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Bone graft on the labial symphysis for the skeletal Class III case

Masaru ISHIGAME, Yukio SEINO, *Mitsumasa YOKOTA, *Harumi MIZUKI, and
Hiroyuki MIURA

Department of Orthodontics, School of Dentistry, Iwate Medical University

(Chief : Prof. Hiroyuki MIURA)

*First Department of Oral and Maxillofacial Surgery, School of Dentistry, Iwate Medical University

(Chief : Prof. Harumi MIZUKI)

[Received : May 29, 2003 ; Accepted : Jun 9, 2003]

Abstract : Bone graft in clinical dentistry prevails in periodontal patients who have three wall infrabony defect around the tooth because of its pathological morphology.

In this case report, bone graft on the labial bone surface of the lower incisors (mandibular symphysis) was applied as an auxiliary procedure at the same time of orthognathic surgery to a patient who had fenestrations and circumscribed holes without gingival recession and skeletal Class III malocclusion.

The initial lateral cephalometric radiograph revealed a narrow and high symphysis, with an incisor position straight above the thin bone. During the pre-surgical orthodontic treatment, the incisors had been derotated and moved in the minimal labiolingual direction. Some fenestrations and circumscribed holes were found during orthognathic surgery.

Through the bone allograft, the labial bone surface of the lower incisors (mandibular symphysis) with fenestrations and circumscribed holes were covered with the patient's cancellous bone.

Consequently, a series of the lateral cephalometric radiographs revealed that the grafted bone was kept for four years and ten months after surgery with stable occlusion and no rotational relapse on the lower incisors where it is usually easy to relapse clinically.

Key words : bone graft, mandibular symphysis, gingival recession, orthognathic surgery, genioplasty

Introduction

A long-term stability of the occlusion is one of the great goals for orthodontic

treatment. Good teeth alignment is essential to good occlusion. Also, good and healthy periodontal condition is essential to good teeth alignment. Thus, alveolar bone height

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Masaru ISHIGAME, Yukio SEINO, *Mitsumasa YOKOTA, *Harumi MIZUKI, and Hiroyuki MIURA

Department of Orthodontics, School of Dentistry, Iwate Medical University

*First Department of Oral and Maxillofacial Surgery, School of Dentistry, Iwate Medical University.

1-3-27 Chuo-dori, Morioka, Iwate 020-8505, Japan

岩手県盛岡市中央通1丁目3-27 (〒020-8505)

Dent. J. Iwate Med. Univ. 28 : 92-101, 2003

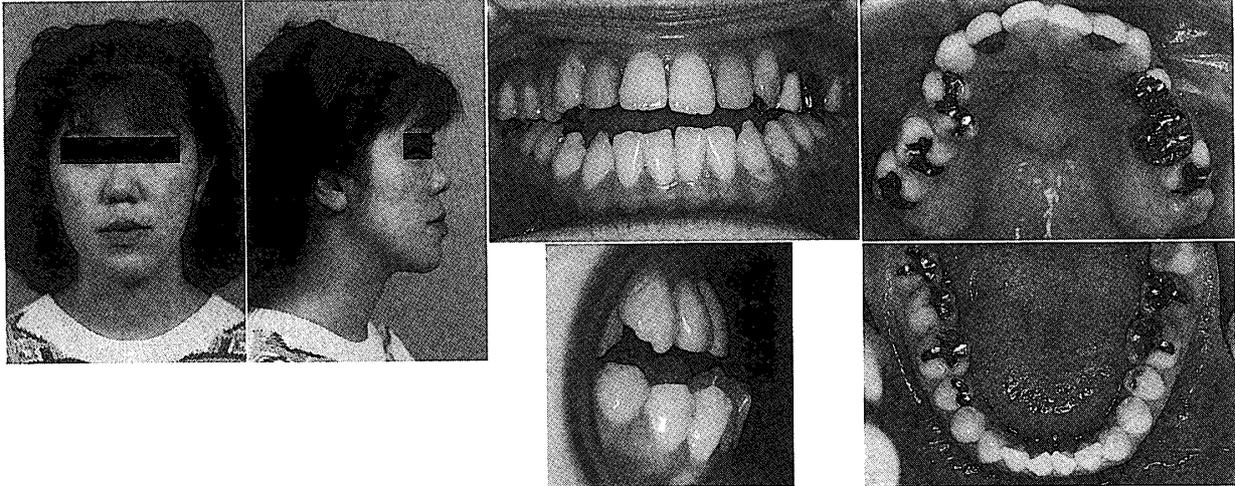


Fig. 1. Facial and intraoral photographs at pre-treatment (32Y5M) records

and thickness will be one of the important factors for the long-term stability.

