from the left medial canthus to the left cheilion.

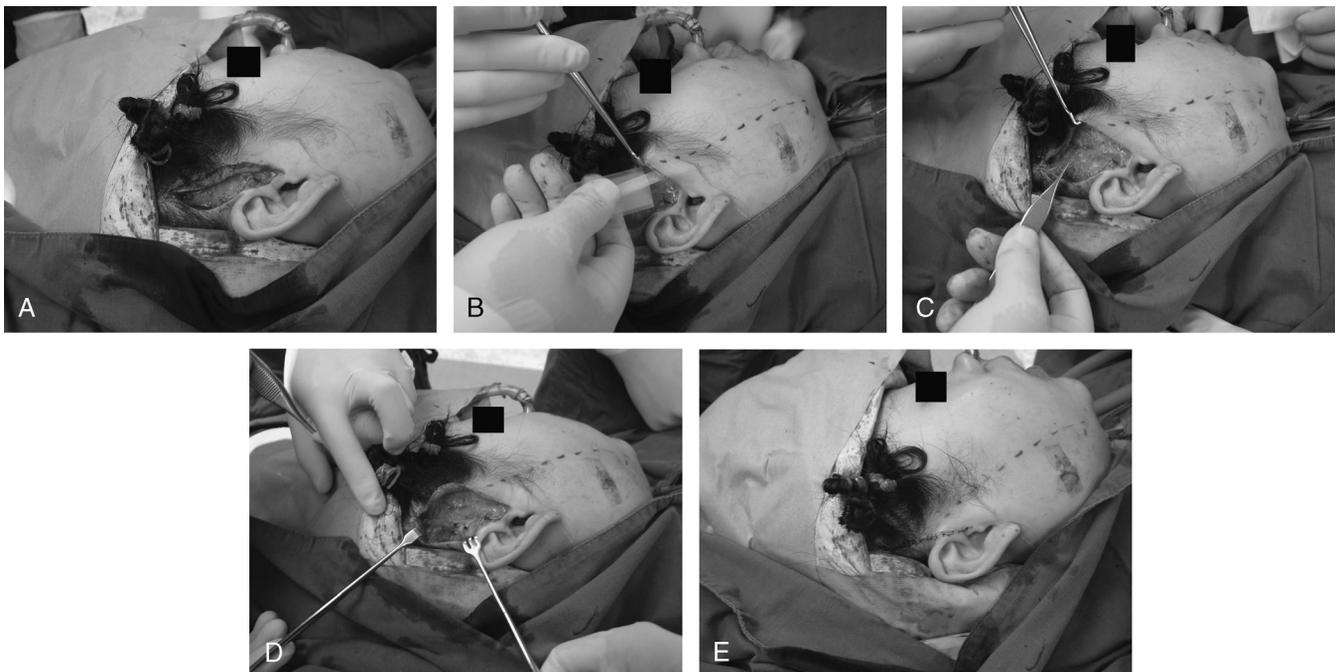


FIGURE 3. A, A preauricular incision design that was extended to the temporal area by hockey-stick extension. B, After undermining of the subcutaneous fatty layer, Endotine Ribbon (Coapt Systems) is inserted. C, Endotine Ribbon, which holds the SMAS layer, was pulled superolaterally. D, After Endotine Ribbon was anchored with 3-0 polydioxanone to the temporal fascia, excess leash of Endotine Ribbon was cut out. E, After traction of the facial skin to the temporal area, excess facial skin was excised. Subcutaneous suture was done with 3-0 or 4-0 Vicryl and skin suture, with 5-0 nylon.

Chin point deviation was noted in 8 patients. Three patients had both upper (mean, 1.83 [SD, 0.29] mm; range, 1.5–2 mm) and lower dental midline deviation (mean, 4.00 [SD, 2.29] mm; range, 1.5–6 mm) from the facial midline, and 5 patients had only the lower dental midline deviation (mean, 4.50 [SD, 1.12] mm; range, 4–6.5 mm) (Table 1).

The face lift procedure, which was done at the right side in 7 patients and the left side in 3 patients, took approximately 30 minutes (mean, 28.40 [SD, 3.31] minutes; range, 25–35 minutes)

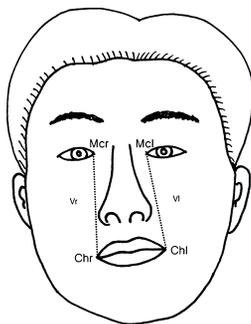


FIGURE 4. The amount of lip canting correction between preoperative and postoperative stages was evaluated by linear distance from right and left medial canthus to right and left cheilion. It was measured with analogous Vernier calipers (Mitutoyo M530-108, Tokyo, Japan). MCr indicates right medial canthus; MCl, left medial canthus; Chr, right cheilion; Chl, left cheilion; Vr, a linear distance from MCr to Chr; Vl, a linear distance from MCl to Chl.

without significant difficulty (Table 1). Although the patients could feel the fixation device on palpation, there was no one who noticed whether the fixation device was placed under the skin on observation.