The thickness of the labial bone on mandibular symphysis varies depending on the malocclusions. It is widely known that skeletal Class III patients have a great possibility to have a significant thin symphysis^{1~3}. Moreover, thinner symphysis could increase the chances of having fenestration, circumscribed hole, dehiscence, and a split in the alveolar bone. Furthermore, low stability, hypo function, easy relapse, and gingival recession after orthodontic treatment might appear on it. In addition, adult patients are more likely to have bone and attachment loss than are adolescents due to aging and periodontal problems. Also, in the natural growing process, the labial symphysis (especially Point B region) tends to move lingually^{4~6}. Therefore, patients who have a thinner symphysis will be at greater risk to aggravate vulnerable periodontal condition.

In this case report, bone allograft was performed on the labial bone surface of the lower incisors (mandibular symphysis) with fenestrations and circumscribed holes due to the thin labial symphysis at the same time

as orthognathic surgery and genioplasty. No one has reported about this procedure and its long-term observation yet. From the results of this case, stable occlusion has been maintained well, with no teeth relapse for four years and ten months after this surgery.

History and background

The patient is a Japanese adult female who is 32 years and 5 months of age. Her chief complaint was facial appearance due to protruded mandible. She had noticed her anterior crossbite since mixed dentition. Also, she was a mouth breather and tongue thruster with large adenoids at this time.

From the front view of her face (Fig. 1), she was of dolichofacial head shape and her facial structures were symmetrical. The lips were apart at rest but there was no difficulty in breathing through the nose. The maxillary dental midline was centered relative to the facial midline.

From the side view of her face (Fig. 1), she had a prognathic facial and straight profile type. Lip harmony and balance were both poor due to lower lip protrusion.

Intraoral records (Fig. 1) revealed anterior and bilateral posterior lingual crossbite,

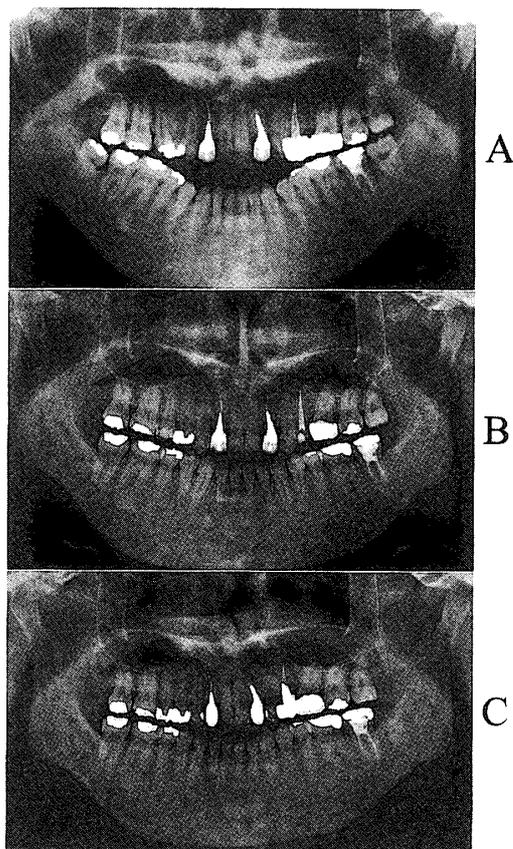


Fig. 2. The panoramic radiograph
 A : Pre-treatment (32Y 5 M)
 B : Post-treatment (35Y 4 M)
 C : Post-retention (39Y 3 M)

anterior open bite, mesio-lingual rotation on the lower central incisors, linguoversion on the upper right second bicuspid, facing cast crown on the upper lateral incisors, and one piece bridge connected from the upper left first bicuspid to the upper left first molar. No gingival recession existed around the lower incisors with less than 3.0 mm probing pocket depth. The dentition showed Angle Class III molar and canine relationships. Overjet was -5.5 mm and overbite was -3.2 mm. The clinical crown height of the lower left central incisor was 8.6 mm. The maxillary midline was centered relative to the median raphe and the facial midline. The mandibular midline was centered relative to the maxillary midline. The curve of Spee was reversed and the compensating curve was excessive. The maxillary arch form was tapering and asymmetrical with 3.0 mm crowding. The mandibular arch form was ovoid and symmetrical with 3.5 mm crowding. A minimal (0.17 mm) anterior

Table 1. Cephalometric analysis

The lateral cephalometric radiograph was traced and analyzed at pre-treatment, post-treatment, and post-retention.

Measurements from this analysis revealed skeletal changes due to orthognathic surgery and dental changes due to orthodontic treatment. Mandibular inferior borderline has changed after BSSO and genioplasty.

Measurement	Mean	S.D.	Pre-treatment	Post-treatment	Post-retention
			32Y5M	35Y4M	39Y3M
NP-SN ($^{\circ}$)	80.3	3.2	84.6	83.8	84.1
Convexity ($^{\circ}$)	3.5	4.1	-2.8	-0.1	0.1
SNA ($^{\circ}$)	82.2	2.8	83.2	83.8	84.2
SNB ($^{\circ}$)	80.4	2.9	85.0	83.1	83.6
ANB ($^{\circ}$)	1.8	1.7	-1.8	0.7	0.6
A-B plane ($^{\circ}$)	-3.0	2.6	3.0	-1.8	-1.4
Mandibular plane-FH ($^{\circ}$)	26.8	5.6	36.4	32.9	30.8
Occlusal plane-FH ($^{\circ}$)	9.1	4.0	15.4	11.7	12.5
Y-axis ($^{\circ}$)	62.7	3.1	66.9	66.3	65.3
Gonial angle ($^{\circ}$)	123.2	6.6	135.1	129.6	128.9
ANS-Me (mm)	70.7	5.6	80.9	72.7	72.2
U1-SN ($^{\circ}$)	107.4	6.9	118.7	116.2	115.0
L1-Mandibular plane ($^{\circ}$)	91.8	5.3	87.6	84.3	85.3
L1-Occlusal plane ($^{\circ}$)	69.4	6.4	71.3	74.5	76.4
L1-AP (mm)	3.0	1.5	11.3	5.5	5.7
L1-AP ($^{\circ}$)	25.0	5.0	35.1	25.4	25.0