Initial and final amounts of the lip cant were 4.15 (SD, 0.53) and 0.80 (SD, 0.48) mm, respectively (Table 2). Correction rate of the lip cant was approximately 76.8% (Table 2), which might result from conservative excision of the skin excess to avoid the scar formation in some cases.

For the pain scale addressed by patients during admission period, 9 patients regarded their pain as mild 1, although 1 patient (patient 2) addressed moderate pain in the left temporal area where the device was inserted (Table 3).

There were no severe postoperative complications such as infection, hematoma, wound dehiscence, facial nerve injury, or postoperative scar (Table 3; Fig. 5). The device stability was good without any significant relapse (Table 3). The scale of satisfaction of patients and operator was very good in 7 patients and acceptable in 3 patients (Table 3).

Patient 1

The patient's chief complaints were facial asymmetry and mandibular prognathism (Fig. 6; patient 1 in Tables 1–3). There were 4 mm of maxillary occlusal plane canting on the upper first molar level (the left side is longer than the left side) and 4-mm deviation of the chin midline to the right side. Therefore, bimaxillary orthognathic surgery was simultaneously done with face lift using the Endotine Ribbon (Coapt Systems) on the left side. Operation time for the face lift was 35 minutes, and the surgical outcome was satisfactory for the patient and operator. There were no significant scar formation, complication, and relapse tendency.

TABLE 3. Postoperative Evaluation by the Patients and Surgeons

Patients (Age/Sex)	Pain	Stability of Fixation	Adverse Effect/		Patients' Satisfaction	Surgeon's Satisfaction
			Complications	Relapse		
1 (21 y/female)	++	++	Nonspecific	No	+++	+++
2 (27 y/male)	+	+++	Nonspecific	No	+++	+++
3 (19 y/female)	+	+++	Nonspecific	No	+++	+++
4 (33 y/male)	+	+++	Nonspecific	No	++	++
5 (22 y/female)	+	+++	Nonspecific	No	++	++
6 (20 y/female)	+	+++	Nonspecific	No	+++	+++
7 (24 y/female)	+	+++	Nonspecific	No	++	++
8 (18 y/female)	+	+++	Nonspecific	No	+++	+++
9 (24 y/male)	+	+++	Nonspecific	No	+++	+++
10 (25 y/female)	+	+++	Nonspecific	No	+++	+++

The scale of pain that was addressed by patients was evaluated during admission period as follows: +, means mild; ++, moderate; +++, severe.

The scale of stability of fixation and patients' and surgeon's satisfaction of aesthetic outcome is as follows: +, means unsatisfactory; ++, acceptable; +++, satisfactory.

Patient 2

The patient complained about his facial asymmetry and mandibular prognathism (Fig. 7; patient 2 in Tables 1–3). He had 4 mm of maxillary occlusal plane canting on the upper first molar level (the right side is longer than the left side). Both upper and lower dental midlines were deviated to the left side as much as 1.5 and 4.5 mm, respectively. Therefore, bimaxillary orthognathic surgery was simultaneously done with face lift using the Endotine Ribbon (Coopt Systems) on the right side. The patient reported the surgical outcome as satisfactory. There were no significant complication and relapse tendency.

Patient 3

The patient's chief complaint was facial asymmetry (Fig. 8; patient 6 in Tables 1–3). Because there was 3.5 mm of maxillary occlusal plane canting on the upper first molar level (the right side is longer than the left side) and both upper and lower dental midlines were deviated to the left side as much as 2 and 6 mm, respectively, bimaxillary orthognathic surgery was simultaneously done with face lift using the Endotine Ribbon (Coopt Systems) on the right side. Both patient and operator considered the surgical outcome as satisfactory. There were no noticeable relapse and complication.



FIGURE 5. No significant postoperative scar after wound healing.

Patient 4

The patient wanted her facial asymmetry corrected (Fig. 9; patient 10 in Tables 1–3). She had 3.0 mm of maxillary occlusal plane canting on the upper first molar level (the left side is longer than the right side). Chin midline was 4 mm deviated to the right side. Therefore, bimaxillary orthognathic surgery was simultaneously done with face lift using the Endotine Ribbon (Coopt Systems) on the left side. Additional contouring of the inferior border of the mandible (the left side) and the zygoma was performed. The surgical outcome was satisfactory to both patient and operator. Wound healing was accomplished without any relapse and complication.

DISCUSSION

When the face lift procedure with the Endotine Ribbon (Coopt Systems) is used for correction of the soft-tissue facial asymmetry, pulling vector and amount of tension seem to be of paramount importance.