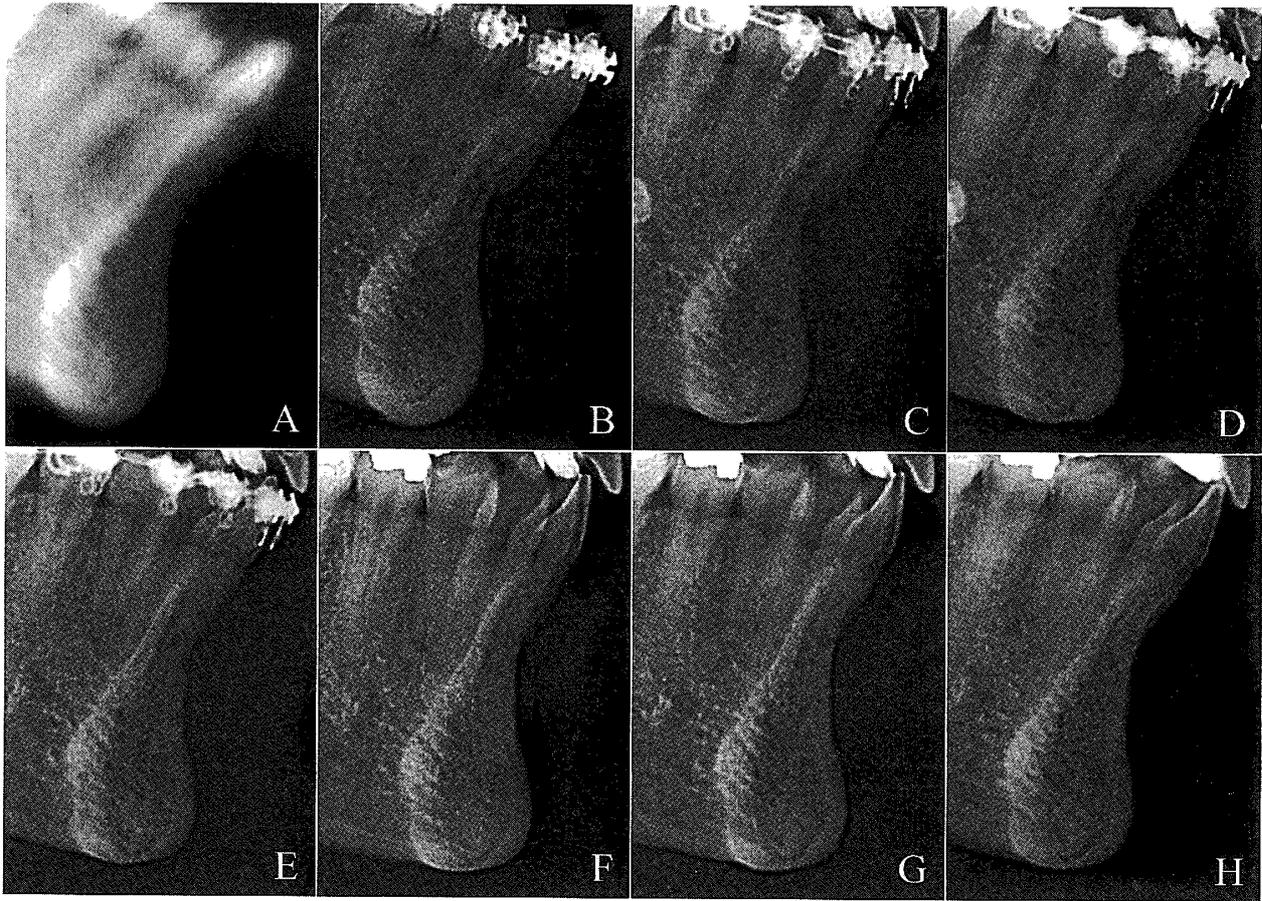


Fig. 3. Radiographs of the mandibular symphysis

A : Pre-treatment (32Y 5 M)

B : Right before operation (34Y 4 M)

C : One month after operation (34Y 6 M)

D : Three months after operation (34Y 8 M)

E : Six months after operation (34Y 11 M)

F : One year after operation, post-treatment (35Y 4 M)

G : Two years after operation, post-treatment (36Y 4 M)

H : Four years and ten months after operation, post-retention (39Y 3 M)

tooth size discrepancy existed by Bolton analysis.

The panoramic radiograph (Fig. 2-A) revealed that the upper right third molar and the upper left second bicuspid were missing. Root canal treatments had been done on the upper bilateral lateral incisors, the upper left first premolar, and the lower left second molar.

The lateral cephalometric radiograph and analysis (Table 1) revealed increased NP-SN (84.6°), decreased convexity (-2.8°), decreased ANB (-1.8°) due to increased SNB

(85.0°), and increased A-B plane angle (3.0°) that are indicate a skeletal denture base discrepancy relative to cranial base. Increased mandibular plane-FH (36.4°), occlusal plane-FH (15.4°), and Y-axis (66.9°) indicated a vertical vector of growth had taken place. Lower facial height (ANS-Me) was increased (80.9 mm). Dentally, the upper incisor was proclined (U 1 -SN : 118.7°), and the lower incisor was proclined (L 1 -AP : 35.1°) and protruded from AP line (L 1 -AP : 11.3 mm). Moreover, the initial lateral cephalometric radiograph evaluation

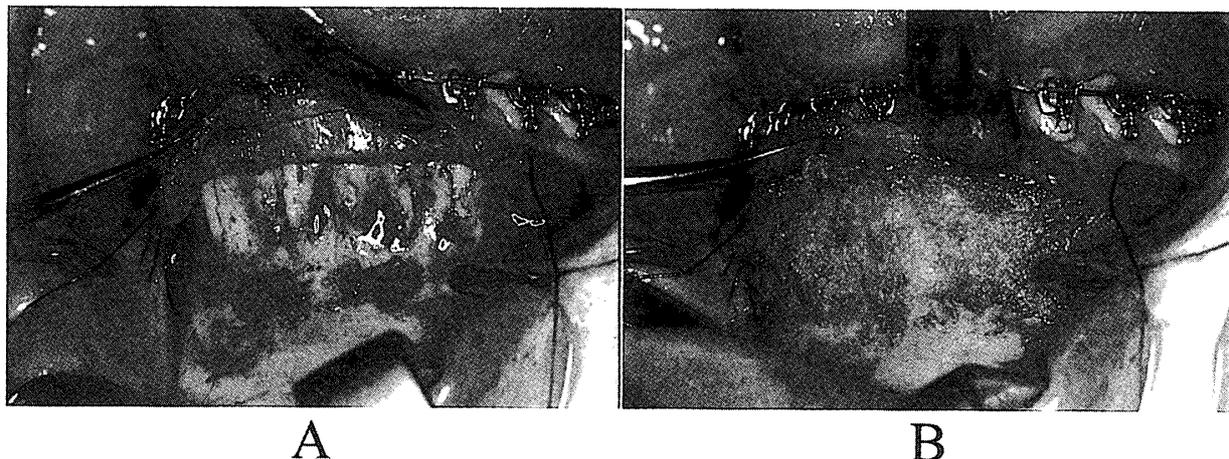


Fig. 4. Photographs of the labial root surface of the lower incisors before and after the bone graft.

The gum tissue of the labial surface of the lower incisors was flapped after BSSO and genioplasty. A, The photograph shows root fenestration and circumscribed hole. Particulate bone was harvested by bone-collecting chambers when the bone was drilled and shaved. B, The cancellous bone was grafted and covered (1~2 mm thick) the exposed roots of the lower incisors.

revealed a narrow and high symphysis, with an incisor position straight above the thin bone. Labial aspects of the lower incisal roots were seemed to be out of the labial alveolar bone and largely without cortical plate covering (Fig. 3-A).

Treatment plan and progress

Problem list : prognathic mandible, anterior and posterior crossbite, anterior open bite, crowding, rotation, unfavorable compensated incisors, Angle Class III canine and molar relationship, and thin symphysis

Treatment objectives : retrude mandible, improve crossbite and open bite, reduce crowding, improve rotation, decompensate incisors, achieve Angle Class I canine and right side molar relationship, and establish a good functional and stable occlusion

Diagnosis : This case was diagnosed as a skeletal mandibular prognathism with anterior and posterior crossbite and anterior open bite.

Treatment plan : Orthodontic treatment combined with surgical correction of the

mandibular prognathism had been planned. Extraction of the lower bilateral third molars and removal of the upper left one piece bridge preceded presurgical orthodontic treatment. Bone graft could be used to improve thin symphysis and prevent gingival recession.

Treatment progress : The orthodontic treatment was designed extraction of the lower bilateral third molars and remove of the upper left one piece bridge with a preadjusted edgewise appliance (0.018x0.025 inch slot) when the patient was 32 years and 8 months of age. Bilateral sagittal split ramus osteotomy (BSSO) with titanium miniplates and screws was performed for the mandible setback by 7.0 mm on both sides at 34 years and 5 months of age. Bone allograft was performed on the labial symphysis due to fenestrations and circumscribed holes (Fig. 3-B, 4-A) as well as reducing anterior mandibular height by genioplasty after consultation with the patient. The cancellous bone of the same patient was used for the graft that was

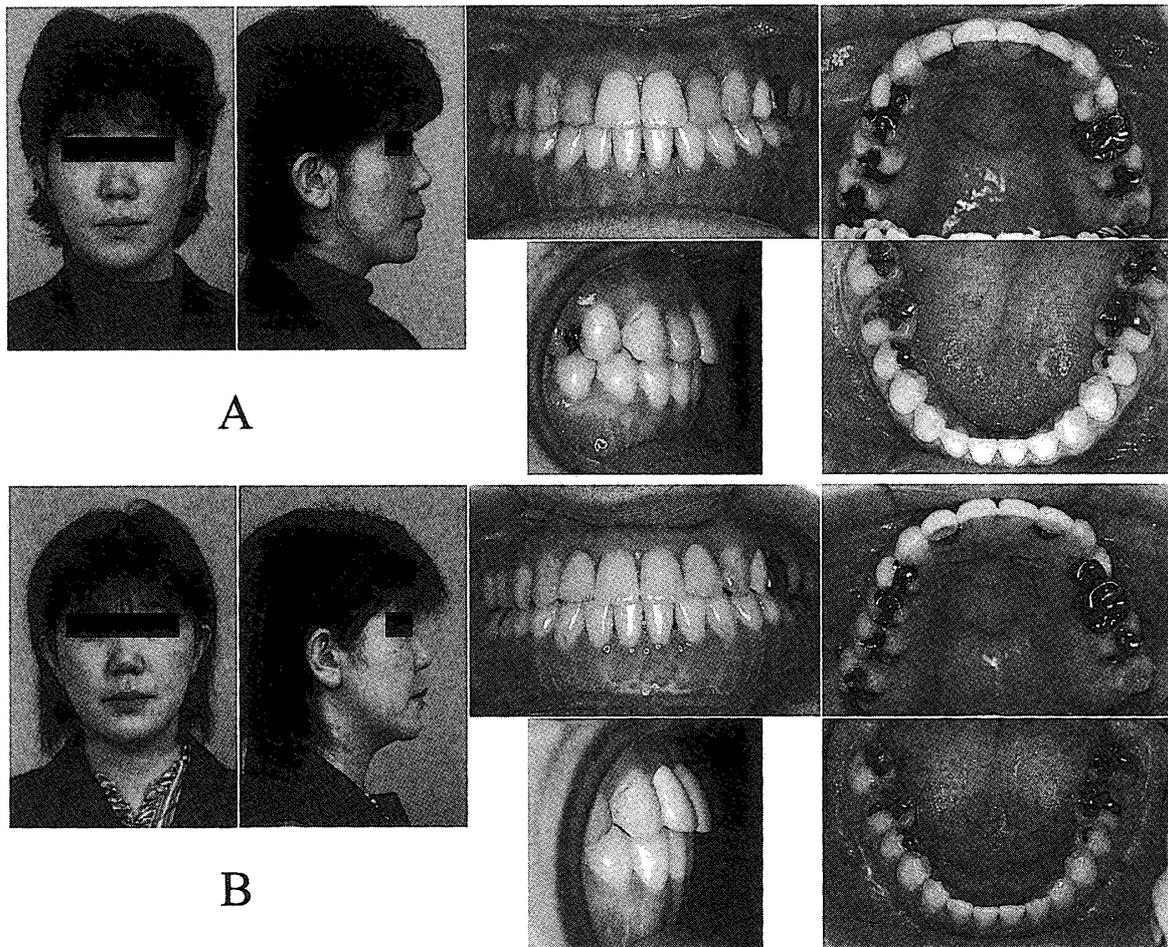


Fig. 5. Facial and intraoral photographs
 A : Post-treatment (35Y 4 M)
 B : Post-retention (39Y 3 M)