Altug-Atac et al⁵ stated that there was no 1:1 relationship between the changes in ramus height and improvement in parallelism of lip commissures to the orbital plane. The reason why it is difficult to expect the lip position after orthognathic surgery seems to be that the soft-tissue change in the upper and lower lips after

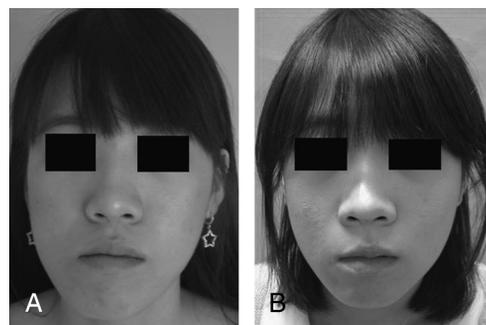


FIGURE 6. Patient 1 (patient 1 in Tables 1–3). A, Preoperative facial photograph. B, Postoperative facial photograph.

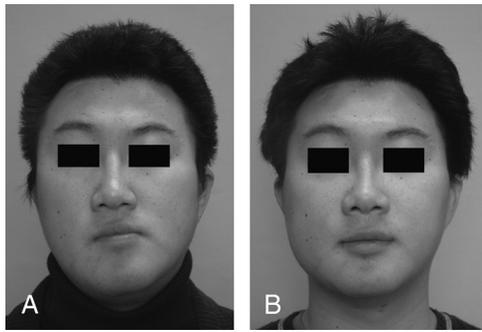


FIGURE 7. Patient 2 (patient 2 in Tables 1–3). A, Preoperative facial photograph. B, Postoperative facial photograph.

orthognathic surgery occurs because of movement of the underlying hard tissue, continuity of the orbicularis oris muscle, and soft-tissue tension.^{1–3,5} To correct the lip cant with combination of orthognathic surgery and face lift procedure, it would be better to pull the Endotine Ribbon (Coapt Systems) into the superior-posterior direction until slight overcorrection of the lip canting could be obtained.

Jung et al³ showed that asymmetric mandibular setback procedure in cases with facial asymmetry and mandibular prognathism could produce more soft-tissue redundancy at the gonial angle area in the contralateral side (greater setback side) than in the deviated side (less setback side). For correction of the soft-tissue redundancy at the gonial angle area, Endotine Ribbon (Coapt Systems) should be pulled into superior direction until soft-tissue symmetry of the gonial angle area could be obtained.

Because heavy tension can cause the scar tissue formation in the preauricular and temporal area, too much excision of the facial skin should be avoided. In addition, the finding that postoperative scar was unnoticeable and hematoma and infection did not occur in the samples (Table 3) seems to be because of hydrodissection and hemostasis promotion by injection of tumescent solution before the surgical procedure.

There are several advantages of the face lift procedure using the Endotine Ribbon (Coapt Systems) as follows: (1) it can be performed simultaneously with bimaxillary orthognathic surgery within 30 minutes and achieve correction of soft-tissue asymmetry with good satisfaction to the patients and surgeons (Tables 1 and 3); (2) it can provide a firm and flexible soft-tissue fixation platform and reduce issue of visibility due to thin thickness (0.25 mm); (3) because it has multiple points of contact (34 tines), it can provide greater holding strength than other face lift procedures; (4) it can

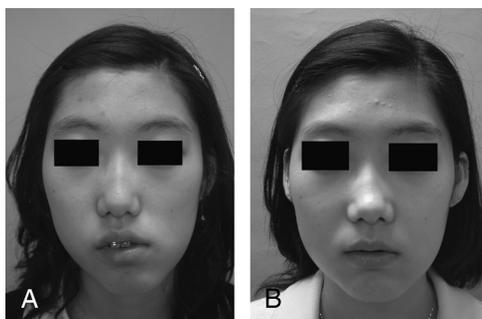


FIGURE 8. Patient 3 (patient 6 in Tables 1–3). A, Preoperative facial photograph. B, Postoperative facial photograph.

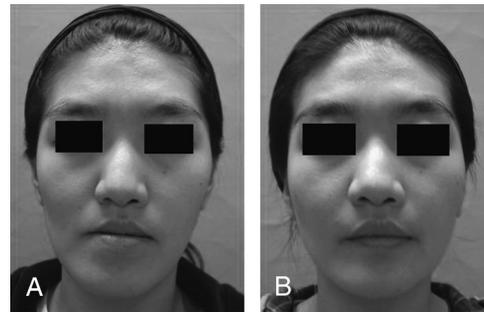


FIGURE 9. Patient 4 (patient 10 in Tables 1–3). A, Preoperative facial photograph. B, Postoperative facial photograph.

eliminate suture problems of thread lift such as pull-through, tissue stretch, or nerve entrapment; (5) compared with the subcutaneous face lift, it seems to be better because it can pull the deep SMAS layer; (6) as contrasted with the conventional SMAS face lift,²² it can save procedure time and cause less complications such as facial nerve injury. Actually, none of the patients in the current study showed a symptom or sign of facial nerve damage (Table 3).

In summary, if the face lift procedure using a resorbable fixation device is done with proper vector control during orthognathic surgery, the hard- and soft-tissue facial asymmetry can be corrected simultaneously with satisfactory outcomes.

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