collected during BSSO and genioplasty (Fig. 4-B). The grafted bone had been monitored by lateral cephalometric radiograph periodically (Fig. 3-C~H). All brackets were debonded at 35 years and 4 months of age after teeth detailing and interdigation. Removable wraparound type retainers had been used full-time for the first year and the next two years at night only. Clinical examination and records for the post-treatment and three years and eleven months following the debonding at 39 years and 3 months of age were taken.

Treatment results : The improvement of the facial profile and the bite problem were achieved with orthognathic facial type (Fig. 5). The canine and right side first molar

relationship achieved Angle Class I relationship with favorable incisal overjet (+2.5 mm) and overbite (+2.6 mm). The clinical crown height of the lower left central incisor was 8.7 mm with derotation. The panoramic radiograph reveals that no major pathology is present (Fig. 2-B, C). The lateral cephalometric radiograph analysis reveals remarkable improvement of skeletal and dental measurements. Good lips balance and harmony was achieved. Good periodontal condition around the lower incisors has been kept since the debonding with less than 2.0 mm probing pocket depth.

The conventional method of assessing overall dentofacial change is to superimpose, with point registration at sella

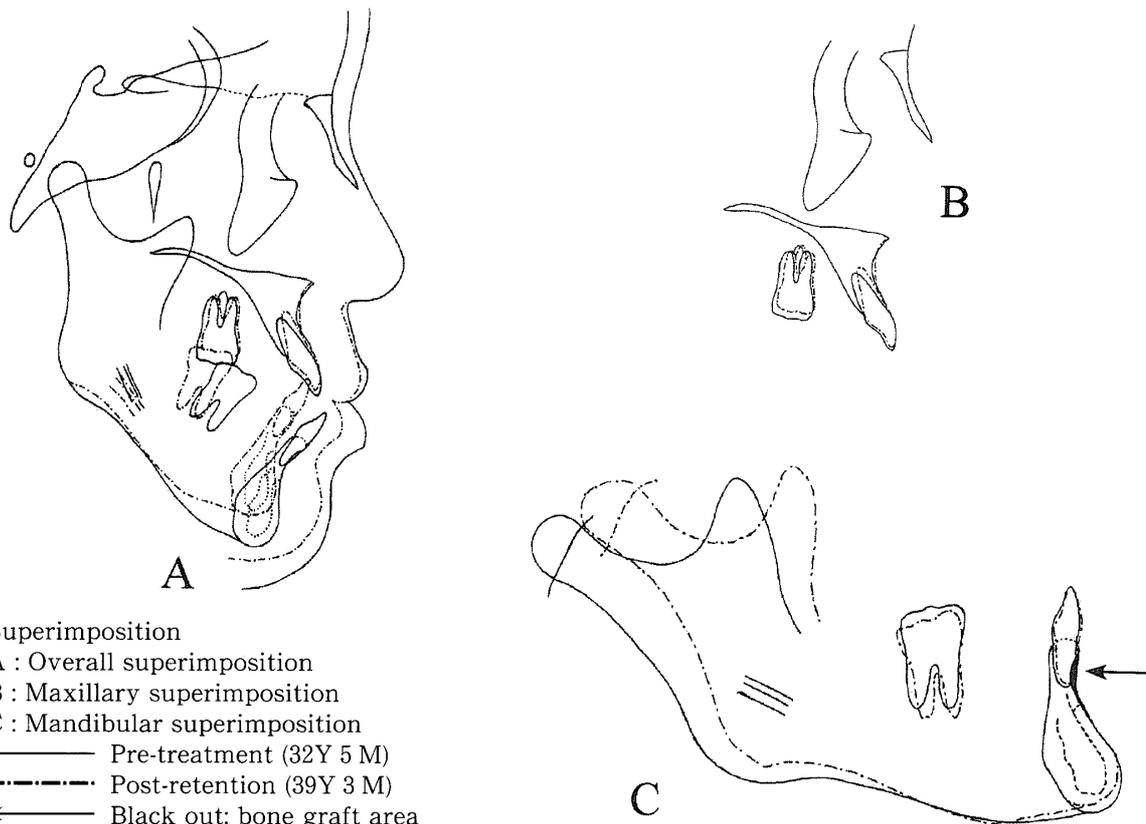


Fig. 6. Superimposition

- A : Overall superimposition
- B : Maxillary superimposition
- C : Mandibular superimposition
- Pre-treatment (32Y 5 M)
- - - Post-retention (39Y 3 M)
- ← Black out: bone graft area

and the S-N line, one over the other. This overall superimposition (Fig. 6-A) reveals that remarkable skeletal change has been shown at the mandible due to orthognathic surgery. The distal segment of the mandible was displaced upward and backward but the proximal segment was not displaced. Little measurable skeletal changes have been shown in the cranial base and the maxilla. Both upper and lower lips were displaced backward.

The maxillary superimposition was done by superimposing the anterior and the posterior portions of the zygomatic process for anteroposterior registration. The floor of the orbit raised more than the palatal plane lowered in a ratio of 1.5 to 1.0 mm⁷⁾. This maxillary superimposition (Fig. 6-B) reveals that little measurable skeletal changes have been shown in the maxilla. The upper incisors were intruded with pure root movement. The upper first molars were

also intruded without tipping.

The mandibular superimposing was completed by superimposing the tip of the chin, the inner contour of the cortical plate of the symphysis, and the trabecular structures related to the mandibular canal according to a best fit system⁸⁾. This mandibular superimposition (Fig. 6-C) reveals that skeletal change of the distal segment and the proximal segment. Lower border of the symphysis was trimmed for genioplasty. The lower first molars were intruded and tipped distally. The labial alveolar bone of the symphysis was moved labially due to the bone graft. Minimal anteroposterior width of the symphysis was 4.1 mm at the time of the pre-treatment record. The outcome of its change from post-retention record showed that the width has been increased by 1.3 mm at the same position.

Discussion

1. Bone graft

The gingival recession occurs easily due to dental plaque and / or occlusal trauma where there is fenestration or a circumscribed hole or dehiscence or split⁹⁾. Especially, the lower incisors sometimes tend to have these periodontal problems due to thin symphysis. Unfortunately, there is no complete procedure to improve fenestration and dehiscence. But once the patient has got gingival recession, Proffit and Fields¹⁰⁾ stated that periodontal surgery with a laterally positioned flap can be indicated to prevent further dehiscence and reestablish gingival attachment.

As for this patient, flap operation was needed prior to genioplasty. At the same time we could find fenestrations and circumscribed holes directly. Usually, bone graft prevails in periodontal patients who have three wall infrabony defect around the tooth because of its pathological morphology. Bone graft on the labial symphysis might have some advantages and might be more useful with genioplasty than by itself independently. There is no reason to wait for gingival recession to arise in the future when we might be able to prevent it by means of bone graft. Currently no one has ever compared laterally positioned flaps and bone grafts for long-term periodontal stability.

To evaluate the results of bone graft on the labial symphysis, instead of the most reliable method, that is flap operation to see the bone directly, we used a lateral cephalometric radiograph. A series of the lateral cephalometric radiographs showed that the grafted bone has reduced in

thickness gradually for approximately six months and then maintained stable width until the last records.

2. Treatment strategy and results

Sasakura, et al.¹¹⁾ suggested that a patient with narrow symphysis should be treated considering periodontal condition, lip pressure, and screw fixation for the open bite case to avoid the elongation of the lower incisor position. Large labial tipping of the lower incisors will induce bone resorption of the labial bone surface of the lower incisors and gingival recession^{11,12)}. Also, derotation of the lower incisors seems to be critical in the potential risk of progressive lingual and labial bone loss¹³⁾. When it is difficult to avoid bone loss, during decompensation of the lower incisors, bone graft might be an alternative treatment to reduce gingival recession.

Treatment results were good with all specific objectives met and the patient's chief complaint satisfied. Finally, a well balanced facial profile has been achieved via orthognathic surgery. Besides, the anterior and posterior crossbites were corrected, and Angle Class I canine and right side molar relationship was attained. The upper arch form became ovoid and coordinated with the lower arch form. Leveling and alignment teeth via edgewise appliance, resolved crowding and rotation, and good interdigitation has been achieved. The lower incisors were derotated and have been maintained without relapse for a long time though rotated teeth relapse easily. Through this treatment case, the bone graft seems to have ended in a good result. The chance of suffering from gingival recession easily and rapidly at the lower incisors seems to be increased when the patient gets gingivitis or

occlusal trauma and if the bone graft has not been performed.

Further long-term observation will be necessary to have more reliability in this treatment method, including the bone graft.

Conclusions

Bone graft on the labial bone surface of the lower incisors (mandibular symphysis) with fenestrations and circumscribed holes could cover with the patient's cancellous bone. Besides, the grafted bone has been kept for four years and ten months after the surgery with stable occlusion, no rotational relapse on the lower incisors, and no gingival recession. Consequently, bone graft might be an alternative treatment to achieve a good functional and stable occlusion.

References

- 1) Jacobson, A., Evans, W. G., Preston, C. B., and Sadowsky, P. L. : Mandibular prognathism. *Am. J. Orthod.* 66 : 140-171, 1974.
- 2) Sekiya, T., Nakamura, Y., Kim, T., and Kuwahara, Y. : Morphological study on the mandibular symphysis in skeletal Class III malocclusion of young and adult Japanese female patients. *J. Jpn. Orthod. Soc.* 52 : 306-315, 1993.
- 3) Ichikawa, K., Itoh, T., Kiyosue, S., Hirose, T., Kamogashira, K., and Matsumoto, M. : Morphological studies on the mandibular symphysis of skeletal Class I, II, III malocclusions. *J. Jpn. Orthod. Soc.* 47 : 433-441, 1988.
- 4) Enlow, D. H. and Harris, D. B. : A study of the postnatal growth of the human mandible. *Am. J. Orthod.* 50 : 25-50, 1964.
- 5) Ricketts, R. M. : The keystone triad, II. Growth, treatment, and clinical significance. *Am. J. Orthod.* 50 : 728-750, 1964.
- 6) Buschang, P. H., Julien, K., Sachdeva, R., and Demirjian, A. : Childhood and pubertal growth changes of the human symphysis. *Angle Orthod.* 62 : 203-210, 1992.
- 7) Doppel, D. M., Damon, W. M., Joondeph, D. R., and Little, R. M. : An investigation of maxillary superimposition techniques using metallic implants. *Am. J. Orthod.* 105 : 161-168, 1994.
- 8) Björk, A. : Prediction of mandibular growth rotation. *Am. J. Orthod.* 55 : 585-599, 1969.
- 9) Rufenacht, C. R., ed.; Maruyama, T., tr., Fundamentals of esthetics. 1st ed., Quintessence Publishing Co., Inc., Tokyo, pp 237, 1994 : Fundamentals of esthetics. Quintessence Publishing Co., Inc., Chicago, 1990.
- 10) Proffit, W. R. and Fields, H. W. Jr. : Contemporary orthodontics. 3rd ed., Mosby, Inc., St. Louis, pp 644-709, 2000.
- 11) Sasakura, H., Hanada, K., Yoshie, H., Hara, K., and Nakajima, T. : A case report : Autogenous gingival graft for alveolar bony dehiscence in the mandibular central incisor associated with orthognathic surgery. *J. Jpn. Orthod. Soc.* 50 : 241-250, 1991.
- 12) Årtun, J. and Krogstad, O. : Periodontal status of mandibular incisors following excessive proclination. -A study in adults with surgically treated mandibular prognathism- *Am. J. Orthod.* 91 : 225-232, 1987.
- 13) Wehrbein, H., Bauer, W., and Diedrich, P. : Mandibular incisors, alveolar bone, and symphysis after orthodontic treatment. A retrospective study. *Am. J. Orthod.* 110 : 239-246, 1996.

骨格型Ⅲ級患者の下顎結合部唇側面への骨移植術について

石亀 勝, 清野 幸男,*横田 光正,*水城 春美, 三浦 廣行

岩手医科大学歯学部歯科矯正学講座

(主任:三浦 廣行 教授)

*岩手医科大学歯学部口腔外科学第一講座

(主任:水城 春美 教授)

(受付:2003年 5 月 29 日)

(受理:2003年 6 月 9 日)

抄録: 通常臨床歯科医学における骨移植は, その病理学的形態より 3 壁性骨欠損を有する歯周病患者に対して広く行われている。

今回, 下顎前歯部(下顎結合部)唇側面歯槽骨の開窓や限局性穿孔は存在するが, 歯肉退縮を生じていない骨格型Ⅲ級不正咬合患者へ顎矯正手術と同時に自家骨移植を付加的に行った。

初診時のセファログラム所見より高く幅の狭い下顎結合部とこの薄い骨に直立している下顎前歯が確認された。また, 術前矯正歯科治療中, 下顎前歯はその捻転の解消と頬舌的な移動が行われた。手術時には下顎前歯部の開窓や限局性穿孔が確認された。

下顎前歯部(下顎結合部)唇側面に自己海面骨を移植することによって歯槽骨の開窓や限局性穿孔は覆われた。結果的にセファログラム上での経過所見より, その後 4 年 10 か月間移植骨の残留が認められ, さらに臨床的に咬合が安定し通常後戻りしやすいとされる下顎前歯捻転の後戻りも認められず良好な結果を得たので報告した。